



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

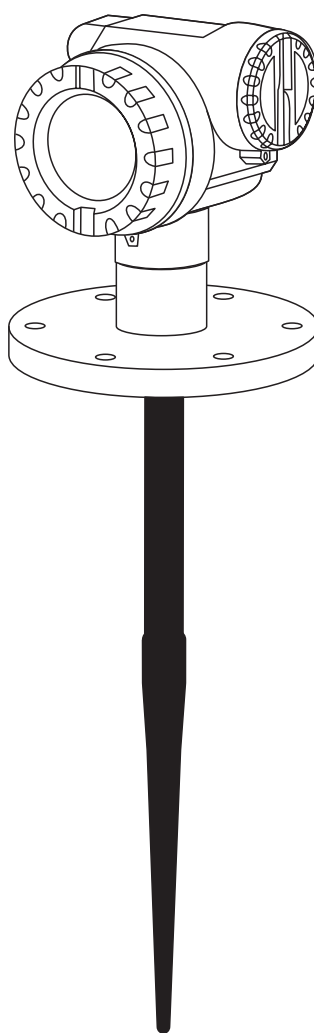


Solutions

Operating Instructions

Micropilot M FMR231

Level-Radar



BA00226F/00/EN/13.11
71139060

Valid as of software version:
01.04.00

Micropilot M FMR230, FMR231 - Brief operating instructions

KA159F/00/a2/08.06
52006292

000 measured value

Contrast: $\boxed{E} + \boxed{+}$ or $\boxed{E} + \boxed{-}$

Group selection

00 basic setup

01 safety settings

04 linearisation

05 extended calibr.

06 output (HART, FF) profibus param.(PA)

09 display

0E envelope curve

0A diagnostics

0C system parameter

002 tank shape

003 medium cond.

004 process cond.

005 empty calibr.

006 full calibr.

007 pipe diameter

008 dist./meas value

051 check distance

052 range of mapping

053 start mapping

008 dist./meas value

092 language

0E1 plot settings

0E2 recording curve

0A0 present error

0A1 previous error

0A4 unlock parameter

25dB 090
-0.01 2.461m 5.00

threaded connection:
reference point of measurement

flange:
reference point of measurement

D
E
F
L

100 FMR2xxx-10/00/00-en-01

52006292

L00-FMR2xxx-19-00-00-en-039



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.

The operating manual BA00221F/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	4	9	Trouble-shooting	70
1.1	Designated use	4	9.1	Trouble-shooting instructions	70
1.2	Installation, commissioning and operation	4	9.2	System error messages	71
1.3	Operational safety and process safety	4	9.3	Application errors	73
1.4	Notes on safety conventions and symbols	5	9.4	Orientation of the Micropilot	75
2	Identification	6	9.5	Spare Parts	77
2.1	Device designation	6	9.6	Return	78
2.2	Scope of delivery	9	9.7	Disposal	78
2.3	Certificates and approvals	9	9.8	Software history	78
2.4	Registered trademarks	9	9.9	Contact addresses of Endress+Hauser	78
3	Mounting	10	10	Technical data	79
3.1	Quick installation guide	10	10.1	Additional technical data	79
3.2	Incoming acceptance, transport, storage	11	11	Appendix	88
3.3	Installation conditions	12	11.1	Operating menu PA (display modul)	88
3.4	Installation instructions	18	11.2	Patents	90
3.5	Post-installation check	20	Index		93
4	Wiring	21			
4.1	Quick wiring guide	21			
4.2	Connecting the measuring unit	24			
4.3	Recommended connection	25			
4.4	Degree of protection	25			
4.5	Post-connection check	25			
5	Operation	26			
5.1	Quick operation guide	26			
5.2	Display and operating elements	28			
5.3	Local operation	31			
5.4	Display and acknowledging error messages	34			
5.5	PROFIBUS PA communication	35			
6	Commissioning	50			
6.1	Function check	50			
6.2	Switching on the measuring device	50			
6.3	Basic Setup	51			
6.4	Basic Setup with the device display	53			
6.5	Basic Setup with the Endress+Hauser oprating program	63			
7	Maintenance	67			
8	Accessories	68			
8.1	Weather protection cover	68			
8.2	Commubox FXA291	68			
8.3	ToF Adapter FXA291	68			
8.4	Proficard	68			
8.5	Profiboard	68			
8.6	Remote display FHX40	69			

1 Safety instructions

1.1 Designated use

The Micropilot M is a compact radar level transmitter for the continuous, contactless measurement of liquids, pastes and sludge. The device can also be freely mounted outside closed metal vessels because of its operating frequency of about 6 GHz and a maximum radiated pulsed energy of 1 mW (average power output 1 μ W). 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 instrument.

1.3.1 Hazardous areas

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

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

1.3.2 FCC approval

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.















Caution!

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

1.4 Notes on safety conventions and symbols

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

Safety conventions	
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.
Explosion protection	
	Device certified for use in explosion hazardous area If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area.
	Explosion hazardous area Symbol used in drawings to indicate explosion hazardous areas. Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	Safe area (non-explosion hazardous area) Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.
Electrical symbols	
	Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied.
	Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	Grounded terminal A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	Protective grounding (earth) terminal A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	Equipotential connection (earth bonding) A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice.
	Temperature resistance of the connection cables States, that the connection cables must be resistant to a temperature of at least 85 °C (185 °F).

2 Identification

2.1 Device designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:

The nameplate diagram includes the following elements:

- EH ENDRESS+HAUSER** logo and brand name.
- Field **1**: Instrument designation.
- Field **2**: Order Code.
- Field **3**: Ser.-No. (Serial number).
- Field **4**: Process pressure.
- Field **5**: Process temperature.
- Field **6**: Length (optional).
- Field **7**: Power supply.
- Field **8**: Current supply.
- Field **9**: Ambient temperature.
- Field **10**: Cable specification.
- Field **11**: Factory sealed.
- Field **12**: Radio equipment number.
- Field **13**: TÜV identification mark.
- Field **14**: Certificate symbol (optional) e.g. Ex, NEPSI.
- Field **15**: Certificate symbol (optional) e.g. 3A.
- Field **16**: Certificate symbol (optional) e.g. SIL, FF.
- Field **17**: Place of production.
- Field **18**: Degree of protection e.g. IP65, IP67.
- Field **19**: Certificates and approvals.
- Field **20**: Document number of safety instructions e.g. XA, ZD, ZE.
- Field **21**: Dat./Insp. (Date/Inspection) xx / yy (xx = week of production, yy = year of production).
- Symbols: CE mark, explosion protection symbol (Ex), and a warning triangle with an exclamation mark.
- Text: "X = if modification see sep. label" and "Patents" with a book icon.

L00-FMR2xxxx-18-00-00-en-001

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 Certificate 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 1/2 G EEx ia IIC T6, IECEx Zone 0/1 2 ATEX II 1/2 G EEx ia IIC T6, XA, IECEx Zone 0/1; Note safety instruction (XA) (electrostatic charging)! 5 ATEX II 1/2 G EEx d (ia) IIC T6, XA, IECEx Zone 0/1; Note safety instruction (XA) (electrostatic charging)! 6 ATEX II 1/2 G EEx ia IIC T6, WHG, IECEx Zone 0/1 7 ATEX II 1/2 G EEx ia IIC T6, WHG, XA, IECEx Zone 0/1; Note safety instruction (XA) (electrostatic charging)! 3 ATEX II 1/2 G EEx em (ia) IIC T6 8 ATEX II 1/2 G EEx em (ia) IIC T6, WHG 4 ATEX II 1/2 G EEx d (ia) IIC T, IECEx Zone 0/16 G ATEX II 3 G EEx nA II T6, XA, fully insulated antenna: Note safety instruction (XA) (electrostatic charging)! H ATEX II 1/2G EEx ia IIC T6, ATEX II 3D, XA, fully insulated antenna: Note safety instruction (XA) (electrostatic charging)! 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 I NEPSI Ex ia IIC T6 J NEPSI Ex d (ia) ia IIC T6 R NEPSI Ex nAL IIC T6 Y Special version, TSP-no. to be spec.
20	Antenna; Inactive Length
	A PPS antistatic 360mm/14", Viton, 316L; nozzle height max 100mm/4" B PPS antistatic 510mm/20", Viton, 316L; nozzle height max 250mm/10" E PTFE 390mm/15", fully insulated; nozzle height max 100mm/4" F PTFE 540mm/21", fully insulated; nozzle height max 250mm/10" H PTFE antistatic 390mm/15", fully insul.; nozzle height max 100mm/4" J PTFE antistatic 540mm/21", fully insul.; nozzle height max 250mm/10" Y Special version, TSP-no. to be spec.
30	Process Connection
	GGJ Thread EN10226 R1-1/2, 316L GGS Thread EN10226 R1-1/2, PVDF GNJ Thread ANSI NPT1-1/2, 316L GNS Thread ANSI NPT1-1/2; PVDF TEJ Tri-Clamp ISO2852 DN40-51 (2"), 316L TLJ Tri-Clamp ISO2852 DN70-76.1 (3"), 316L MFJ DIN11851 DN50 PN40, slotted-nut, 316L HFJ DIN11864-1 A DN50 Tube DIN11850, slotted-nut, 316L BFJ DN50 PN10/16 A, 316L flange EN1092-1 (DIN2527 B) CFJ DN50 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C) CFK DN50 PN10/16, PTFE > 316L flange EN1092-1 (DIN2527) BMJ DN80 PN10/16 A, 316L flange EN1092-1 (DIN2527 B) CMJ DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C) BNJ DN80 PN25/40 A, 316L flange EN1092-1 (DIN2527 B) CNJ DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C) CMK DN80 PN10/16, PTFE > 316L flange EN1092-1 (DIN2527) BQJ DN100 PN10/16 A, 316L flange EN1092-1 (DIN2527 B) CQJ DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C) CQK DN100 PN10/16, PTFE > 316L flange EN1092-1 (DIN2527) BWJ DN150 PN10/16 A, 316L flange EN1092-1 (DIN2527 B) CWJ DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C) CWK DN150 PN10/16, PTFE (black) > 316L flange EN1092-1 (DIN2527) PTFE (black) = conductive cladding AEJ 2" 150lbs RF, 316/316L flange ANSI B16.5 AEK 2" 150lbs, PTFE > 316/316L flange ANSI B16.5 ALJ 3" 150lbs RF, 316/316L flange ANSI B16.5

30										Process Connection	
										AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5
										ALK	3" 150lbs, PTFE > 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
										APK	4" 150lbs, PTFE > 316/316L flange ANSI B16.5
										AVJ	6" 150lbs RF, 316/316L flange ANSI B16.5
										AVK	6" 150lbs, PTFE (black) > 316/316L flange ANSI B16.5
											PTFE (black) = conductive cladding
										KEJ	10K 50A RF, 316L flange JIS B2220
										KEK	10K 50A, PTFE > 316L flange JIS B2220
										KLJ	10K 80A RF, 316L flange JIS B2220
										KLK	10K 80A, PTFE > 316L flange JIS B2220
										KPJ	10K 100A RF, 316L flange JIS B2220
										KPK	10K 100A, PTFE > 316L flange JIS B2220
										KVJ	10K 150A RF, 316L flange JIS B2220
										KVK	10K 150A, PTFE (black) > 316L flange JIS B2220
											PTFE (black) = conductive cladding
										YY9	Special version, TSP-no. to be spec.
40										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, TSP-no. to be spec.
50										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, TSP-no. to be spec.
60										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, TSP-no. to be spec.
70										Gas-Tight Feed Through	
										A	Not selected
										C	Selected
80										Additional Option	
										A	Basic version
										B	EN10204-3.1 material, wattet parts, (316L wetted parts) inspection certificate
										C	EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
										H	5-point linearity protocol, see additional spec.
										J	5-point, 3.1, wetted parts 5-point linearity protocol, see additional spec., EN10204-3.1 material, wetted parts, (316L wetted parts) inspection certificate
										K	5-point, 3.1, pressurized, 5-point linearity protocol, see additional spec., EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
										S	GL/ABS/NK marine certificate
										Y	Special version, TSP-no. to be spec.
995										Marking	
										1	Tagging (TAG)
										2	Bus adress
FMR231-											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 (→ 68)
- Endress+Hauser operating instrument on the enclosed CD-ROM
- Brief operating instructions KA01004F/00/EN for quick commissioning
- Brief operating instructions KA00159F/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 Instruction
 - Description of Instrument Functions

2.3 Certificates and approvals

CE mark, declaration of conformity

The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG 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

PROFIBUS®

Registered trademark of the PROFIBUS Trade Organisation, Karlsruhe, Germany

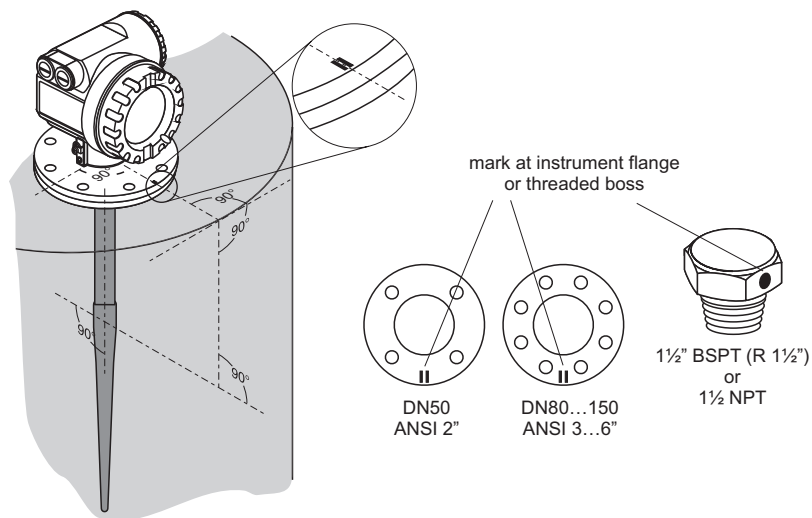
3 Mounting

3.1 Quick installation guide



Observe orientation when installing!

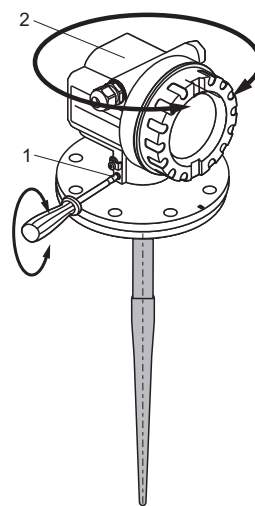
Installation in tank (free space):
Mark on process connector facing the nearest tank wall!



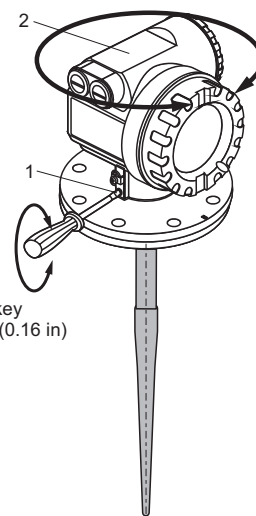
Turn housing

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)

3.2 Incoming acceptance, transport, storage

3.2.1 Incoming acceptance

Check the packing and contents for any signs of damage.

Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.2.2 Transport



Caution!

Follow the safety instructions and transport conditions for instruments of more than 18 kg (39.69 lbs). Do not lift the measuring instrument by its housing in order to transport it.

3.2.3 Storage

Pack the measuring instrument so that is protected against impacts for storage and transport.

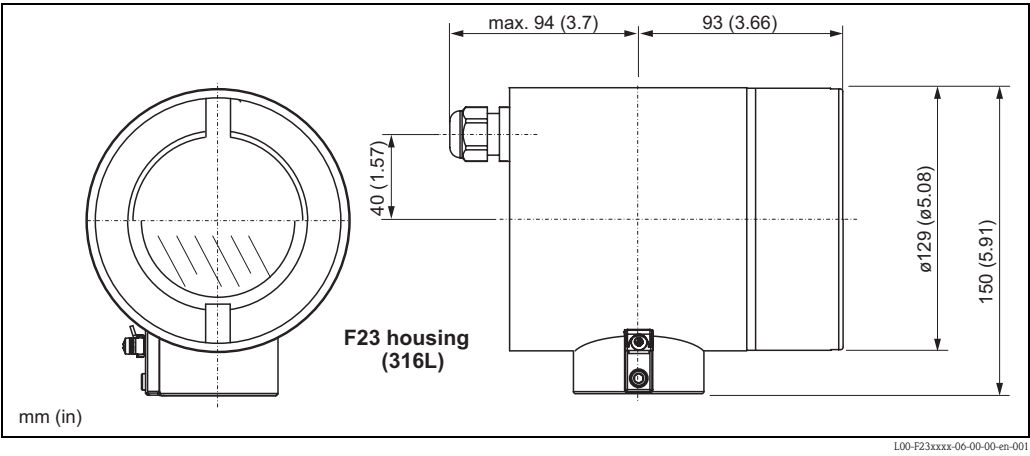
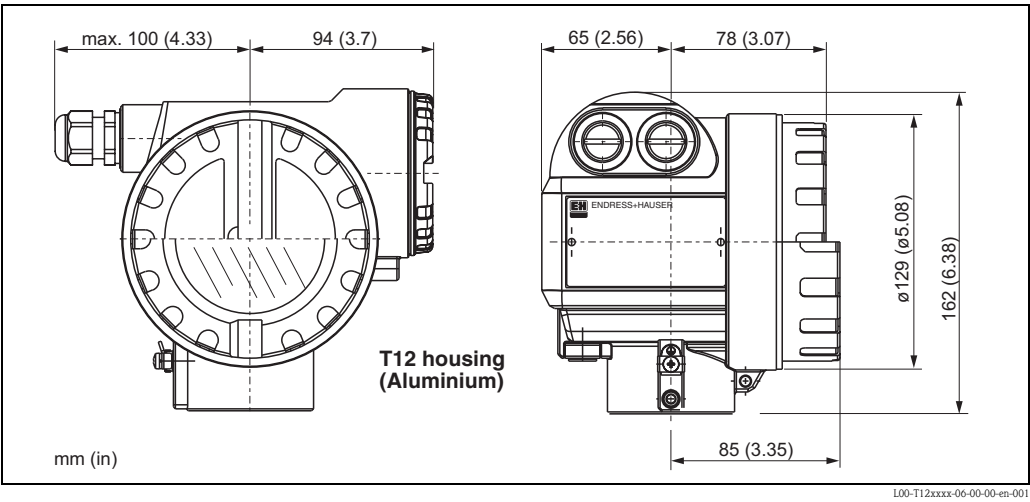
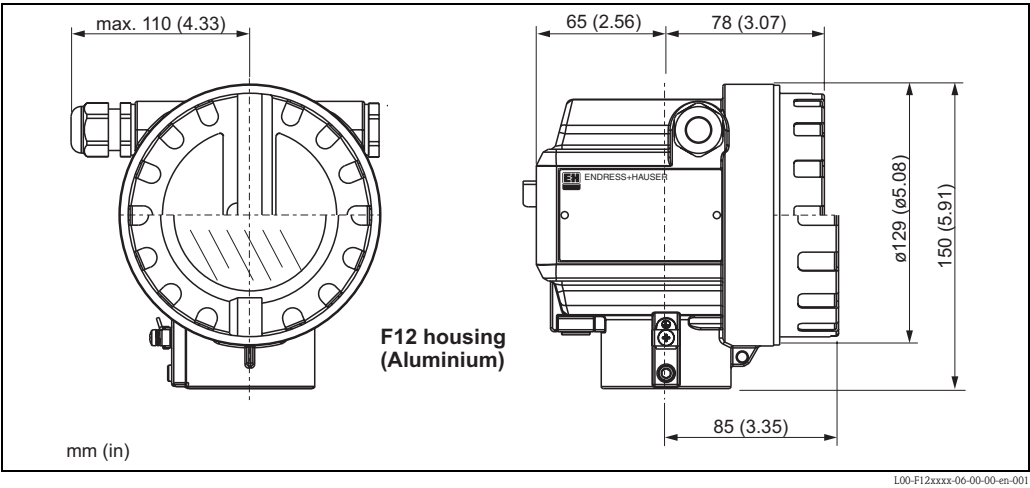
The original packing material provides the optimum protection for this.

The permissible storage temperature is -40 °C to +80 °C (-40 °F to +176 °F) or -50 °C to +80 °C (-58 °F to +176 °F).

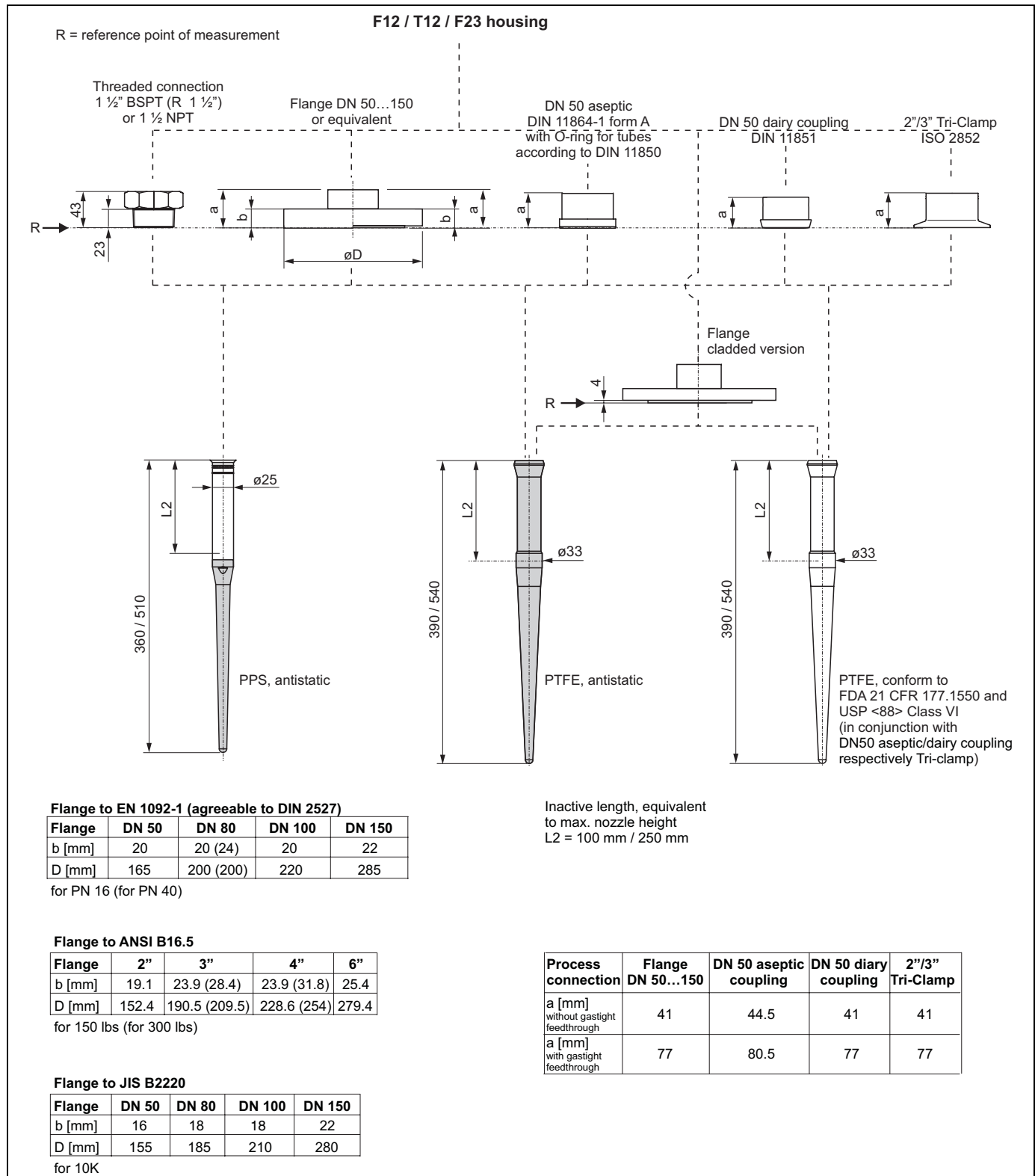
3.3 Installation conditions

3.3.1 Dimensions

Housing dimensions



Process connection, type of antenna

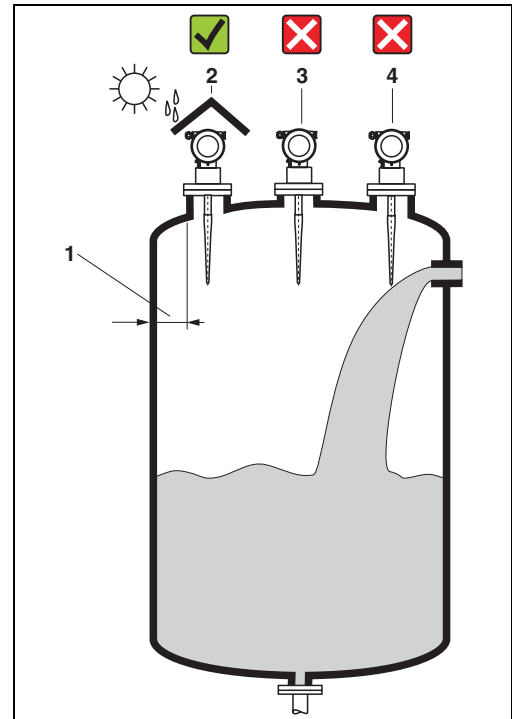


100-FMR231xx-06-00-00-en-005

3.3.2 Engineering hints

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: $\sim 1/6$ of tank diameter. Nevertheless the device should not be installed closer than 30 cm (11.8 in) to the tank wall.
- Not in the centre (3), interference can cause signal loss.
- Not above the fill stream (4).
- It is recommended to use a weather protection cover (2) in order to protect the transmitter from direct sun or rain. Assembly and disassembly is simply done by means of a tension clamp (\rightarrow 68, "Accessories").



L00-FMR2xxxx-17-00-00-xx-006

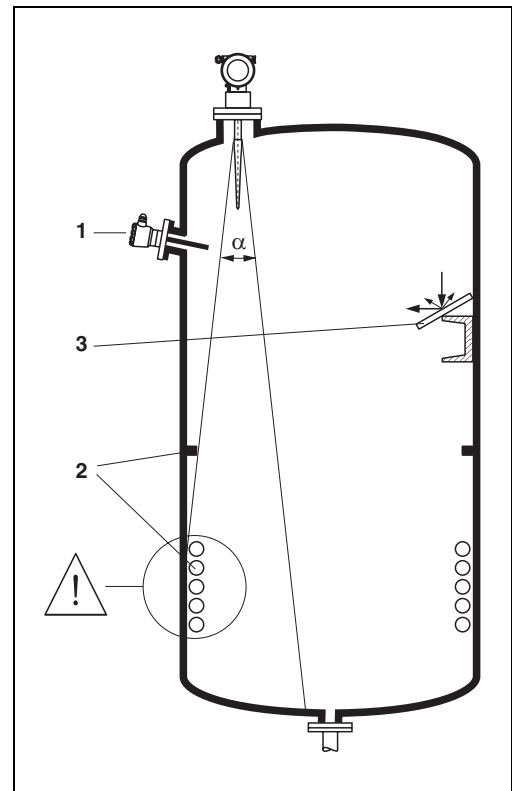
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (\rightarrow 15, "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: refer to "optimum mounting position", \rightarrow 18.
- 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.

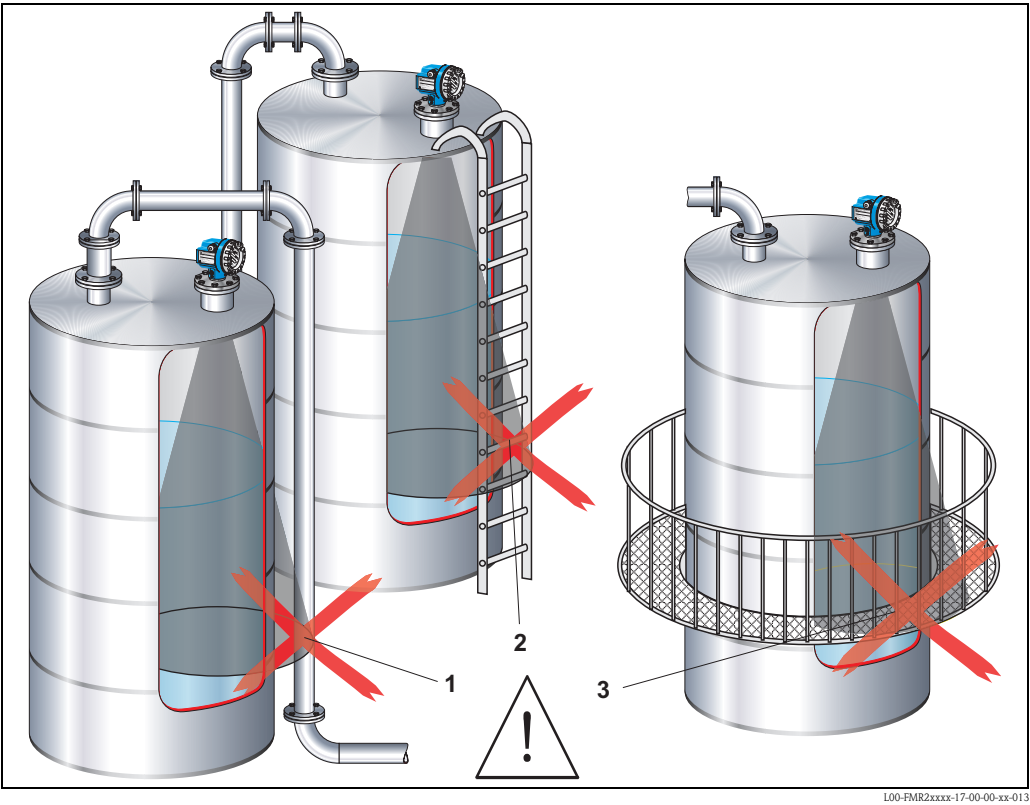
Please contact Endress+Hauser for further information.



L00-FMR2xxxx-17-00-00-xx-007

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.



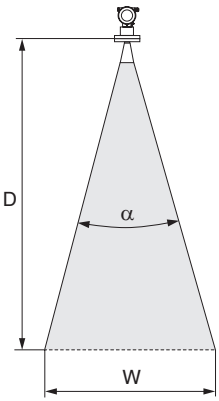
L00-FMR2xxxx-17-00-00-xx-013

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	Rod
Beam angle α	30°

Measuring distance (D)	Beam diameter (W) Rod
3 m (9.8 ft)	1.61 m (5.3 ft)
6 m (20 ft)	3.22 m (11 ft)
9 m (30 ft)	4.82 m (16 ft)
12 m (39 ft)	6.43 m (21 ft)
15 m (49 ft)	8.04 m (26 ft)
20 m (66 ft)	10.72 m (35 ft)



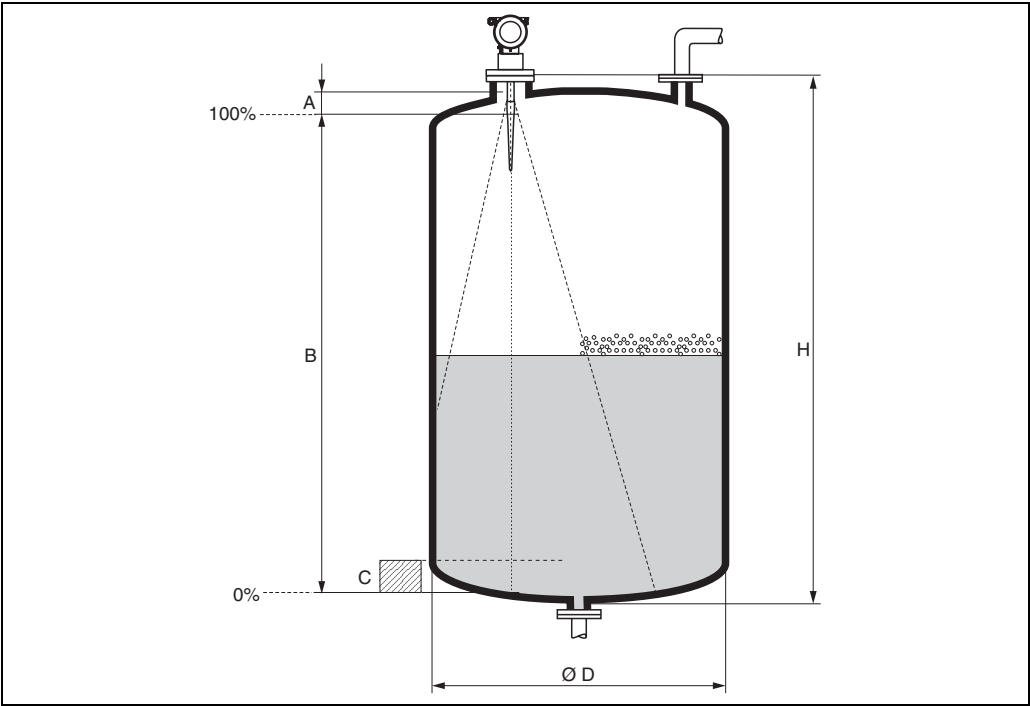
$$W = 2 \cdot D \cdot \tan \frac{\alpha}{2}$$

L00-FMR2xxxx-14-00-06-de-027

Measuring conditions



- 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 NH₃** or some **fluorocarbons** ¹⁾, please use FMR230 in a stilling well.



- 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)	> 0,5 (> 1.6)	150 to 300 (5.91 to 11.8)	> 1 (> 3.3)	> 1,5 (> 4.9)

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

Measuring range

The usable measuring range depends on the size of the antenna, the reflectivity of the medium, the mounting location and eventual interference reflections.

The maximum configurable range is:

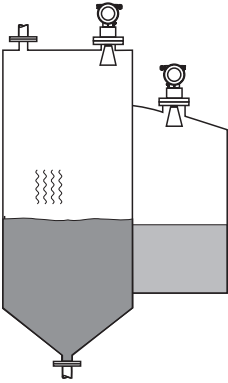
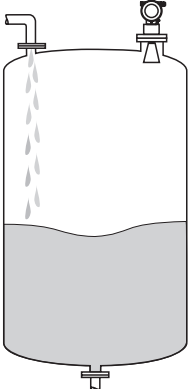
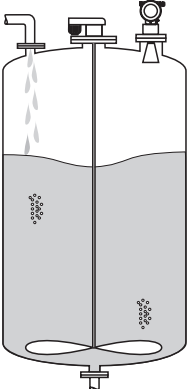
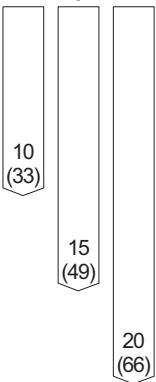
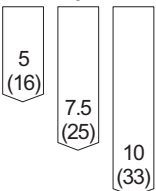
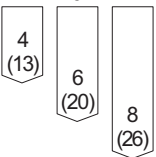
- 20 m (66 ft)

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

Measuring range depending on vessel type, conditions and product

Storage tank ¹⁾	Buffer tank ¹⁾	Process tank with agitator ¹⁾
		
Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes).	Moving surfaces (e.g. continuous filling, from above, mixing jets).	Turbulent surface. Single stage agitator < 60 U/min.
Rod antenna	Rod antenna	Rod antenna
		
Measuring range [m (ft)]		

1) For media group A to use a stilling well (20 m (66 ft)).

3.4 Installation instructions

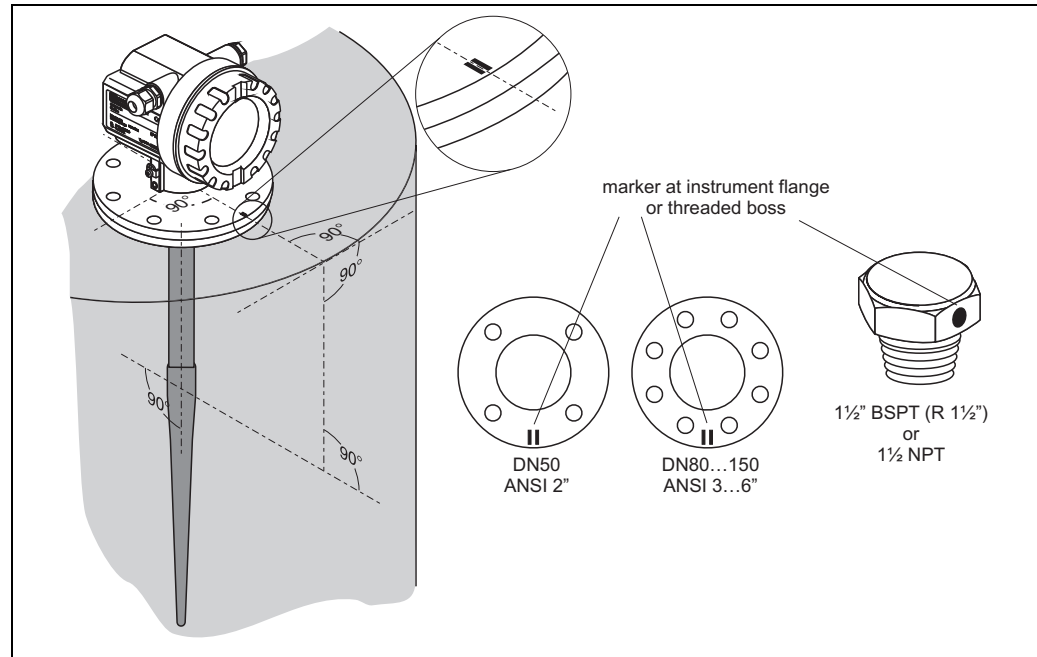
3.4.1 Mounting kit

In addition to the tool needed for flange mounting, you will require the following tool:

- 4 mm (0.16 in) Allen wrench for turning the housing.

3.4.2 Installation in tank (free space)

Optimum mounting position



100-FMR231-xx-17-00-00-en-001

Standard installation

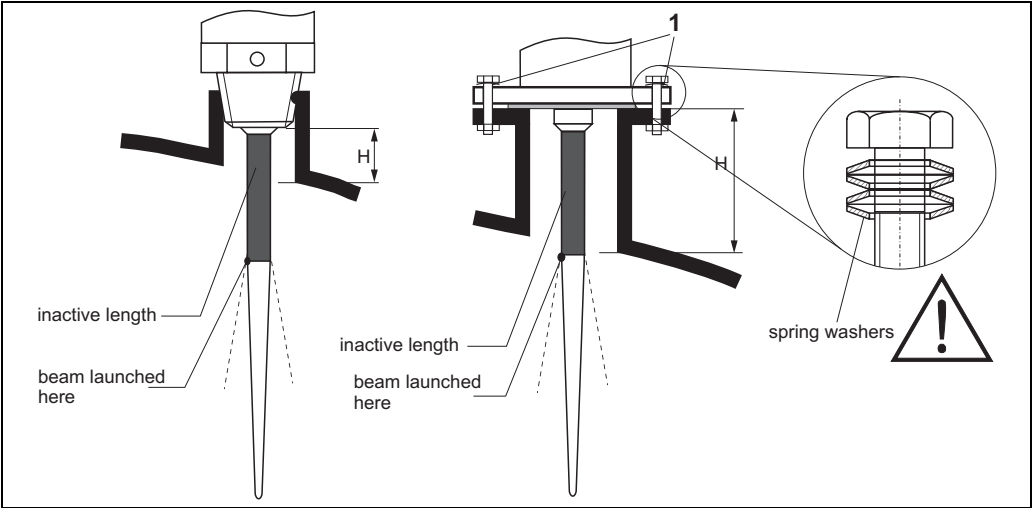
For installations in a stilling well, follow the engineering hints (→ 14) and note the following points:

- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- Use spring washers (1) (see Fig.).

Note!

It is recommended to retighten the flange bolts periodically, depending on process temperature and pressure. Recommended torque: 60 to 100 Nm (44.25 to 73.75 lbf ft).

- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The inactive part of the rod antenna must extend below the nozzle.
- The rod antenna must be aligned vertically.



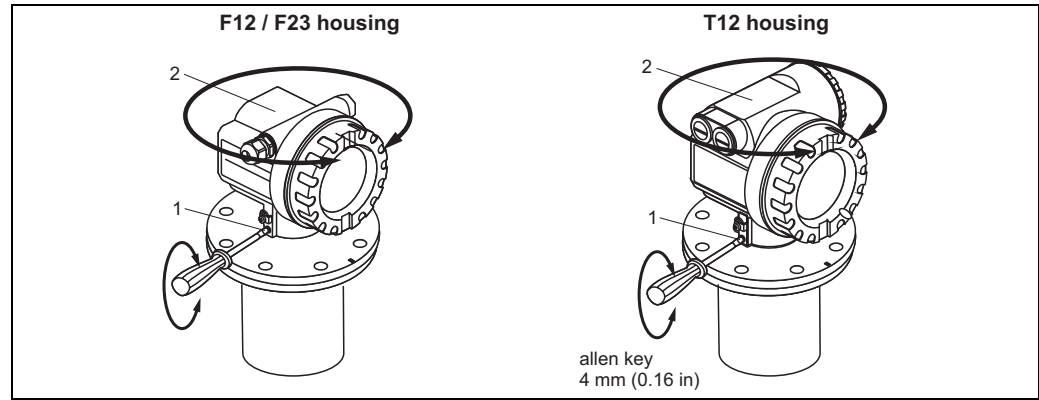
L00-FMR231:xx-17-00-00-en-002

Material	PPS		PTFE	
Antenna length [mm (in)]	360 (14.2)	510 (20.1)	390 (15.4)	540 (21.3)
H [mm (in)]	< 100 (< 3.94)	< 250 (< 9.84)	< 100 (< 3.94)	< 250 (< 9.84)

3.4.3 Turn housing

After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment. Proceed as follows to turn the housing to the required position:

- Undo the fixing screws (1)
- Turn the housing (2) in the required direction
- Tighten up the fixing screws (1)



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

3.5 Post-installation check

After the measuring instrument has been installed, perform the following checks:

- Is the measuring instrument damaged (visual check)?
- Does the measuring instrument correspond to the measuring point specifications such as process temperature/pressure, ambient temperature, measuring range, etc.?
- Is the flange marking correctly aligned (→ 10)?
- Have the flange screws been tightened up with the respective tightening torque?
- Are the measuring point number and labeling correct (visual check)?
- Is the measuring instrument adequately protected against rain and direct sunlight (→ 68)?

4 Wiring

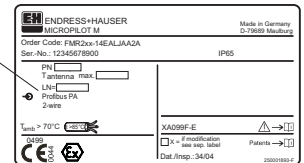
4.1 Quick wiring guide

Wiring in F12/F23 housing



Before connection please note the following:

- PROFIBUS devices are marked on the nameplate (1). The voltage is determined by the PROFIBUS standard and the desired safety concept. (see chapter 4.3).
- Connect potential matching line to transmitter earth terminal before connecting up the device.
- Tighten the locking screw:
It forms the connection between the antenna and the housing earth potential.

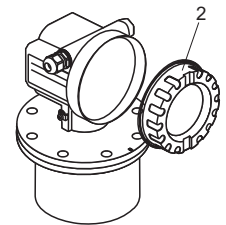


When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's). Make sure you use the specific cable gland.



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.

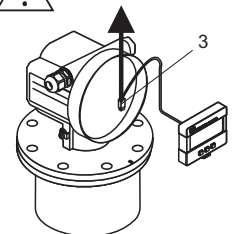


Connect up the Micropilot M as follows:

- 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.

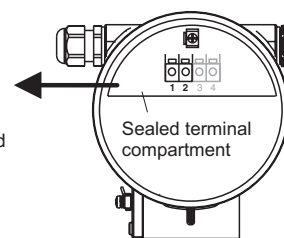
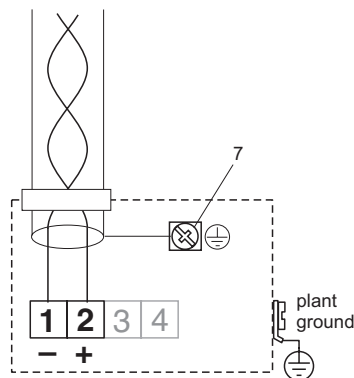
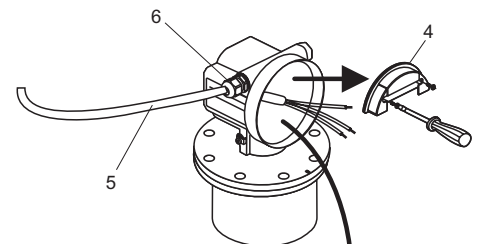


Unplug display connector!



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).

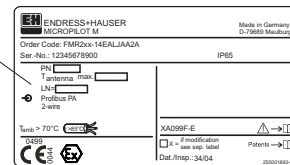


Wiring in T12 housing



Before connection please note the following:

- PROFIBUS devices are marked on the nameplate (1).
- The voltage is determined by the PROFIBUS standard and the desired safety concept. (see chapter 4.3).
- Connect potential matching line to transmitter earth terminal before connecting up the device.
- Tighten the locking screw:
It forms the connection between the antenna and the housing earth potential.



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



Connect up the Micropilot M as follows:

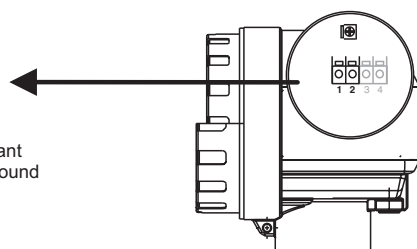
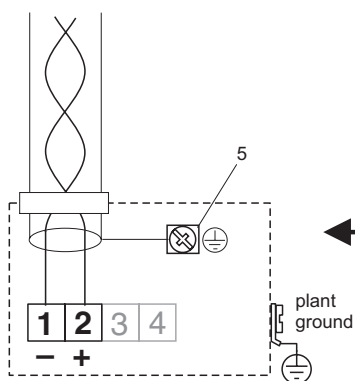
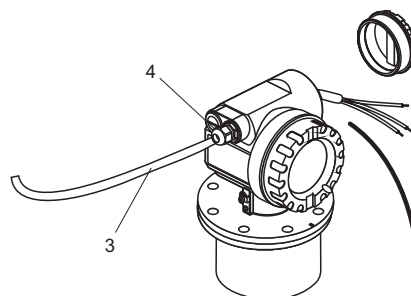
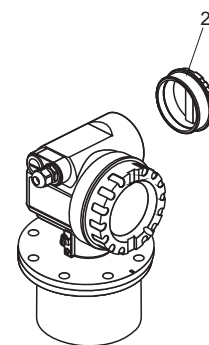
Before unscrew housing cover (2) at separate connection room turn off the power supply!

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




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

- Make connection (see pin assignment).
- Tighten cable gland (4).
- Screw on housing cover (2).
- Switch on power supply.



L00-FMR2xxxx-04-00-00-en-022

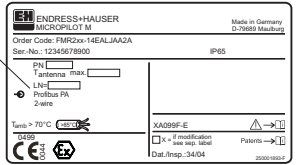
Wiring with M12 connector




Caution!

Before connection please note the following:

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



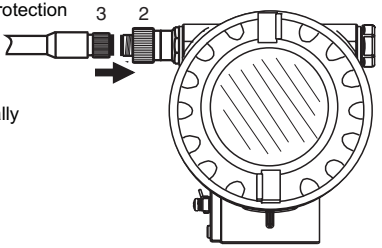
EX

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-004

Cable specification PROFIBUS

Twisted, screened pairs must be used. The following specification must be met for explosion hazardous application (EN50020, FISCO model):

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

The following cable types can be used, for example

Non-Ex-area:

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

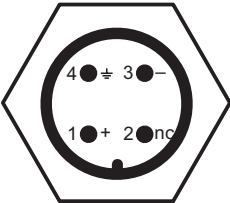
Ex-area:

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

Fieldbus plug connectors

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

Pin assignment of the M12 plug connector (PROFIBUS PA plug)

	Pin	Meaning
	1	Ground
	2	Signal +
	3	Signal -
	4	not connected

L00-FMxxxxxx-04-00-00-yy-016

4.2 Connecting the measuring unit

Cable entry

- Cable gland: M20x1.5 (for Ex-d: only cable entry)
- Cable entry: G½ or ½NPT
- PROFIBUS-PA M12 plug

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
polarity sensitive	No
FISCO/FNICO compliant in accordance to IEC60079-27	9 V

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

Current consumption

- Device basic current: max. 13 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA

Overvoltage protector

The level transmitter Micropilot M with T12-housing (housing version "D", see ordering information) 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, $\hat{I} = 10$ 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.

Connection with M12 plug

The Micropilot M PROFIBUS-PA sensor version with M12 plug is supplied ready wired and need only be connected to the bus by means of a suitable cord set.

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)





Caution!

Degree of protection IP68 NEMA 6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in.

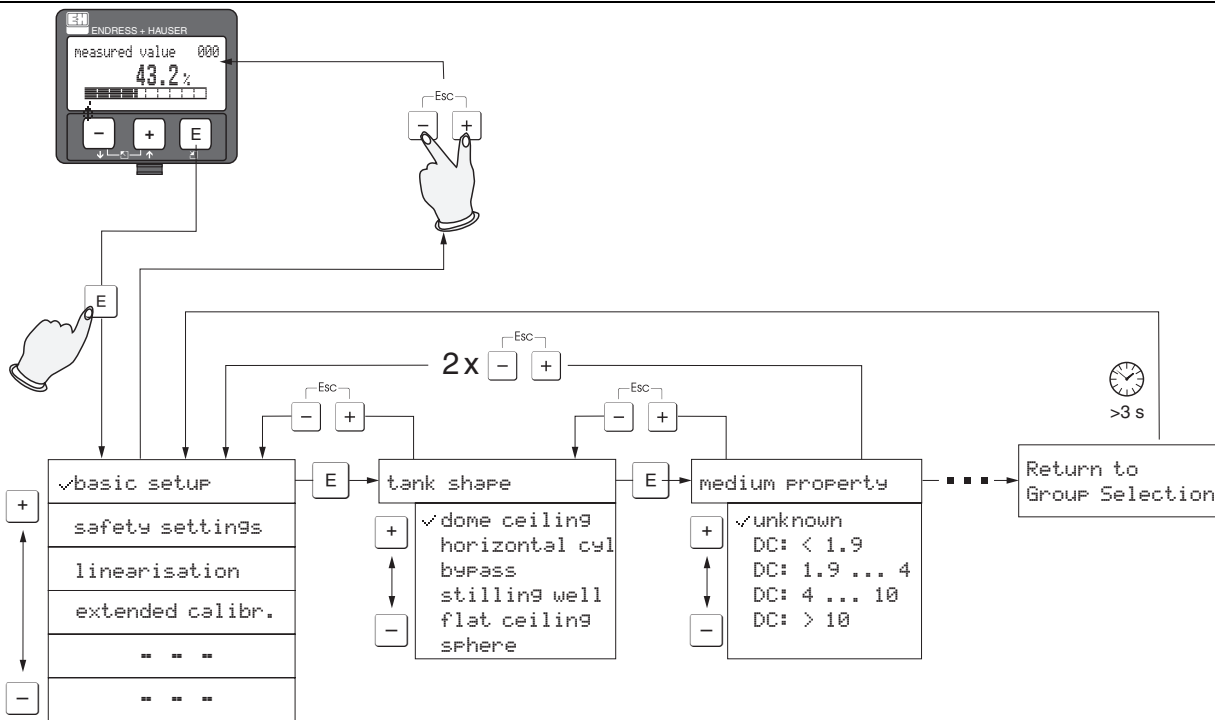
4.5 Post-connection check

After wiring the measuring instrument, perform the following checks:

- Is the terminal allocation correct (→  21 and →  23)?
- Is the cable gland tight?
- Is the M12 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

5.1 Quick operation guide



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 function** (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**

5.1.1 General structure of the operating menu

The operating menu is made up of two levels:

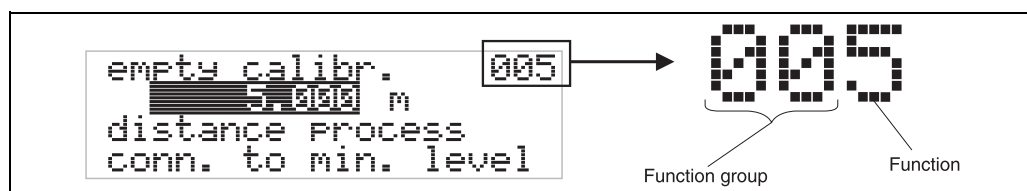
- **Function groups (00, 01, 03, ..., 0C, 0D):** The individual operating options of the instrument are split up roughly into different function groups. The function groups that are available include, e.g.: "**basic setup**", "**safety settings**", "**output**", "**display**", etc.
- **Functions (001,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

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

1. Select the "**basic setup**" (00) function group.
2. Select the "**tank shape**" (002) function (where the existing tank shape is selected).

5.1.2 Identifying the functions

For simple orientation within the function menus (→ 88), for each function a position is shown on the display.



The first two digits identify the function group:

- **basic setup** 00
- **safety settings** 01
- **linearisation** 04

...

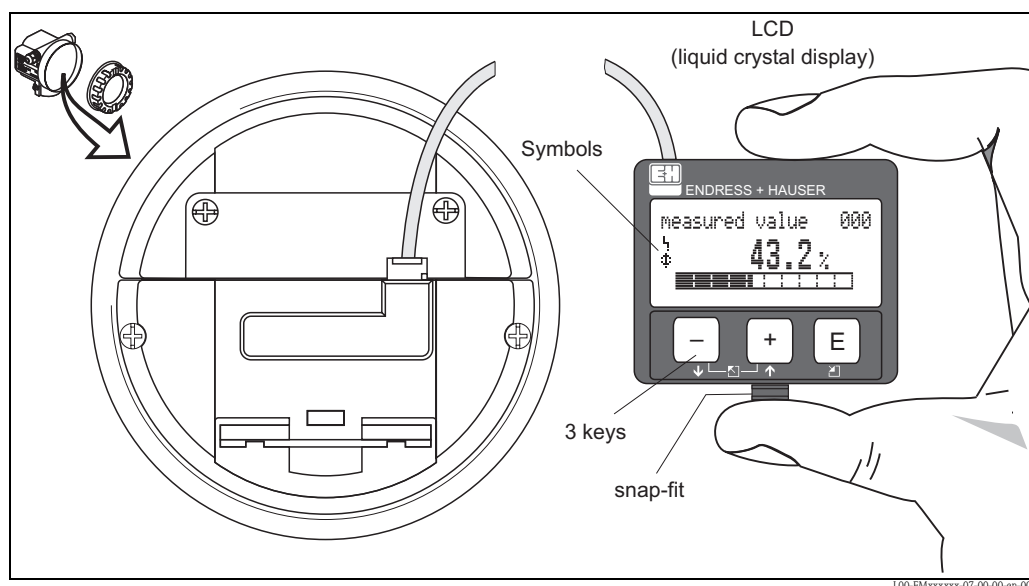
The third digit numbers the individual functions within the function group:

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

...

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

5.2 Display and operating elements



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.



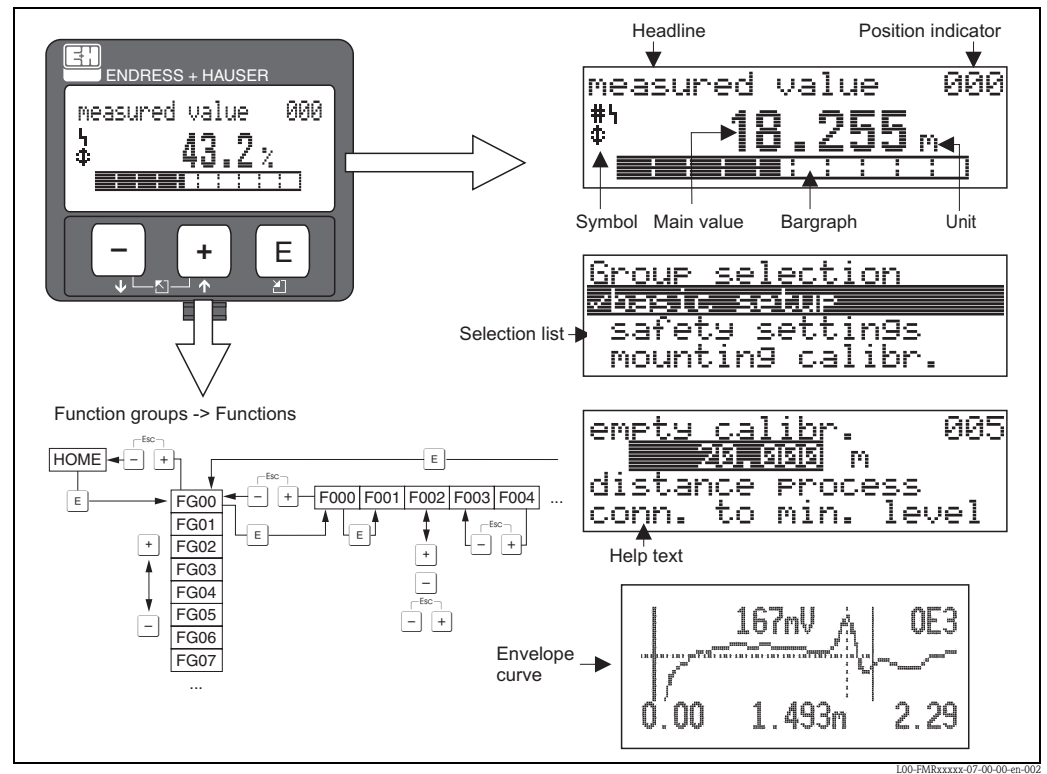
Note!

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

5.2.2 Display symbols
















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

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

5.2.3 Key assignment

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

Function of the keys


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

5.3 Local operation

5.3.1 Locking of the configuration mode





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

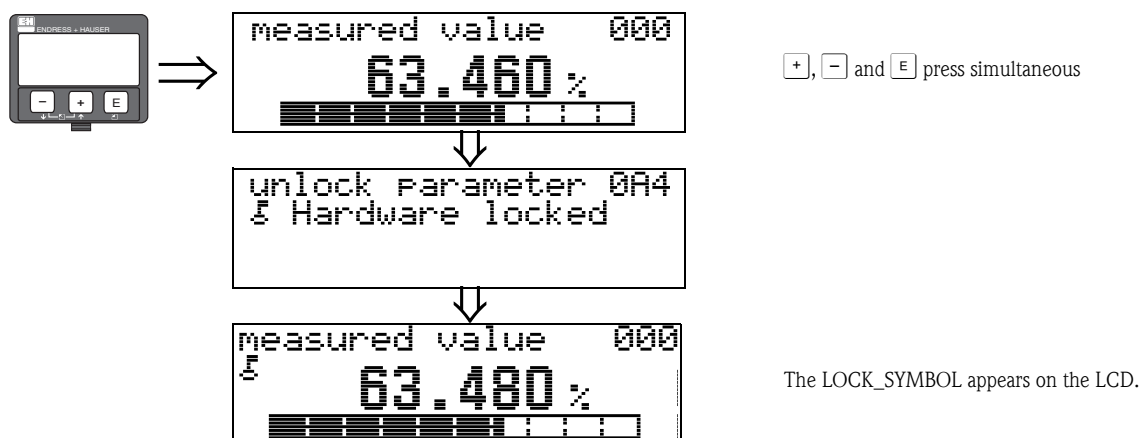
Function "unlock parameter" (0A4):

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

Hardware lock:

The instrument is locked by pressing the ,  and  keys at the same time.

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



5.3.2 Unlocking of configuration mode

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




Function "unlock parameter" (0A4):

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

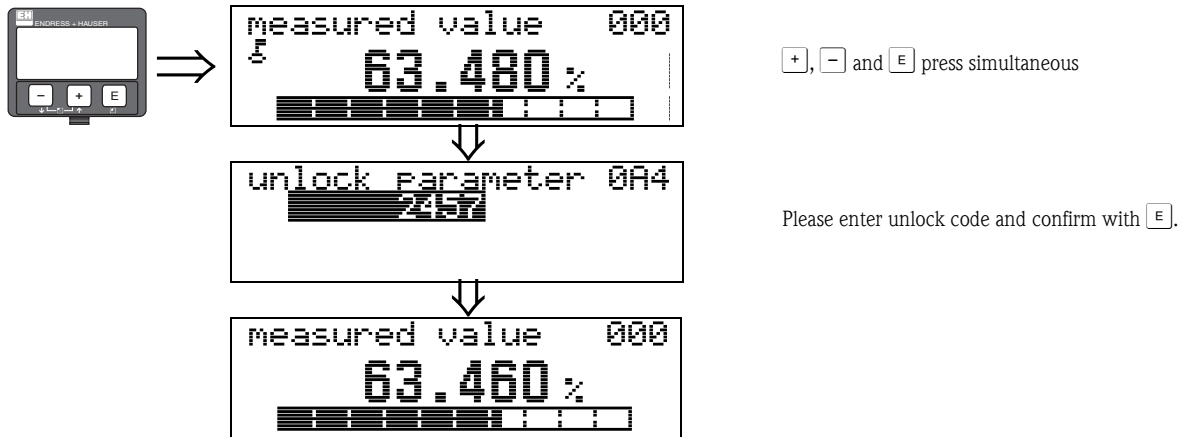
2457 = for PROFIBUS PA devices

the Micropilot is released for operation.

Hardware unlock:

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

2457 = for PROFIBUS PA devices.



Caution!

Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy.

There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization.

Please contact Endress+Hauser if you have any questions.

5.3.3 Factory settings (Reset)

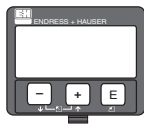


Caution!

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

A reset is only necessary, if the instrument...

- ... no longer functions
- ... must be moved from one measuring point to another
- ... is being de-installed /put into storage/installed



```
reset          0A3
[REDACTED]
for reset code
see manual
```

User input ("reset" (0A3)):

- 33333 = customer parameters (PROFIBUS PA)

33333 = reset customer parameters

This reset is recommended whenever an instrument with an unknown "history" is to be used in an application:

- The Micropilot is reset to the default values.
- The customer specific tank map is not deleted.
- A linearisation is switched to "**linear**" although the table values are retained. The table can be reactivated in the "**linearisation**" (04) function group.

List of functions that are affected by a reset:

- | | |
|-------------------------|--------------------------|
| ■ tank shape (002) | ■ linearisation (041) |
| ■ empty calibr. (005) | ■ customer unit (042) |
| ■ full calibr. (006) | ■ diameter vessel (047) |
| ■ pipe diameter (007) | ■ range of mapping (052) |
| ■ output on alarm (010) | ■ pres. Map dist (054) |
| ■ output on alarm (011) | ■ offset (057) |
| ■ outp. echo loss (012) | ■ simulation (065) |
| ■ ramp %span/min (013) | ■ simulation value (066) |
| ■ delay time (014) | ■ format display (094) |
| ■ safety distance (015) | ■ distance unit (0C5) |
| ■ in safety dist. (016) | ■ download mode (0C8) |
| ■ level/ullage (040) | |

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

This reset is recommended whenever an instrument with an unknown "history" is to be used in an application or if a faulty mapping was started:

- The tank map is deleted. The mapping must be recommenced.

5.4 Display and acknowledging error messages

Type of error


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

The measuring system distinguishes between two types of error:

- **A (Alarm):**

Instrument goes into a defined state (e.g. max 22 mA)


Indicated by a constant  symbol.

(For a description of the codes, →  71)

- **W (Warning):**

Instrument continue measuring, error message is displayed.


Indicated by a flashing  symbol.

(For a description of the codes, →  71)

- **E (Alarm / Warning):**


Configurable (e.g. loss of echo, level within the safety distance)



Indicated by a constant/flashing  symbol.

(For a description of the codes, →  71)



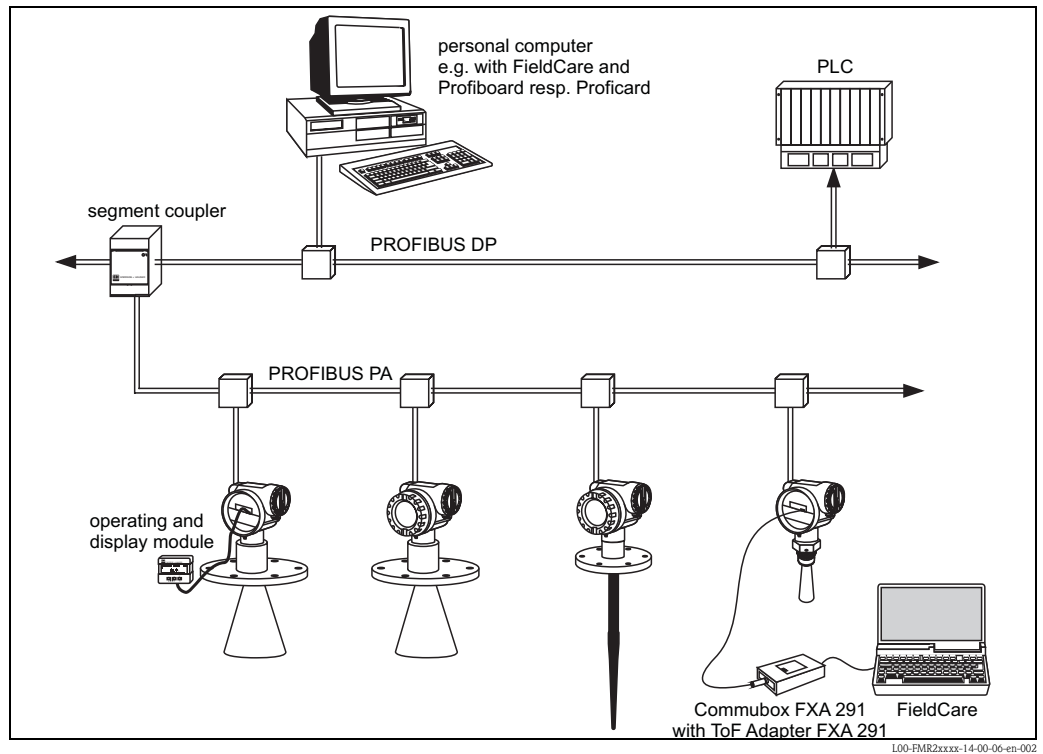
5.4.1 Error messages

Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of the error codes, →  71.

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

5.5 PROFIBUS PA communication

5.5.1 Synopsis



A maximum of 32 transmitters can be connected to the bus (only 8 in explosion hazardous areas Ex ia IIC according to the FISCO model). The bus power is supplied by the segment coupler. On-site- as well as remote operation are possible. For detailed information on the PROFIBUS-PA standard refer to Operation Instructions BA198F/00/EN and the standards EN50170/DIN19245 (PROFIBUS-PA) and EN50020 (FISCO model).

5.5.2 Device address

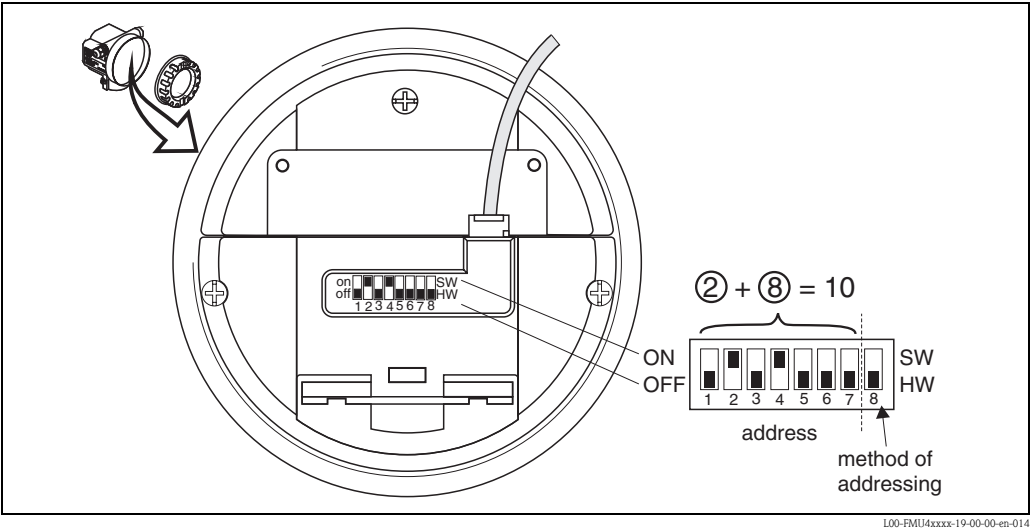
Selecting the device address

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

Software addressing

Software addressing comes into operation, when DIP-switch 8 is in the position "ON".
BA198F/00/EN describes, how to set the address in this case.
In FieldCare, the address can be set via the **"Set address"** function in the **"Device"** menu.

Hardware addressing



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

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

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

5.5.3 Device database and type files (GSD)

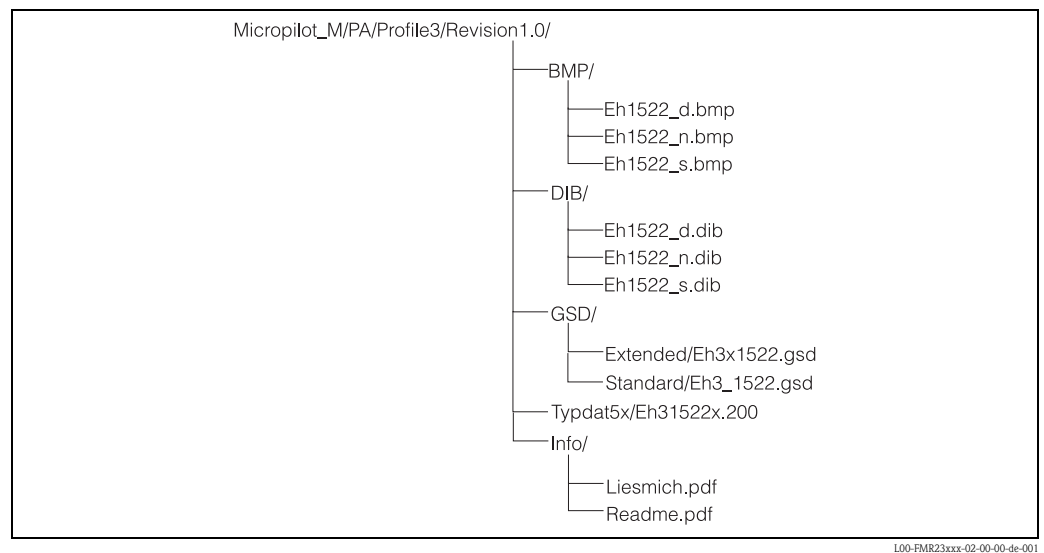
A device database file (GSD) contains a description of the properties of the PROFIBUS-PA device, e.g. the supported transmission rates and the type and format of the digital information output to the PLC. Additional bitmap files are required in order to represent the device by an icon in the network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

Source of supply

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

Directory structure

The files are organized in the following structure:



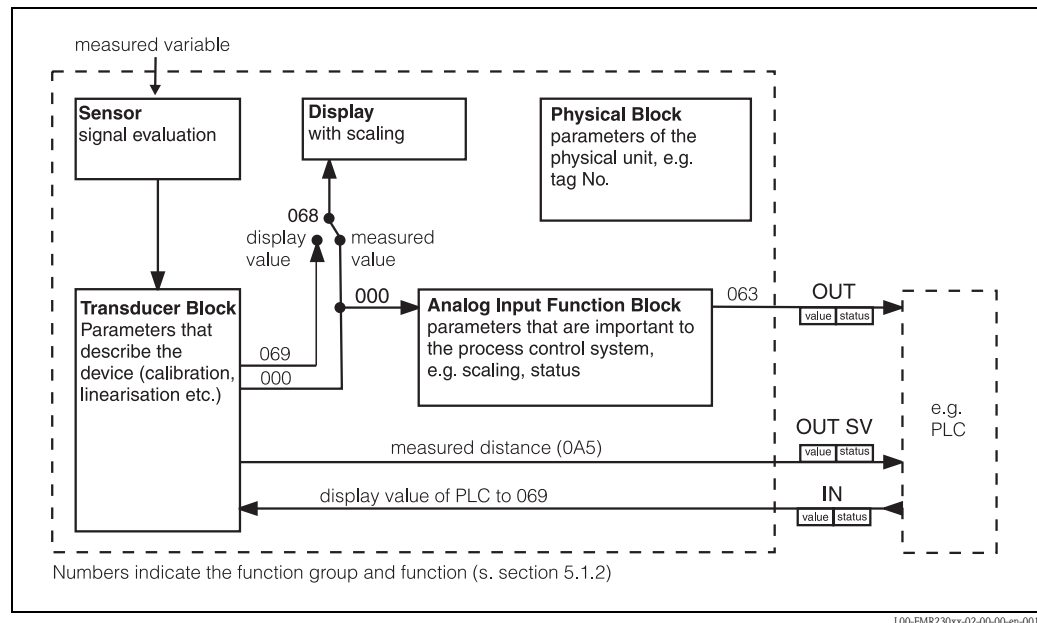
- The GSD files in the directory "Extended" are needed for the network design software STEP 7 of the S7-300/400 PLC family.
- The GSD files in the directory "Standard" are used for PLCs, which do not support an identifier format but only an identifier byte (e.g. PLC5 of Allen-Bradley)
- For the network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

Universal Database File

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

5.5.4 Cyclic data exchange

Block model of the Micropilot M



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

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

Modules for the cyclic data telegram

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

1. **Main Process Value**
This is the main measured value scaled by the Analog Input Block (063).
2. **2nd Cyclic Value**
This is the measured distance between the sensor mebrane and the product surface (0A5) or the measured temperature (030).
3. **Display Value**
This is a value which can be transferred from the PLC to the Micropilot M in order to be shown on the display.
4. **FREE PLACE**
This module must be applied during configuration (see below), if the 2nd cyclic value or the display value are not to appear in the data telegram.

Configuration of the cyclic data telegram

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

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

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

Structure of the input data (Micropilot M → PLC)

The input data are transmitted according to the following structure:

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

Structure of the output data (PLC → Micropilot M)

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

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

IEEE-745 Floating Point Number

The measured value is transmitted as a IEEE 754 floating point number, whereby

$$\text{Measured value} = (-1)^{VZ} \times 2^{(E-127)} \times (1+F)$$

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

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

Example:

$$\begin{aligned}
 40 \text{ F0 } 00 \text{ } 00 \text{ (hex)} &= 0100 \text{ } 0000 \text{ } 1111 \text{ } 0000 \text{ } 0000 \text{ } 0000 \text{ } 0000 \text{ (bin)} \\
 &= (-1)^0 \times 2^{(129-127)} \times (1 + 2^{-1} + 2^{-2} + 2^{-3}) \\
 &= 1 \times 2^2 \times (1 + 0.5 + 0.25 + 0.125) \\
 &= 1 \times 4 \times 1.875 \\
 &= 7.5
 \end{aligned}$$

Status codes

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

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

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

5.5.5 Acyclic data exchange

Acyclic data exchange allows device parameters to be changed independently of the communication between the device and a PLC.

Acyclic data exchange is used to:

- transmit device parameters during commissioning and maintenance;
- display measured values that are not acquired in cyclic traffic.

There are two types of acyclic data exchange:

Acyclic communication with a Class 1 master (MS1AC)

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



Note!

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



Caution!

Permanent writing of parameters, e.g. with every cycle of the application program, must be avoided, since this can drastically reduce the life of the device.

Acyclic write parameters are stored electrically in the RAM (EEPROM, Flash...). The RAM modules are design for a limited number of write operations only. In standard operation without MS1AC, i.e. during parametrisation of the device, the number of write operations is negligible when compared to the limit. If the application program is badly designed, however, this limit can be reached quickly, and the RAM will fail

Acyclic communication with a Class 2 master (MS2AC)

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

- FieldCare
- PDM

Before data can be exchanged via PROFIBUS, however, the Class 2 master must be made aware of the parameters contained within the field device. This can be done by:

- a device description (DD)
- a device type manager (DTM)
- a software component within the master, which accesses the parameters via slot and index addresses.



Note!

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

The device Micropilot M supports MS2AC communication with two SAPs.

The device Micropilot M does not support MS1AC communication.

5.5.6 Slot/index tables

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

The Analog-Input and physical blocks contain standard parameters, block parameters and manufacturer-specific parameters. The transducer block of the Micropilot M is Endress+Hauser specific. The parameters of the Analog-Input block are not available when operating via the display or via FieldCare.

Device Management

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

Analog-Input-Block

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

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

Physical Block

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

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

Endress+Hauser specific level transducer block

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block data		1	130	20	DS-32*	X		constant
Static revision		1	131	2	UNSIGNED16	X		non-vol.
Device tag		1	132	32	OSTRING	X	X	static
Strategy		1	133	2	UNSIGNED16	X	X	static
Alert key		1	134	1	UNSIGNED8	X	X	static
Target mode		1	135	1	UNSIGNED8	X	X	static
Mode		1	136	3	DS-37*	X		dynamic non-vol. static
Alarm summary		1	137	8	DS-42*	X		dynamic
Endress+Hauser-Parameters								
Measured value	V0H0	1	138	4	FLOAT	X		dynamic
gap			139					
tank shape	V0H2	1	140	1	UNSIGNED8	X	X	static
medium cond.	V0H3	1	141	1	UNSIGNED8	X	X	static
process cond.	V0H4	1	142	1	UNSIGNED8	X	X	static
empty calibration	V0H5	1	143	4	FLOAT	X	X	static
full calibration	V0H6	1	144	4	FLOAT	X	X	static
pipe diameter	V0H7	1	145	4	FLOAT	X	X	static
gap			146-147					
output on alarm	V1H0	1	148	1	UNSIGNED8	X	X	static
gap			149					
outp. echo loss	V1H2	1	150	1	UNSIGNED8	X	X	static
ramp %span/min	V1H3	1	151	4	FLOAT	X	X	static
delay time	V1H4	1	152	2	UNSIGNED16	X	X	static
safety distance	V1H5	1	153	4	FLOAT	X	X	static
in safety dist.	V1H6	1	154	1	UNSIGNED8	X	X	static
ackn. alarm	V1H7	1	155	1	UNSIGNED8	X	X	static
overspill protection	V1H8	1	156	1	UNSIGNED8	X	X	static
gap			157-167					
level/ullage	V3H0	1	168	1	UNSIGNED8	X	X	static
linearisation	V3H1	1	169	1	UNSIGNED8	X	X	static
customer unit	V3H2	1	170	2	UNSIGNED16	X	X	static
table no.	V3H3	1	171	1	UNSIGNED8	X	X	static
gap			172					
input volume	V3H5	1	173	4	FLOAT	X	X	static
max. scale	V3H6	1	174	4	FLOAT	X	X	static
diameter vessel	V3H7	1	175	4	FLOAT	X	X	static
check distance	V4H1	1	179	1	UNSIGNED8	X	X	static
range of mapping	V4H2	1	180	4	FLOAT	X	X	static
start mapping	V4H3	1	181	1	UNSIGNED8	X	X	static

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
pres. map. dist.	V4H4	1	182	4	FLOAT	X		dynamic
cust. Tank map	V4H5	1	183	1	UNSIGNED8	X	X	static
echo quality	V4H6	1	184	1	UNSIGNED8	X		dynamic
offset	V4H7	1	185	4	FLOAT	X	X	static
output damping	V4H8	1	186	4	FLOAT	X	X	static
blocking dist.	V4H9	1	187	4	FLOAT	X	X	static
instrument_addr.	V5H0	1	188	1	UNSIGNED8	X		dynamic
ident number	V5H1	1	189	1	UNSIGNED8	X	X	static
set unit to bus	V5H2	1	190	1	UNSIGNED8	X	X	static
out value	V5H3	1	191	4	FLOAT	X		dynamic
out status	V5H4	1	192	1	UNSIGNED8	X		dynamic
simulation	V5H5	1	193	1	UNSIGNED8	X		static
gap			194					
2nd cyclic value	V5H7	1	195	1	UNSIGNED8	X	X	static
select VOH0	V5H8	1	196	1	UNSIGNED8	X	X	static
input value	V5H9	1	197	4	FLOAT	X		dynamic
gap			198					
display contrast	V6H1	1	199	1	UNSIGNED8	X	X	static
language	V6H2	1	200	1	UNSIGNED8	X	X	static
back to home	V6H3	1	201			X	X	static
format display	V6H4	1	202	1	UNSIGNED8	X	X	static
no. decimals	V6H5	1	203	1	UNSIGNED8	X	X	static
sep. character	V6H6	1	204	1	UNSIGNED8	X	X	static
display test	V6H7	1	205	1	UNSIGNED8	X	X	static
gap			206-227					
present error	V9H0	1	228		STRUCT	X		dynamic
previous error	V9H1	1	229		STRUCT	X		dynamic
clear last error	V9H2	1	230	1	UNSIGNED8	X	X	static
reset	V9H3	1	231	2	UNSIGNED16	X	X	static
unlock parameter	V9H4	1	232	2	UNSIGNED16	X	X	static
measured dist.	V9H5	1	233	4	FLOAT	X		dynamic
measured level	V9H6	1	234	4	FLOAT	X		dynamic
gap			235					
application par.	V9H8	1	236	1	UNSIGNED8	X		dynamic
gap			237					
tag no.	VAH0	1	238		STRING	X		const
profile version	VAH1	1	239		STRING	X	X	static
protocol+sw-no.	VAH2	1	240		STRING	X		const
gap			241					
serial no.	VAH4	1	242		STRING	X	X	static
distance unit	VAH5	1	243	2	UNSIGNED16	X	X	static
gap			244-245					
download mode	VAH8	1	246	1	UNSIGNED8	X	X	static

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
antenna ext.	VAH9		247	4	FLOAT	X	X	static
input level semi auto	V3H4	1	248	4	FLOAT	X		dynamic
input level manual	V3H4	1	249	4	FLOAT	X	X	static
simulation level	V3H6	1	250	4	FLOAT	X	X	static
simulation volume	V3H6	1	251	4	FLOAT	X	X	static
TB view_1		1	252	22	OSTRING	X		dynamic

Data strings

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

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

5.5.7 Endress+Hauser operating program

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard. Hardware and software requirements you can find on the internet: www.endress.com → select your country → search: FieldCare → FieldCare → Technical Data.

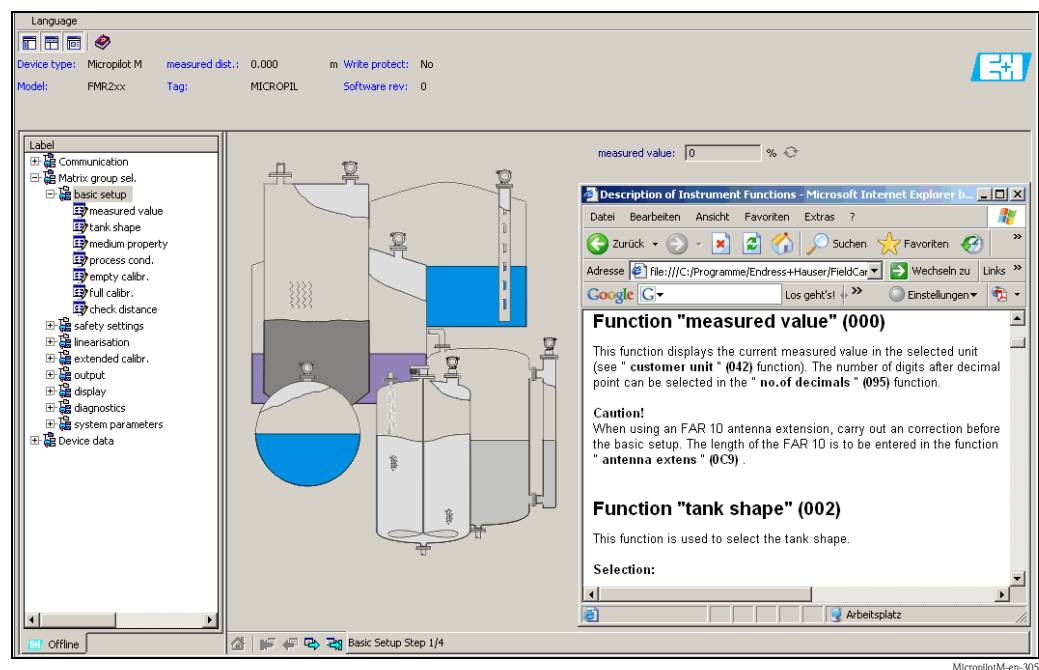
FieldCare supports the following functions:

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

Connection options:

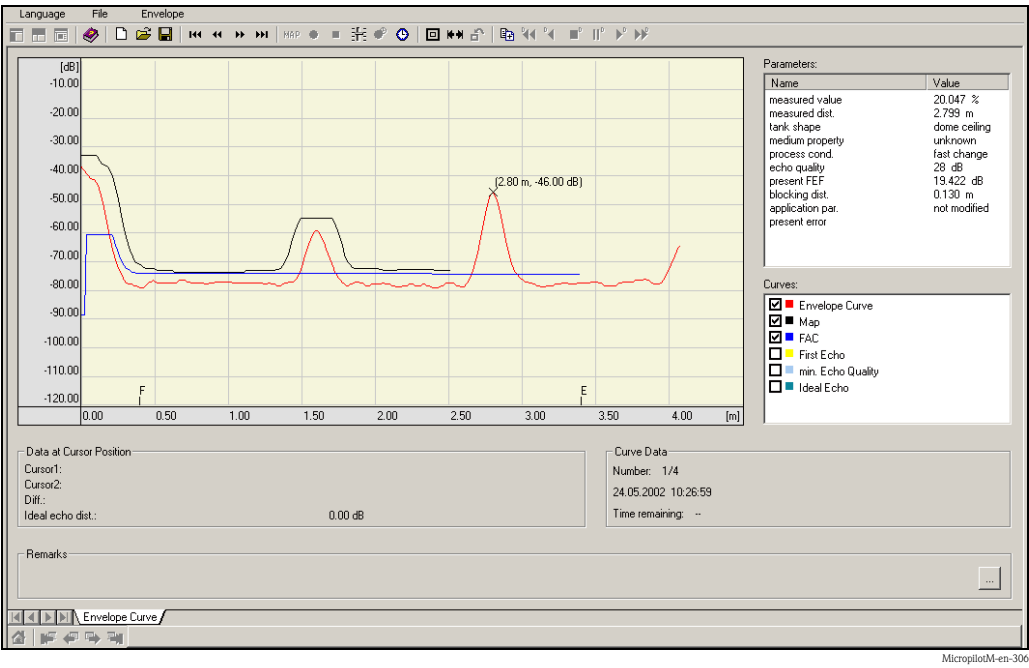
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Commubox FXA291 with ToF Adapter FXA291 (USB) via service interface

Menu-guided commissioning



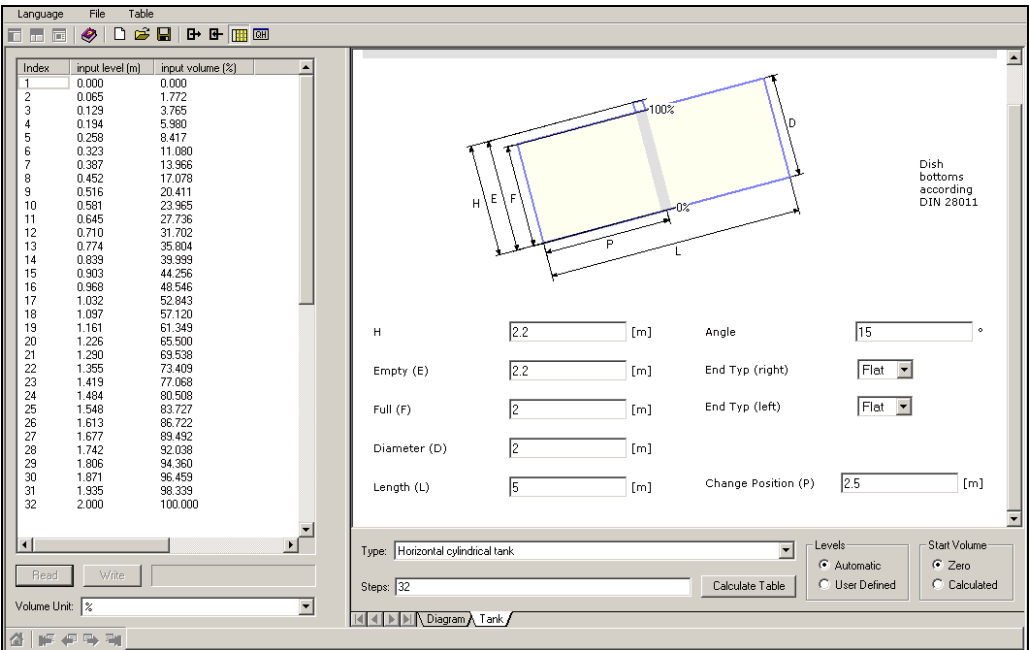
MicropilotM-en-305

Signal analysis via envelope curve



MicroplotM-en-300

Tank linearisation



MicroplotM-en-307

6 Commissioning

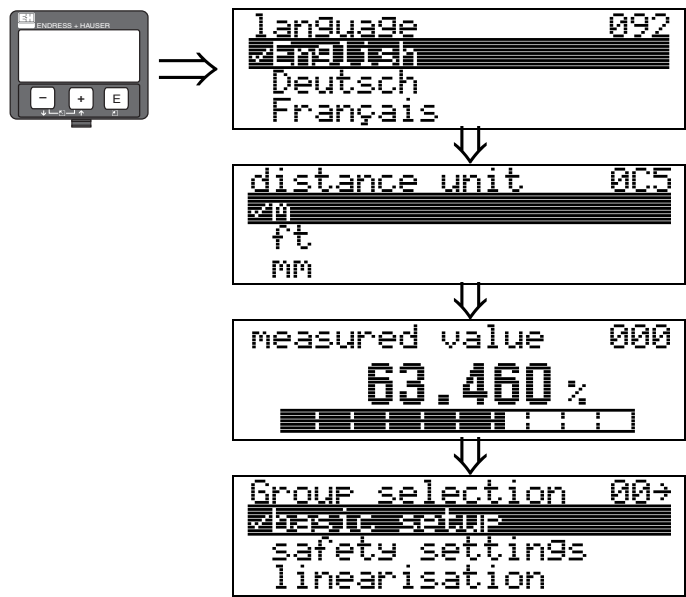
6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:

- Checklist "Post installation check", → 20.
- Checklist "Post connection check", → 25.

6.2 Switching on the measuring device

When the instrument is switched on for the first time, the following messages appear in a sequence of 5 s on the display: software version, communication protocol and language selection.



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

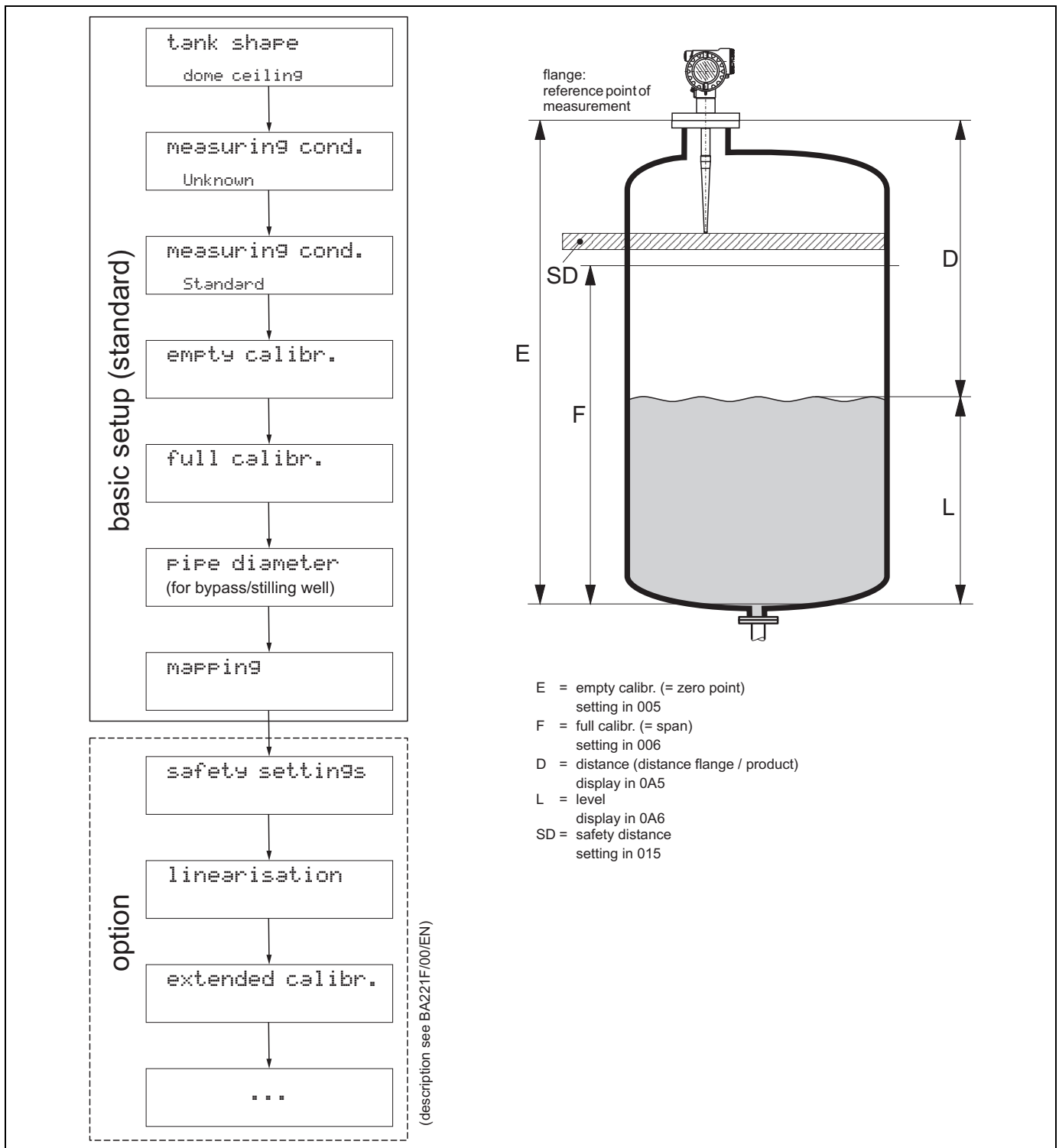
Select the basic unit (this message appears the first time the instrument is switched on)

The current measured value is displayed

After **E** is pressed, you reach the group selection

This selection enables you to perform the basic setup

6.3 Basic Setup



L00-FMR231xx-19-00-00-en-001

**Caution!**

The basic setup is sufficient for successful commissioning in most applications. Complex measuring operations necessitate additional functions that the user can use to customise the Micropilot as necessary to suit his specific requirements. The functions available to do this are described in detail in the BA00221F/00/EN.

Comply with the following instructions when configuring the functions in the "**basic setup**" (00):

- Select the functions as described on → 26.
- Some functions can only be used depending on the parameterisation of the instrument. For example, the pipe diameter of a stilling well can only be entered if "**stilling well**" was selected beforehand in the "**tank shape**" (002) function.
- Certain functions (e.g. starting an interference echo mapping (053)) prompt you to confirm your data entries. Press **+** or **-** to select "**YES**" and press **↵** to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group "**display**" (09)), an automatic return is made to the home position (measured value display).

**Note!**

- The instrument continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimised.
- If the power supply fails, all preset and parameterised values remain safely stored in the EEPROM.
- All functions are described in detail, as is the overview of the operating menu itself, in the manual "**BA00221F - Description of Instrument Functions**", which is found on the enclosed CD-ROM.
- The default values of the parameters are typed in **boldface**.

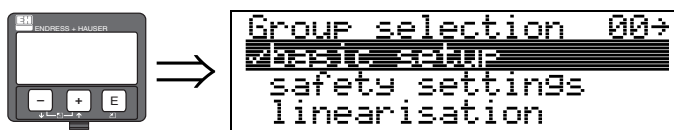
6.4 Basic Setup with the device display

Function "measured value" (000)

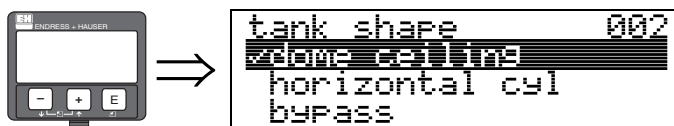


This function displays the current measured value in the selected unit (see "**customer unit**" (042) function). The number of digits after decimal point can be selected in the "**no.of decimals**" (095) function.

6.4.1 Function group "basic setup" (00)



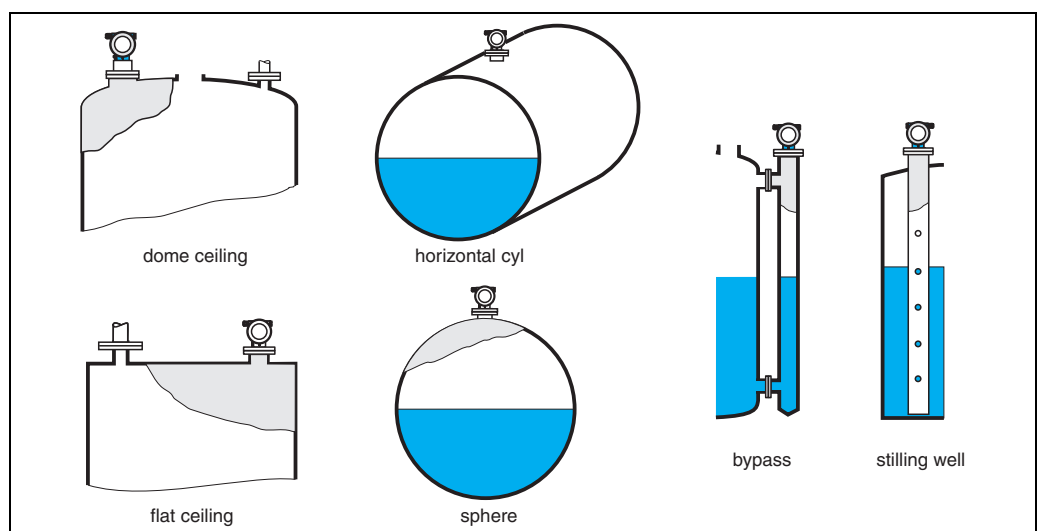
Function "tank shape" (002)



This function is used to select the tank shape.

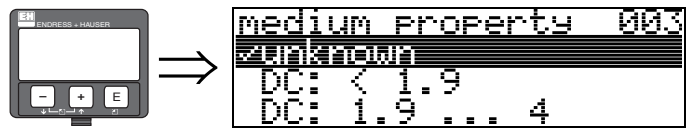
Selection:

- dome ceiling
- horizontal cyl
- bypass
- stilling well
- flat ceiling
- sphere



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

Function "medium property" (003)



This function is used to select the dielectric constant.

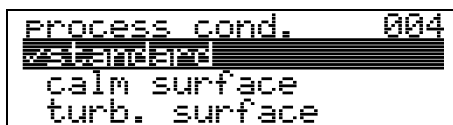
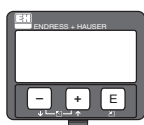
Selection:

- 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.


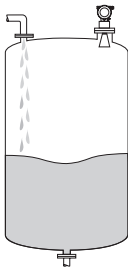
Function "process cond." (004)

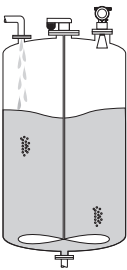
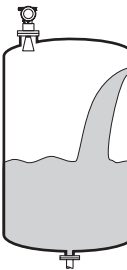


This function is used to select the process conditions.

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

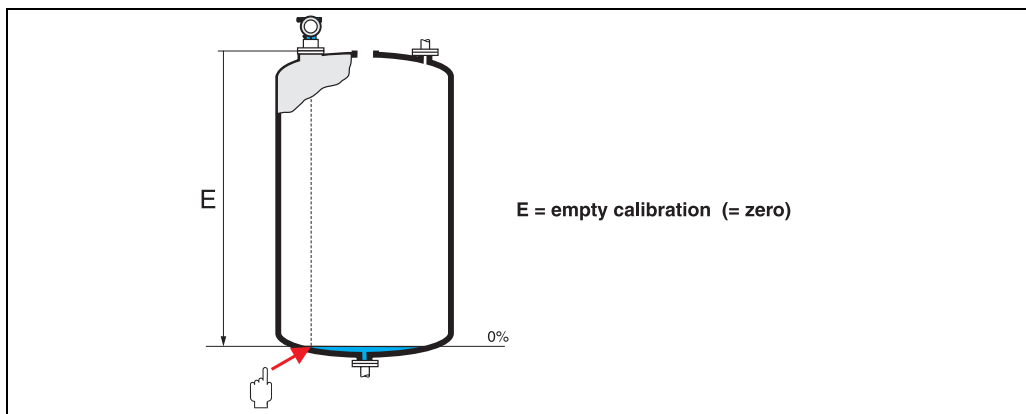
agitator	fast change	test:no filter
Agitated surfaces (with possible vortex) due to agitators.	Rapid change of level, particularly in small tanks.	All filters can be switched off for service / diagnostic purposes.
		
Special filters to smooth the input signals are set to high values. → smoothed meas. 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 "empty calibr." (005)



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

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



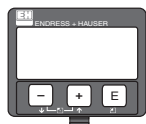
100-FMR2xxxx-14-00-06-en-008



Caution!

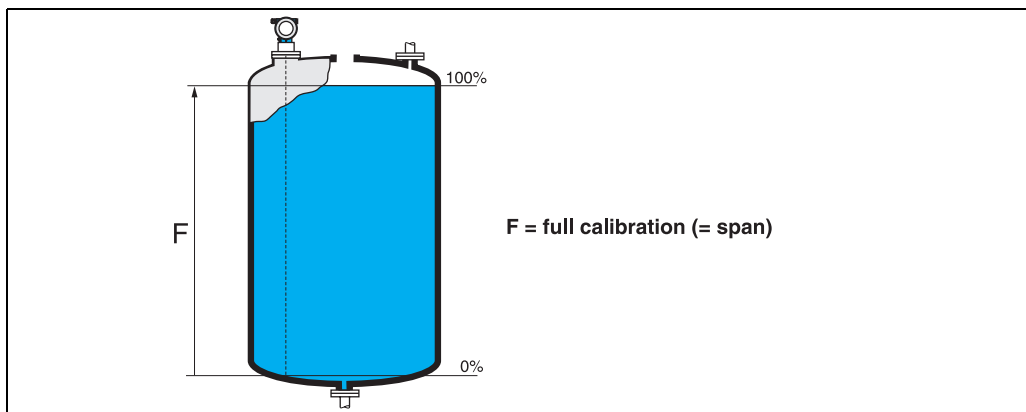
For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the tank.

Function "full calibr." (006)



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

This function is used to enter the distance from the minimum level to the maximum level (=span). In principle, it is possible to measure up to the tip of the antenna. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than 50 mm (1.97 in) to the tip of the antenna.



100-FMR2xxxx-14-00-06-en-009



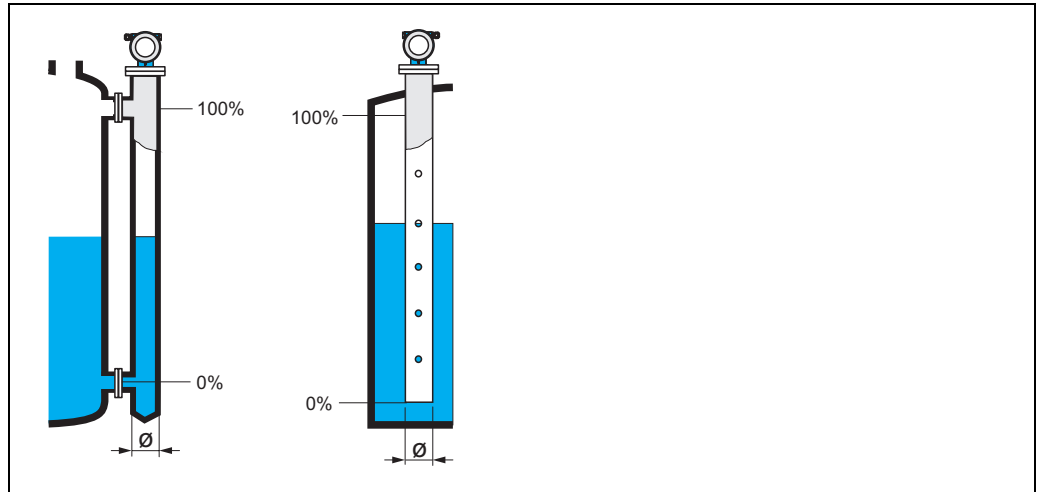
Note!

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

Function "pipe diameter" (007)



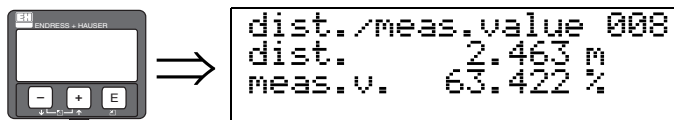
This function is used to enter the pipe diameter of the stilling well or bypass pipe.



L00-FMR2xxxx-14-00-00-en-011

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

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



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

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

Function "check distance" (051)



```

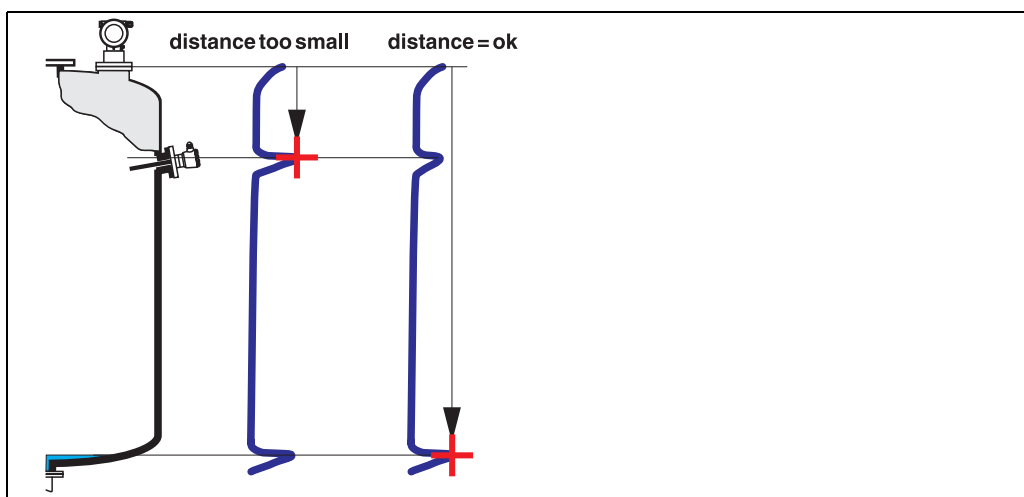
check distance 051
dist. unknown
manual
distance = ok

```

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

Selection:

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



L00_FMR2xxxxx-14-00-06-en-010

distance = ok

- mapping is carried out up to the currently measured echo
- The range to be suppressed is suggested in the **"range of mapping" (052)** function

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

dist. too small

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

dist. too big

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

dist. unknown

If the actual distance is not known, no mapping can be carried out.

manual

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

**Caution!**

The range of mapping must end 0,5 m (1.6 ft) before the echo of the actual level. For an empty tank, do not enter E, but E – 0,5 m (1.6 ft). If a mapping already exists, it is overwritten 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 (→ 51). 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).

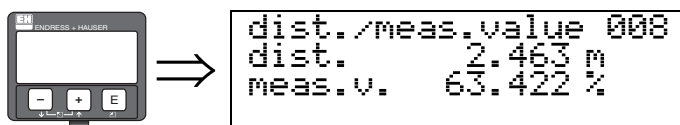
Selection:

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

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

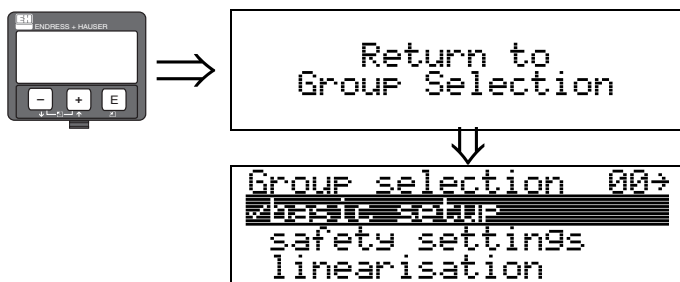
**Caution!**

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

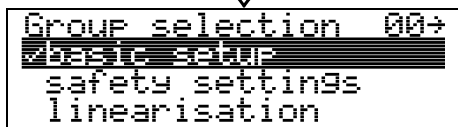
Function "dist./meas.value" (008)

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)



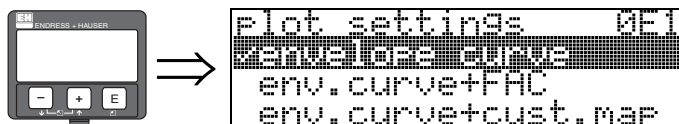
After 3 s, the following message appears



6.4.2 Envelope curve with device display

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 BA00221F/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.**

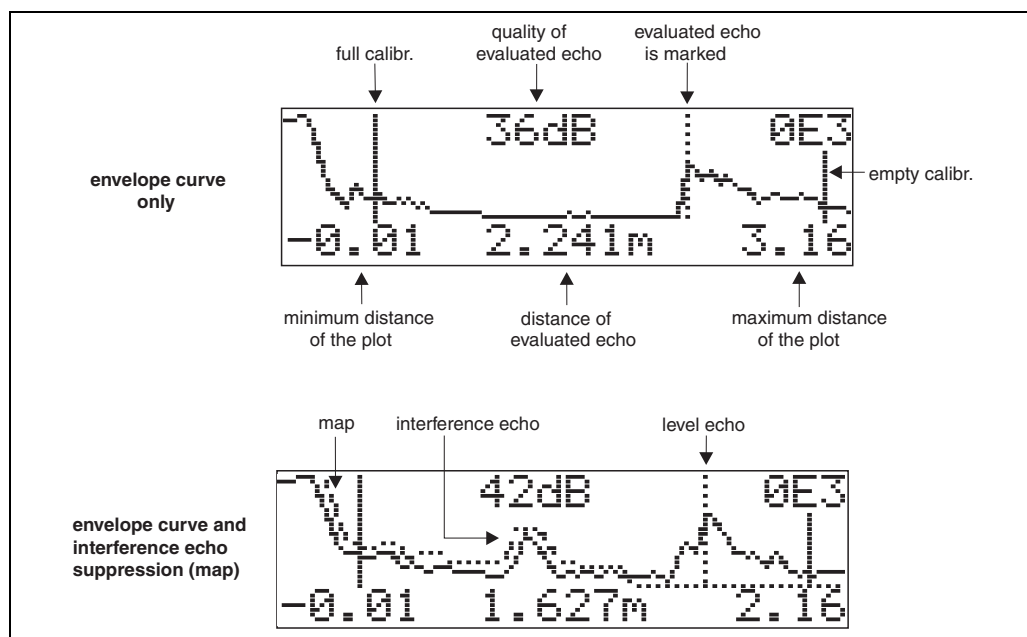


Note!

- 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 (see "Orientation of the Micropilot", → 75).

Function "envelope curve display" (0E3)

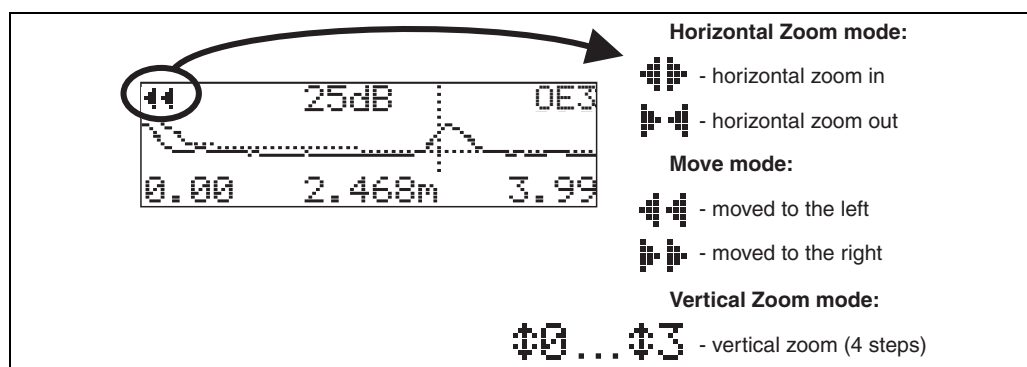
The envelope curve is displayed in this function. You can use it to obtain the following information:



L00-FM14xxxx-07-00-00-en-003

Navigating in the envelope curve display

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

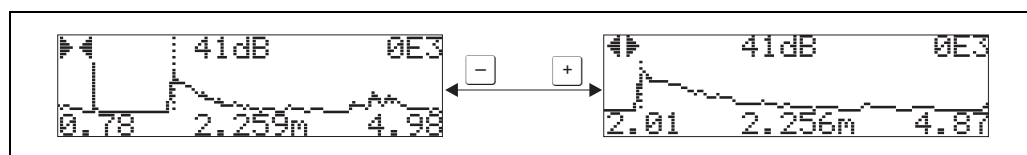


L00-FMxxxxx-07-00-00-en-004

Horizontal Zoom mode

Firstly, go into the envelope curve display. Then press $\boxed{+}$ or $\boxed{-}$ to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either $\boxed{\leftarrow}$ or $\boxed{\rightarrow}$ is displayed.

- $\boxed{+}$ increases the horizontal scale.
- $\boxed{-}$ reduces the horizontal scale.

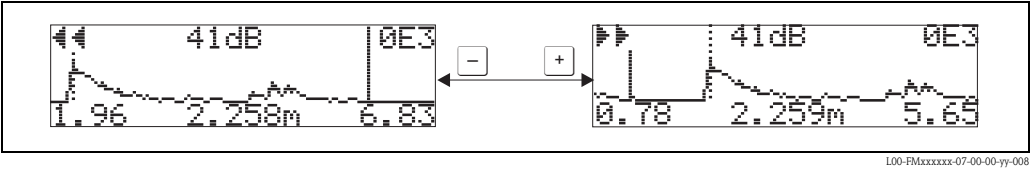


L00-FMxxxxx-07-00-00-yy-007

Move mode

Then press **[E]** to switch to Move mode. Either **←←** oder **→→** is displayed.

- **+** shifts the curve to the right.
- **-** shifts the curve to the left.

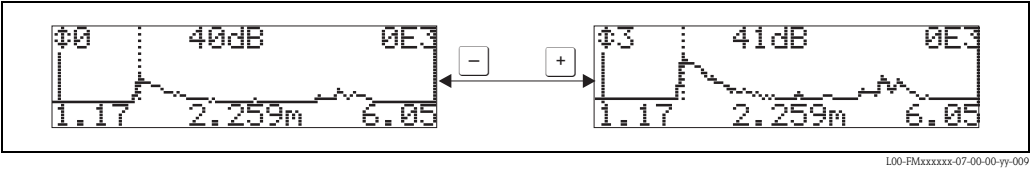


Vertical Zoom mode

Press **[E]** once more to switch to Vertical Zoom mode. **01** is displayed. You now have the following options.

- **+** increases the vertical scale.
- **-** reduces the vertical scale.

The display icon shows the current zoom factor (**00** bis **03**).



Exiting the navigation

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



After 3 s, the following message appears

6.5 Basic Setup with the Endress+Hauser operating program

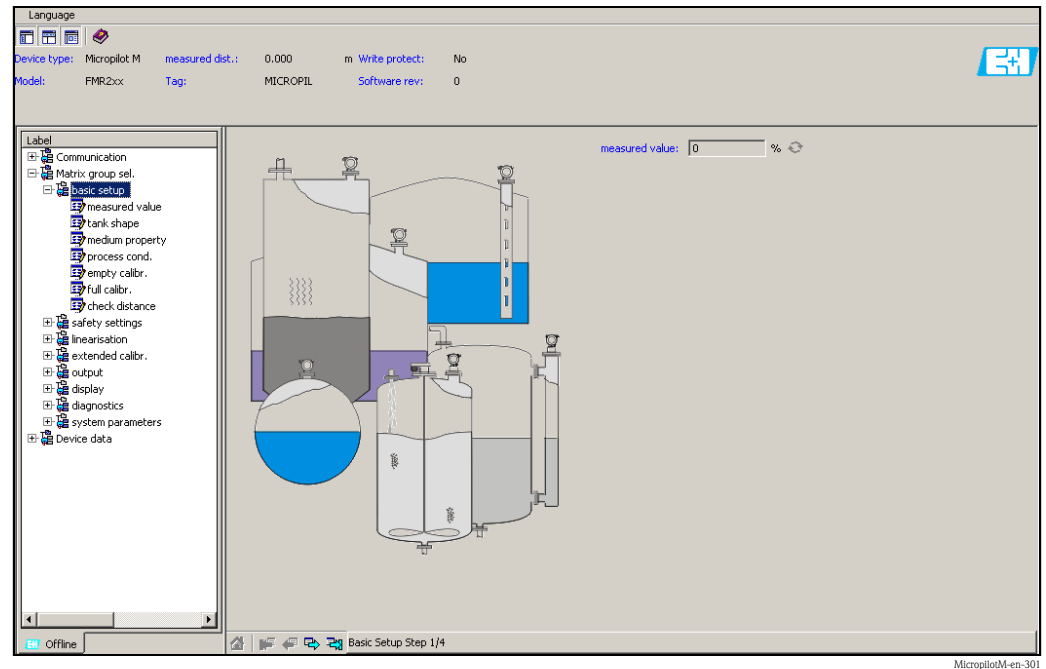
To carry out the basic setup with the operating program, proceed as follows:

- Start the operating program and establish a connection.
- Select the "**basic setup**" function group in the navigation window.

The following display appears on the screen:

Basic Setup step 1/4:

- Measured value



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

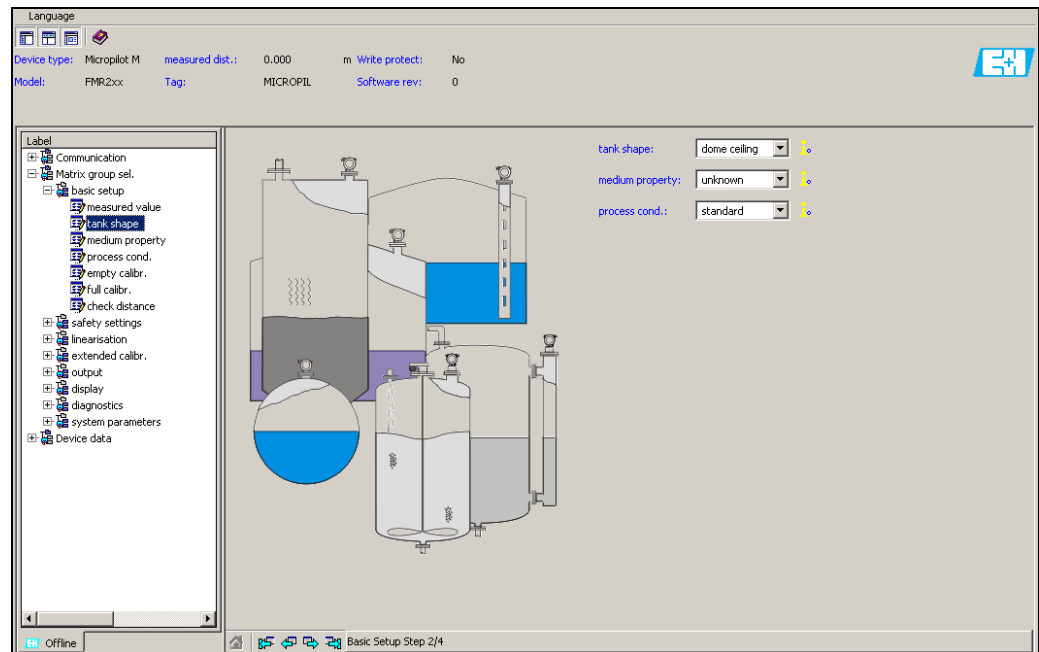


Note!

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

Basic Setup step 2/4:

- Enter the application parameters:
 - Tank shape
 - Medium property
 - Process cond.

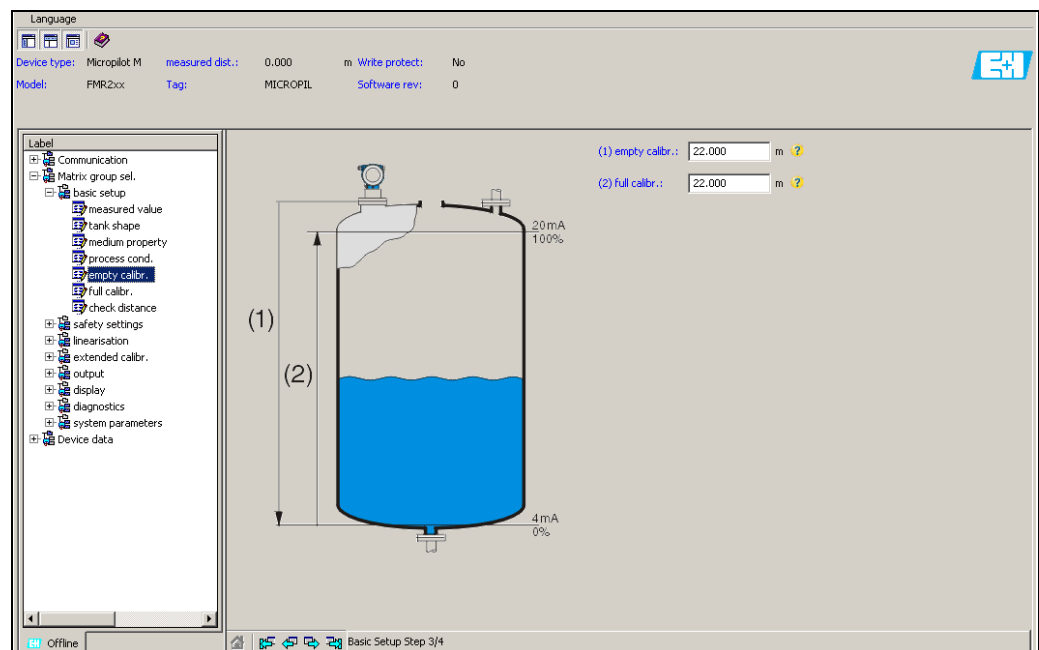


MicropilotM-en-302

Basic Setup step 3/4:

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

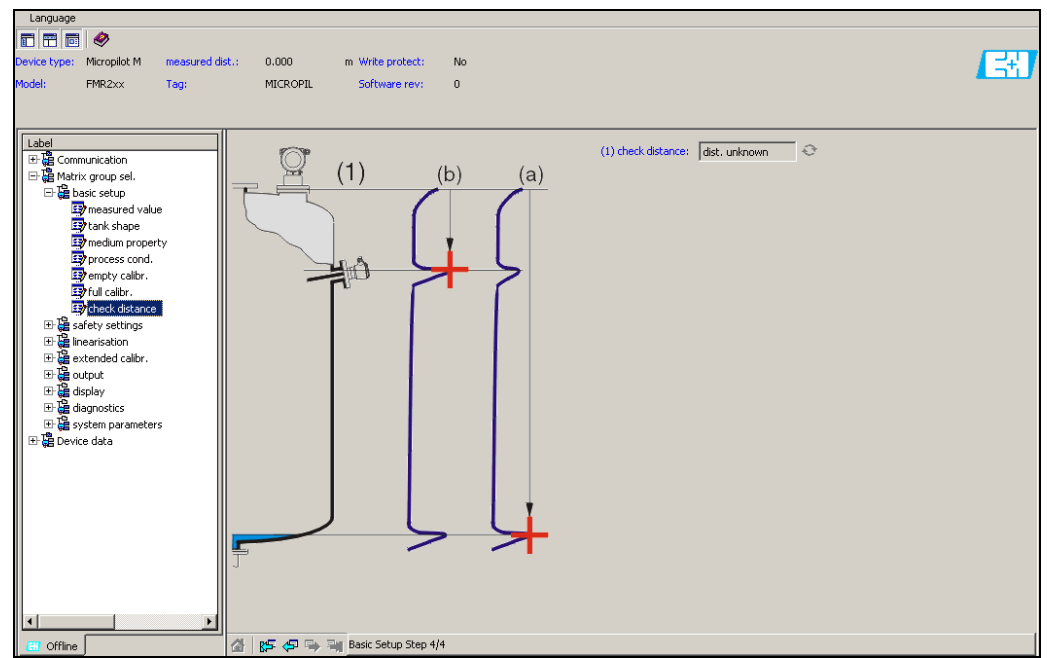
- Empty calibr.
- Full calibr.



MicropilotM-en-303

Basic Setup step 4/4:

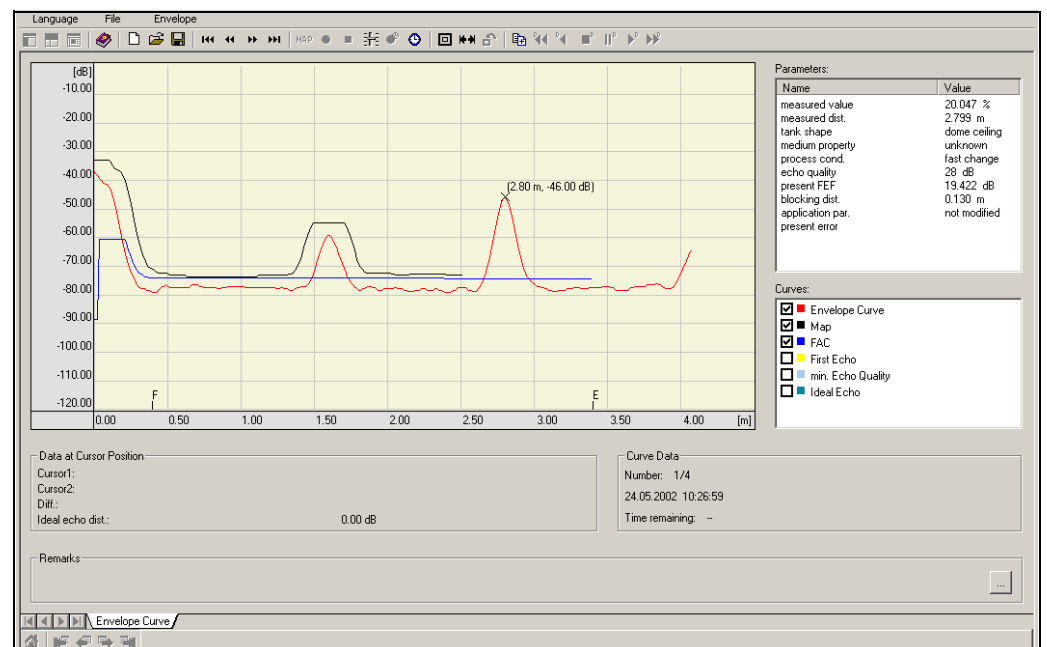
- This step starts the tank mapping
- The measured distance and the current measured value are always displayed in the header



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-304



Note!

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

6.5.2 User-specific applications (operation)

For details of setting the parameters of user-specific applications, see separate documentation BA00221F/00/EN "Description of Instrument Functions" on the enclosed CD-ROM.

7 Maintenance

The Micropilot M measuring instrument requires no special maintenance.


Exterior cleaning

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

Replacing seals

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

Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves (→  77, "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 out 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 BA00221F/00/EN on the enclosed CD-ROM)
- You may need to record the tank map again (see Basic Setup)

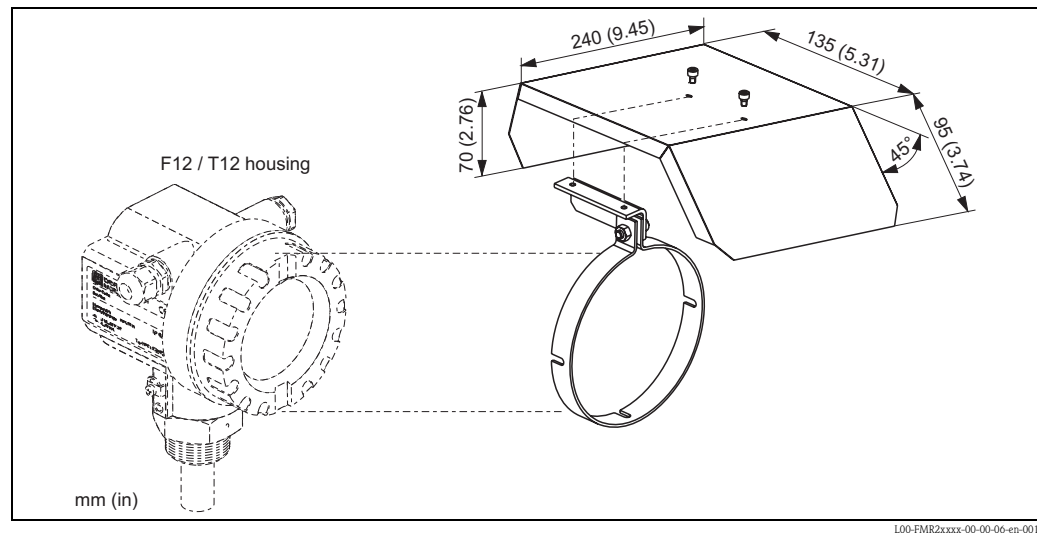
After an antenna component or electronic has been replaced, a new calibration must be carried out. This is described in the repair instructions.

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 TI00405C/07/EN.



Note!

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

8.3 ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the instrument. For details refer to KA00271F/00/A2.

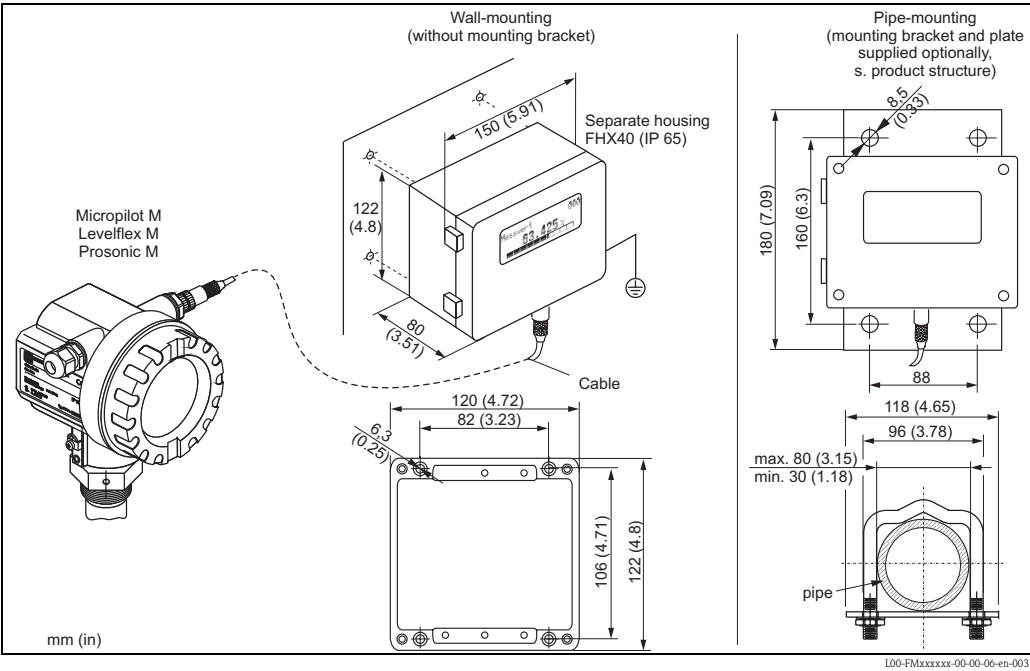
8.4 Proficard

For the connection of a Laptop to PROFIBUS.

8.5 Profiboard

For the connection of a Personal Computer to PROFIBUS.

8.6 Remote display FHX40



Technical data (cable and housing) and product structure:

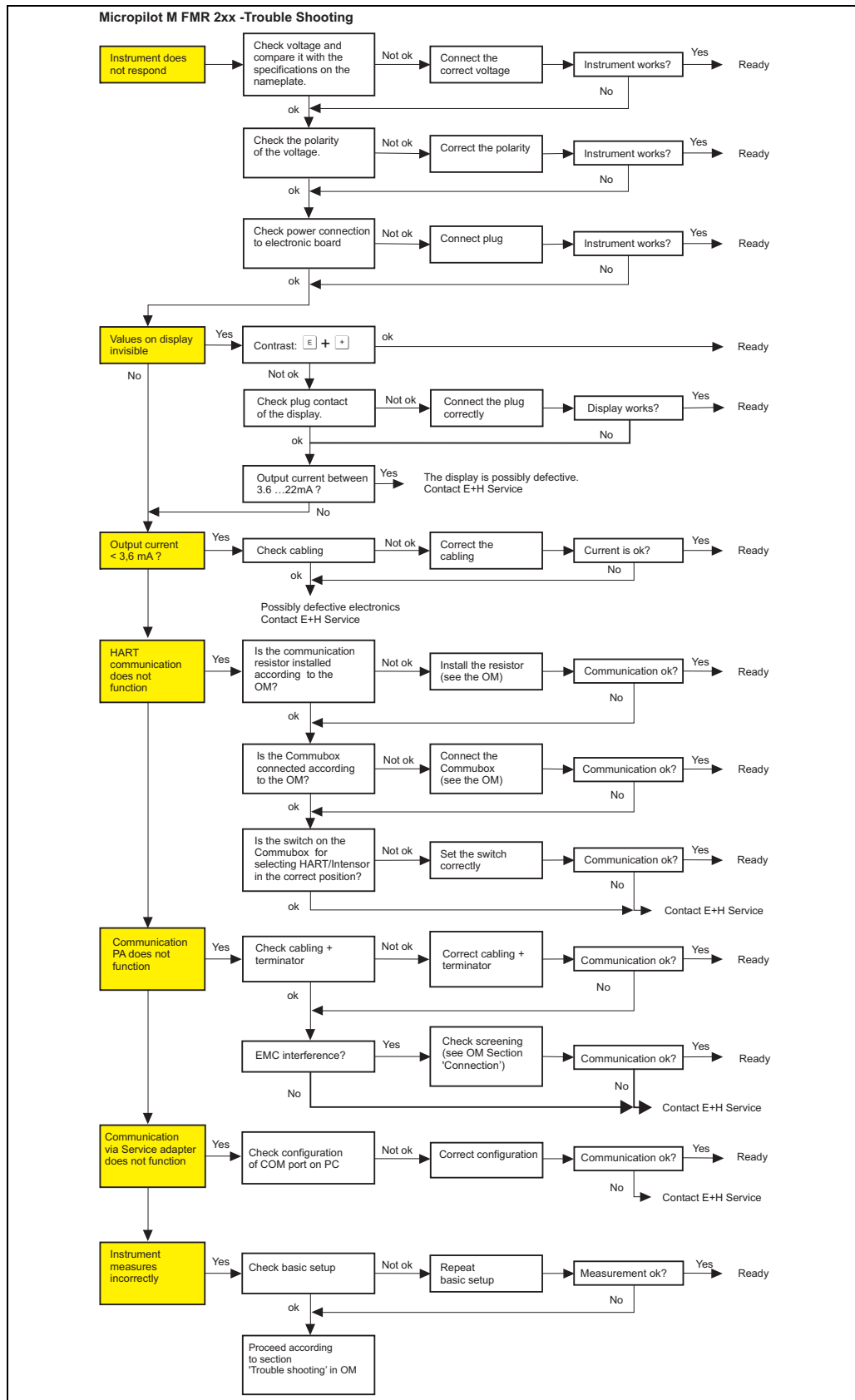
Max. cable length	20 m (66 ft)
Temperature range	-30 °C to +70 °C (-22 °F to +158 °F)
Degree of protection	IP65/67 (housing); IP68 (cable) acc. to IEC60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm (in)]	122x150x80 (4.8x5.91x3.15) / HxWxD

010	Approval	A Non-hazardous area 2 ATEX II 2G Ex ia IIC T6 3 ATEX II 2D Ex ia IIIC T80°C G IECEx Zone1 Ex ia IIC T6/T5 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 Y Special version, TSP-no. to be spec.
020	Cable	1 20m / 65ft: for HART 5 20m / 65ft: for PROFIBUS PA/FOUNDATION Fieldbus 9 Special version, TSP-no. to be spec.
030	Additional option	A Basic version B Mounting bracket, pipe 1" / 2" Y Special version, TSP-no. to be spec.
995	Marking	1 Tagging (TAG), see additional spec.
FHX40 -		Complete product designation

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

9 Trouble-shooting

9.1 Trouble-shooting instructions



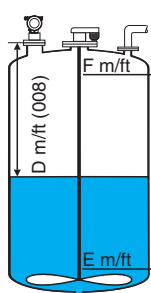
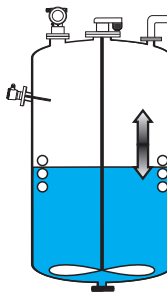
L00-FMR2xxxx-19-00-00-en-010

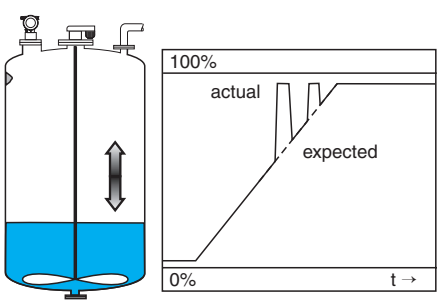
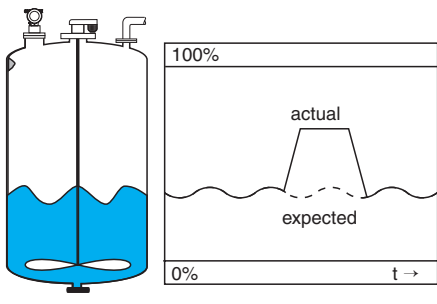
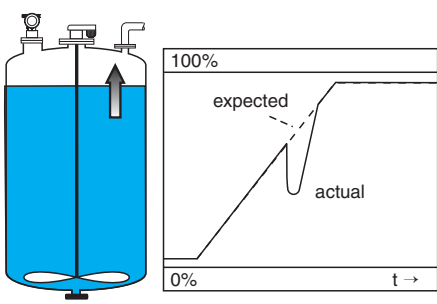
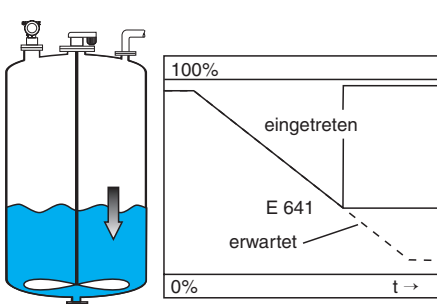


9.2 System error messages

Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; 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
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

Code	Description	Possible cause	Remedy
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
W681	current ch1 out of range	current out of range (3.8 mA to 20.5 mA)	check calibration and linearisation

9.3 Application errors

Error	Output	Possible cause	Remedy
A warning or alarm has occurred	Depending on the configuration	See table of error messages (→ 71)	1. See table of error messages (→ 71)
Measured value (000) is incorrect	 <p>100% expected actual 0% t →</p> <p>L00-FMR2xxxx-19-00-00-en-019</p>	<p>Measured distance (008) OK?</p> <p>yes →</p> <p>no ↓</p> <p>Measurement in bypass or stilling well?</p> <p>yes →</p> <p>no ↓</p> <p>Is an offset (057) active?</p> <p>yes →</p> <p>no ↓</p> <p>An interference echo may have been evaluated.</p> <p>yes →</p>	<p>1. Check empty calibr. (005) and full calibr. (006).</p> <p>2. Check linearisation: → level/ullage (040) → max. scale (046) → diameter vessel (047) → Check table</p> <p>1. Is bypass or stilling well selected in tank shape (002)?</p> <p>2. Is the pipe diameter (007) correct?</p> <p>1. offset (057) correctly set?</p> <p>1. Carry out tank mapping → basic setup</p>
No change off measured value on filling/emptying	 <p>100% actual expected 0% t →</p> <p>L00-FMR2xxxx-19-00-00-en-014</p>	<p>Interference echo from installations, nozzle or extension on the antenna</p>	<p>1. Carry out tank mapping → basic setup</p> <p>2. If necessary, clean antenna</p> <p>3. If necessary, select better mounting position (→ 14)</p> <p>4. If necessary due to wide interference echos set function detection window (0A7) to "off"</p>

Error	Output	Possible cause	Remedy
<p>If the surface is not calm (e.g. filling, emptying, agitator running), the measured value jumps sporadically to a higher level</p>	 <p>L00-FMR2xxxx-19-00-00-en-015</p>  <p>L00-FMR2xxxx-19-00-00-en-016</p>	<p>Signal is weakened by the rough surface – the interference echoes are sometimes stronger</p>	<ol style="list-style-type: none"> 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 (→ 75) 5. If necessary, select a better mounting position and/or larger antenna (→ 14)
<p>During filling/emptying the measured value jumps downwards</p>	 <p>L00-FMR2xxxx-19-00-00-en-017</p>	<p>Multiple echoes</p>	<p>yes →</p> <ol style="list-style-type: none"> 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 (→ 14) 4. Perhaps use a stilling well
<p>E641 (loss of echo)</p>	 <p>L00-FMR2xxxx-19-00-00-en-018</p>	<p>Level echo is too weak.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> ■ Rough surface due to filling/ emptying ■ Agitator running ■ Foam 	<p>yes →</p> <ol style="list-style-type: none"> 1. Check application parameters (002), (003) and (004) 2. Optimise alignment (→ 75) 3. If necessary, select a better installation position and/or larger antenna (→ 14)
<p>E641 (loss of echo) after turn on the power supply</p>	<p>If the instrument is configured to Hold by loss of echo the output is set to any value/current.</p>	<p>noise level during the initialisation phase to high.</p>	<p>Repeat once more empty calibr. (005).</p> <p>Caution!</p> <p>Before conformation change with  or  to the edit mode.</p>

9.4 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.

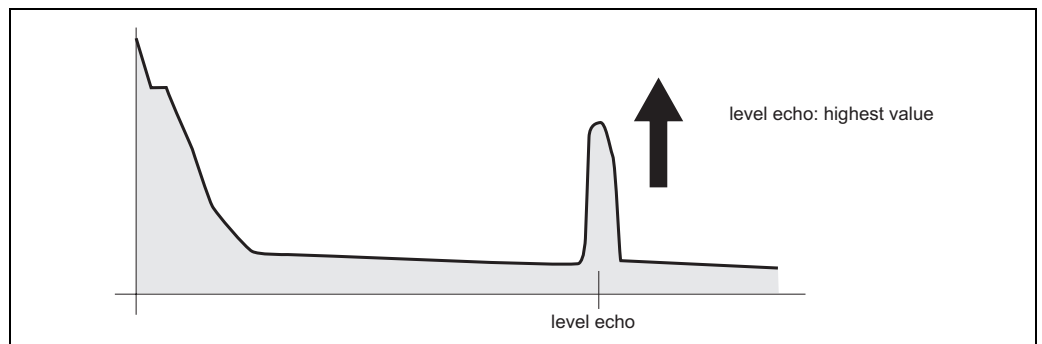
Proceed as follows:



Warning!

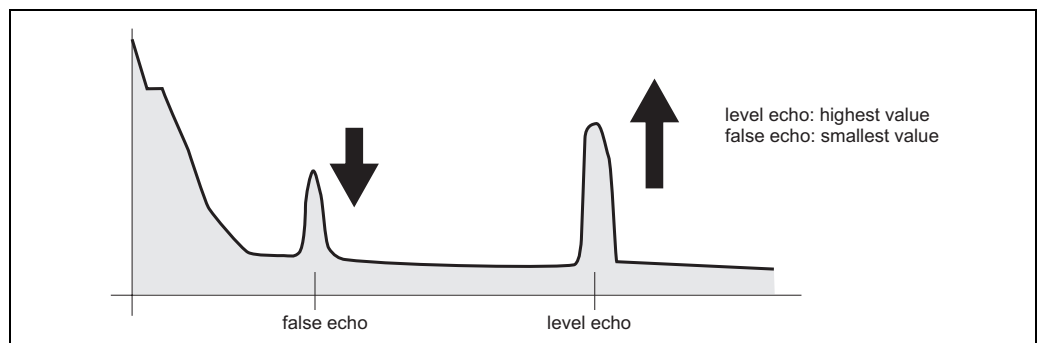
Subsequent alignment can lead to personal injury. Before you unscrew or loosen the process connection, make sure that the vessel is not under pressure and does not contain any injurious substances.

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:



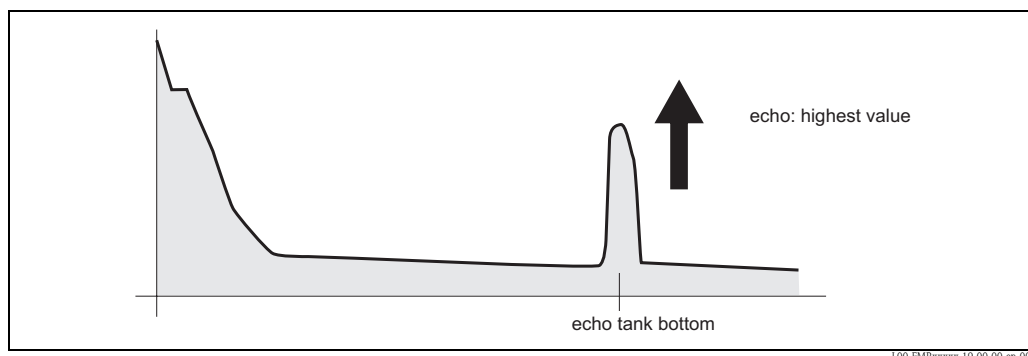
L00-FMRxxxx-19-00-00-en-002

Vessel partly full, no interference echo obtained

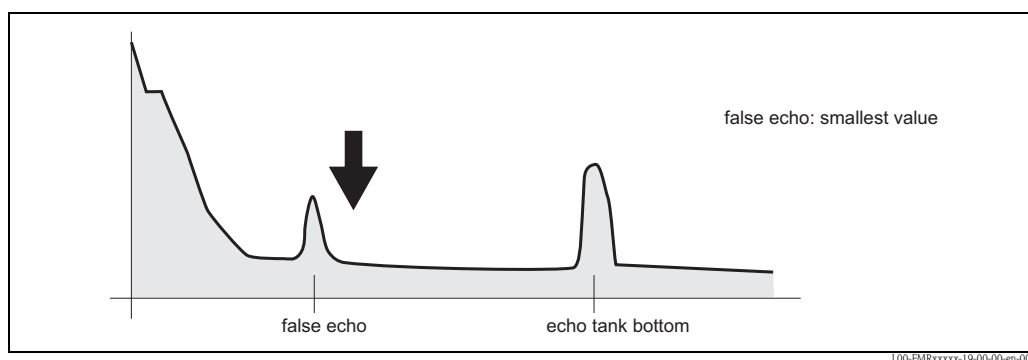


L00-FMRxxxx-19-00-00-en-003

Vessel partly full, interference echo obtained:



Vessel empty, no interference echo



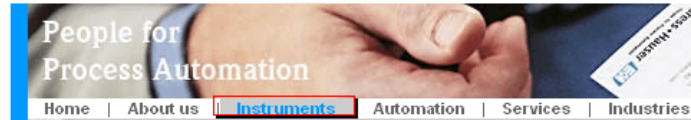
Vessel empty, interference echo obtained

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

9.5 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


Via product name
Enter the product name

4. Select the device.
5. Click the "Accessories/Spare parts" tab.

General information	Technical information	Documents/Software	Service	Accessories/Spare parts
---------------------	-----------------------	--------------------	---------	--------------------------------

▶ Accessories
 ▼ All Spare parts

- ▶ Housing/housing accessories
- ▶ Sealing
- ▶ Cover
- ▶ Terminal module
- ▶ HF module
- ▶ Electronic
- ▶ Power supply
- ▶ Antenna module



Advice
Here you'll find a list of all available accessories and spare parts. To only view accessories and spare parts specific to your product(s), please contact us and ask about our Life Cycle Management Service.

◀ | 1 / 2 | ▶ | 🔍

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.

9.6 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)
- If necessary, give the error code.

9.7 Disposal

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

9.8 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) with Rev. 1, DD 1.	BA221F/00/EN/01.01 52006323
05.2002 03.2003	01.02.00 01.02.02	<ul style="list-style-type: none"> ■ 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	<ul style="list-style-type: none"> ■ 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
			BA221F/00/EN/03.10 71114346

9.9 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 ■ C-band
Up to 8 Micropilot M transmitters can be installed in the same tank because the transmitter pulses are statistically coded.

Distance	Average density in beam direction	
	max. measuring range = 20m (66ft) / 44m (131ft)	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 PROFIBUS PA

Signal coding Manchester Bus Powered (MBP)

Data transmission rate 31.25 Kbit/s, voltage mode

Galvanic isolation Yes (IO-Module)

Signal on alarm Error information can be accessed via the following interfaces:

- Local display:
 - Error symbol (→  29)
 - Plain text display
- Current output, signal on error can be selected (e.g. according to NAMUR recommendation NE43)
- Digital interface

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

10.1.3 Performance characteristics

Reference operating conditions	<ul style="list-style-type: none"> ■ Temperature = +20 °C ±5 °C (+68 °F ±41 °F) ■ Pressure = 1013 mbar abs. ±20 mbar (15 psi ±0.29 psi) ■ Relative humidity (air) = 65 % ±20 % ■ Ideal reflector ■ No major interference reflections inside the signal beam
Maximum measured error	<p>Typical statements of measuring range for reference conditions, include linearity, repeatability, and hysteresis:</p> <ul style="list-style-type: none"> ■ Up to 10 m ±10 mm (33 ft ±0.39 in) ■ Off 10 m ±0,1% (33 ft ±0,1%)
Resolution	Digital: 1 mm (0.04 in)/ 0.03% of measuring range
Reaction time	The reaction time depends on the parameter settings (min. 1 s). In case of fast level changes, the instrument needs the reaction time to indicate the new value.
Influence of ambiente temperature	<p>The measurements are carried out in accordance with EN61298-3:</p> <ul style="list-style-type: none"> ■ digital output PROFIBUS PA: <ul style="list-style-type: none"> – average T_K: 5 mm (0.2 in) /10 K, max. 15 mm (0.59 in) over the entire temperature range -40 °C to +80 °C (-40 °F to +176 °F).
Effect of gas phase	<p>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):</p>

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	505.4	-	-	8.6 %	-	-
	310	590	-	-	-	22 %	-
	364	687.2	-	-	-	-	41.8 %



Note!

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

10.1.4 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 $T_a < -20$ °C (-4 °F) and $T_a > +60$ °C (+140 °F). A weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight.
Storage temperature	-40 °C to +80 °C (-40 °F to +176 °F) or -50 °C to +80 °C (-58 °F to +176 °F).
Climate class	DIN EN 60068-2-38 (test Z/AD)
Vibration resistance	DIN EN 60068-2-64 / IEC 68-52-64: <ul style="list-style-type: none"> ■ FMR230/231, FMR240/244/245 with 40 mm (1½") antenna: 20 to 2000 Hz, 1 (m/s²)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 ϵ_r . 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	<ul style="list-style-type: none"> ■ 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.

10.1.5 Operating conditions: Process

Process temperature range /
Process pressure limits

Note!

The specified range may be reduced by the selected process condition. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C (68 °F), for ASME flanges to 100 °F. Observe pressure temperature dependency.

The pressure values permitted at higher temperatures can be found in the following standards:

■ EN1092-1:2001 Tab. 18

With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN1092-1 Tab.18. The chemical composition of the two materials can be identical.

■ ASME B16.5a - 1998 Tab. 2-.2.2 F316

■ ASME B16.5a - 1998 Tab. 2.3.8 N10276

■ JIS B 2220

Type of antenna		Process connection	Temperature	Pressure	Wetted parts
A, B	PPS	—	-20 °C to +120 °C (-4 °F to +248 °F)	-1 bar to 16 bar (-14.5 psi to 232 psi)	316L/1.4435, Viton, PPS
E, F	PTFE (conform with FDA 21 CFR 177.1550 and USP <88> Class VI)	PVDF threaded connection	-40 °C to +80 °C (-40 °F to +176 °F)	-1 bar to 3 bar (-14.5 psi to 43.5 psi)	PVDF, PTFE
		Metal threaded connection		-1 bar to 40 bar (-14.5 psi to 580 psi)	316L/1.4435, PTFE (conform with FDA 21 CFR 177.1550 and USP <88> Class VI)
		Flange unclad		-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (conform with FDA 21 CFR 177.1550 and USP <88> Class VI)
		Flange clad ¹⁾		-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (conform with FDA 21 CFR 177.1550 and USP <88> Class VI)
		Tri-Clamp 2"		-1 bar to 16 bar (-14.5 psi to 232 psi)	316L/1.4435, PTFE (conform with FDA 21 CFR 177.1550 and USP <88> Class VI)
		Tri-Clamp 3"		-1 bar to 10 bar (-14.5 psi to 145 psi)	
		Aseptic, Dairy		-1 bar to 25 bar (-14.5 psi to 362.5 psi)	
H, J	PTFE antistatic (TFM4220, 2% conductive additives)	Metal threaded connection	-40 °C to +150 °C (-40 °F to +302 °F)	-1 bar to 40 bar (-14.5 psi to 580 psi)	316L/1.4435, PTFE (TFM4220)
		Flange unclad		-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (TFM4220)
		Flange clad ¹⁾		-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (TFM4220)

↑

see ordering information, → 6

1) On DN150, 6" ANSI, JIS 150A the disc is made of antistatic PTFE (=black).

Dielectric constant

■ In a stilling well: $\epsilon_r \geq 1,4$

■ In free space: $\epsilon_r \geq 1,9$

10.1.6 Mechanical construction

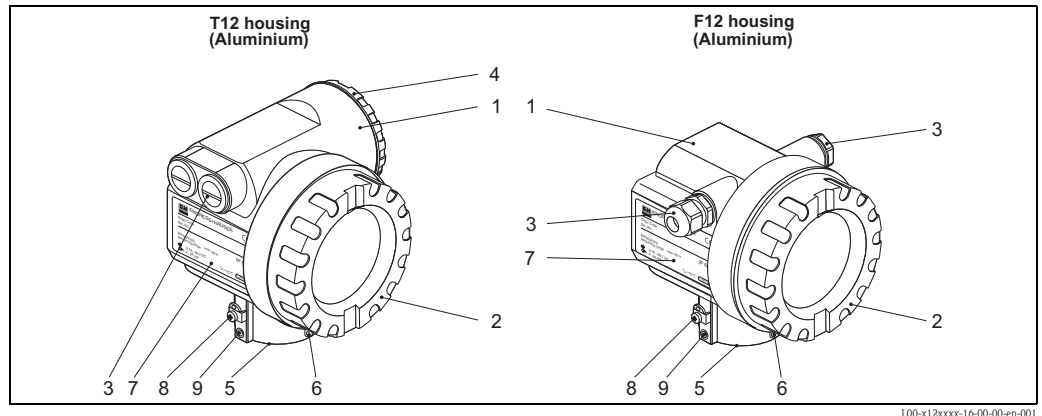
Weight

- 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

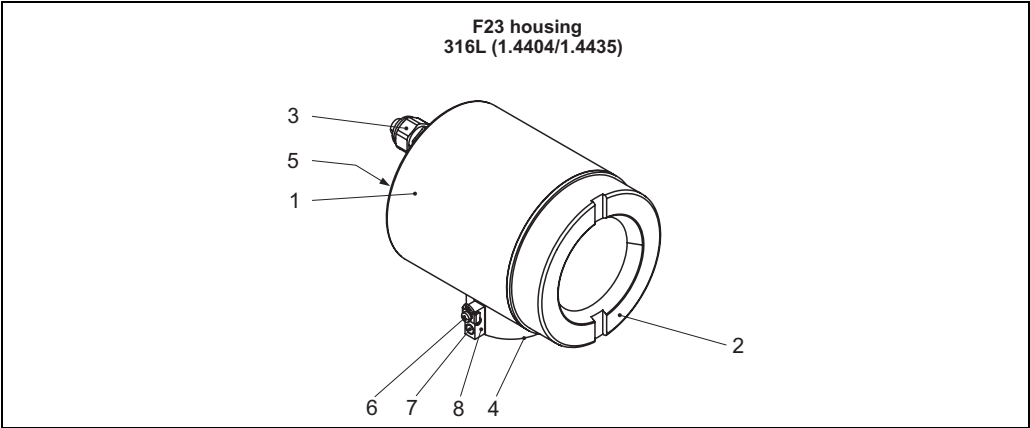
(not in contact with process)

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	

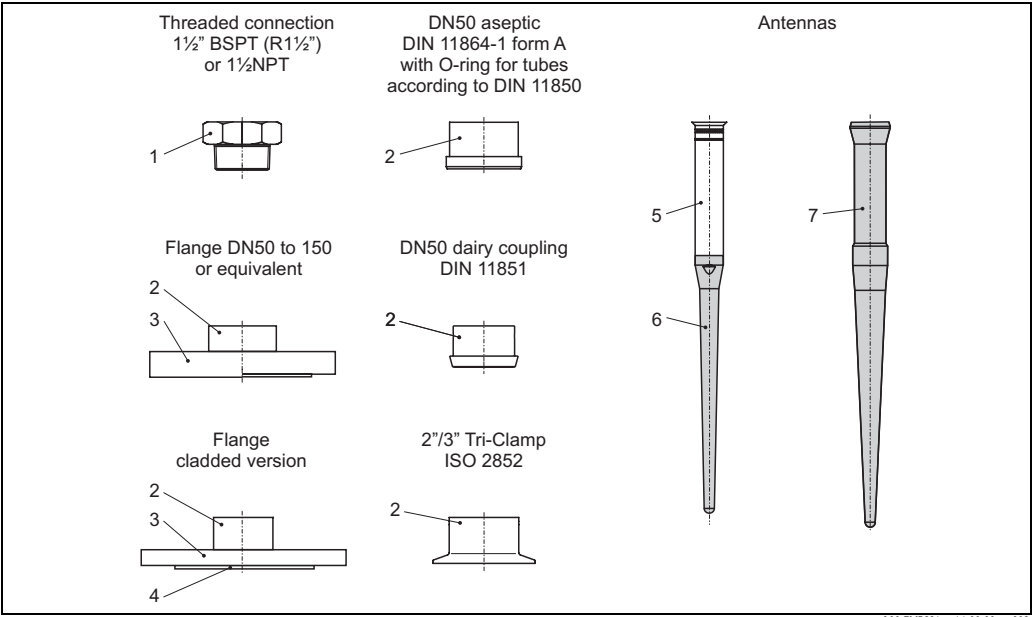
Materials of F23 housing (corrosion-resistant)



L00-x12xxxx-16-00-00-en-001

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

Material
(in contact with process)



Pos.	Bauteil	Werkstoff
1	Adapter	316L (1.4435)
		PVDF
2	Adapter	316L (1.4435)
3	Flange	316L (1.4404/1.4435)
4	Plating	PTFE
5	Pipe	316L (1.4435)
6	Rod antenna	PPS, antistatic
7	Rod antenna	PTFE, antistatic
		PTFE, conform with FDA 21 CFR 177.1550 and USP <88> Class VI (in conjunction with flange, DN50 aseptic/dairy coupling respectively Tri-clamp)

10.1.7 Certificates and approvals

CE approval	The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.
RF approvals	R&TTE, FCC
Overspill protection	German WHG, see ZE00244F/00/DE. SIL 2, see SD00150F/00/EN "Functional Safety Manual".
External standards and guidelines	<p>EN60529 Protection class of housing (IP-code).</p> <p>EN61010 Safety regulations for electrical devices for measurement, control, regulation and laboratory use.</p> <p>EN61326-X EMC product family standard for electrical equipment for measurement, control and laboratory use.</p> <p>NAMUR User association for automation technology in process industrie.</p>
Marine certificate	GL (German Lloyd), ABS, NK – PROFIBUS PA – Not HT antenna

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

Feature		Variant	XA000000	XA000001	XA000002	XA000003	XA000004	XA000005	XA000006	XA000007	XA000008	XA000009	XA000010	XA000011	XA000012	XA000013	XA000014	XA000015	XA000016	XA000017	XA000018	XA000019	XA000020	XA000021	XA000022	XA000023	XA000024	XA000025	XA000026	XA000027	XA000028	XA000029	XA000030	XA000031	XA000032	XA000033	XA000034	XA000035	XA000036	XA000037	XA000038	XA000039	XA000040	XA000041	XA000042	XA000043	XA000044	XA000045	XA000046	XA000047	XA000048	XA000049	XA000050	XA000051	XA000052	XA000053	XA000054	XA000055	XA000056	XA000057	XA000058	XA000059	XA000060	XA000061	XA000062	XA000063	XA000064	XA000065	XA000066	XA000067	XA000068	XA000069	XA000070	XA000071	XA000072	XA000073	XA000074	XA000075	XA000076	XA000077	XA000078	XA000079	XA000080	XA000081	XA000082	XA000083	XA000084	XA000085	XA000086	XA000087	XA000088	XA000089	XA000090	XA000091	XA000092	XA000093	XA000094	XA000095	XA000096	XA000097	XA000098	XA000099	XA000100	XA000101	XA000102	XA000103	XA000104	XA000105	XA000106	XA000107	XA000108	XA000109	XA000110	XA000111	XA000112	XA000113	XA000114	XA000115	XA000116	XA000117	XA000118	XA000119	XA000120	XA000121	XA000122	XA000123	XA000124	XA000125	XA000126	XA000127	XA000128	XA000129	XA000130	XA000131	XA000132	XA000133	XA000134	XA000135	XA000136	XA000137	XA000138	XA000139	XA000140	XA000141	XA000142	XA000143	XA000144	XA000145	XA000146	XA000147	XA000148	XA000149	XA000150	XA000151	XA000152	XA000153	XA000154	XA000155	XA000156	XA000157	XA000158	XA000159	XA000160	XA000161	XA000162	XA000163	XA000164	XA000165	XA000166	XA000167	XA000168	XA000169	XA000170	XA000171	XA000172	XA000173	XA000174	XA000175	XA000176	XA000177	XA000178	XA000179	XA000180	XA000181	XA000182	XA000183	XA000184	XA000185	XA000186	XA000187	XA000188	XA000189	XA000190	XA000191	XA000192	XA000193	XA000194	XA000195	XA000196	XA000197	XA000198	XA000199	XA000200	XA000201	XA000202	XA000203	XA000204	XA000205	XA000206	XA000207	XA000208	XA000209	XA000210	XA000211	XA000212	XA000213	XA000214	XA000215	XA000216	XA000217	XA000218	XA000219	XA000220	XA000221	XA000222	XA000223	XA000224	XA000225	XA000226	XA000227	XA000228	XA000229	XA000230	XA000231	XA000232	XA000233	XA000234	XA000235	XA000236	XA000237	XA000238	XA000239	XA000240	XA000241	XA000242	XA000243	XA000244	XA000245	XA000246	XA000247	XA000248	XA000249	XA000250	XA000251	XA000252	XA000253	XA000254	XA000255	XA000256	XA000257	XA000258	XA000259	XA000260	XA000261	XA000262	XA000263	XA000264	XA000265	XA000266	XA000267	XA000268	XA000269	XA000270	XA000271	XA000272	XA000273	XA000274	XA000275	XA000276	XA000277	XA000278	XA000279	XA000280	XA000281	XA000282	XA000283	XA000284	XA000285	XA000286	XA000287	XA000288	XA000289	XA000290	XA000291	XA000292	XA000293	XA000294	XA000295	XA000296	XA000297	XA000298	XA000299	XA000300	XA000301	XA000302	XA000303	XA000304	XA000305	XA000306	XA000307	XA000308	XA000309	XA000310	XA000311	XA000312	XA000313	XA000314	XA000315	XA000316	XA000317	XA000318	XA000319	XA000320	XA000321	XA000322	XA000323	XA000324	XA000325	XA000326	XA000327	XA000328	XA000329	XA000330	XA000331	XA000332	XA000333	XA000334	XA000335	XA000336	XA000337	XA000338	XA000339	XA000340	XA000341	XA000342	XA000343	XA000344	XA000345	XA000346	XA000347	XA000348	XA000349	XA000350	XA000351	XA000352	XA000353	XA000354	XA000355	XA000356	XA000357	XA000358	XA000359	XA000360	XA000361	XA000362	XA000363	XA000364	XA000365	XA000366	XA000367	XA000368	XA000369	XA000370	XA000371	XA000372	XA000373	XA000374	XA000375	XA000376	XA000377	XA000378	XA000379	XA000380	XA000381	XA000382	XA000383	XA000384	XA000385	XA000386	XA000387	XA000388	XA000389	XA000390	XA000391	XA000392	XA000393	XA000394	XA000395	XA000396	XA000397	XA000398	XA000399	XA000400	XA000401	XA000402	XA000403	XA000404	XA000405	XA000406	XA000407	XA000408	XA000409	XA000410	XA000411	XA000412	XA000413	XA000414	XA000415	XA000416	XA000417	XA000418	XA000419	XA000420	XA000421	XA000422	XA000423	XA000424	XA000425	XA000426	XA000427	XA000428	XA000429	XA000430	XA000431	XA000432	XA000433	XA000434	XA000435	XA000436	XA000437	XA000438	XA000439	XA000440	XA000441	XA000442	XA000443	XA000444	XA000445	XA000446	XA000447	XA000448	XA000449	XA000450	XA000451	XA000452	XA000453	XA000454	XA000455	XA000456	XA000457	XA000458	XA000459	XA000460	XA000461	XA000462	XA000463	XA000464	XA000465	XA000466	XA000467	XA000468	XA000469	XA000470	XA000471	XA000472	XA000473	XA000474	XA000475	XA000476	XA000477	XA000478	XA000479	XA000480	XA000481	XA000482	XA000483	XA000484	XA000485	XA000486	XA000487	XA000488	XA000489	XA000490	XA000491	XA000492	XA000493	XA000494	XA000495	XA000496	XA000497	XA000498	XA000499	XA000500	XA000501	XA000502	XA000503	XA000504	XA000505	XA000506	XA000507	XA000508	XA000509	XA000510	XA000511	XA000512	XA000513	XA000514	XA000515	XA000516	XA000517	XA000518	XA000519	XA000520	XA000521	XA000522	XA000523	XA000524	XA000525	XA000526	XA000527	XA000528	XA000529	XA000530	XA000531	XA000532	XA000533	XA000534	XA000535	XA000536	XA000537	XA000538	XA000539	XA000540	XA000541	XA000542	XA000543	XA000544	XA000545	XA000546	XA000547	XA000548	XA000549	XA000550	XA000551	XA000552	XA000553	XA000554	XA000555	XA000556	XA000557	XA000558	XA000559	XA000560	XA000561	XA000562	XA000563	XA000564	XA000565	XA000566	XA000567	XA000568	XA000569	XA000570	XA000571	XA000572	XA000573	XA000574	XA000575	XA000576	XA000577	XA000578	XA000579	XA000580	XA000581	XA000582	XA000583	XA000584	XA000585	XA000586	XA000587	XA000588	XA000589	XA000590	XA000591	XA000592	XA000593	XA000594	XA000595	XA000596	XA000597	XA000598	XA000599	XA000600	XA000601	XA000602	XA000603	XA000604	XA000605	XA000606	XA000607	XA000608	XA000609	XA000610	XA000611	XA000612	XA000613	XA000614	XA000615	XA000616	XA000617	XA000618	XA000619	XA000620	XA000621	XA000622	XA000623	XA000624	XA000625	XA000626	XA000627	XA000628	XA000629	XA000630	XA000631	XA000632	XA000633	XA000634	XA000635	XA000636	XA000637	XA000638	XA000639	XA000640	XA000641	XA000642	XA000643	XA000644	XA000645	XA000646	XA000647	XA000648	XA000649	XA000650	XA000651	XA000652	XA000653	XA000654	XA000655	XA000656	XA000657	XA000658	XA000659	XA000660	XA000661	XA000662	XA000663	XA000664	XA000665	XA000666	XA000667	XA000668	XA000669	XA000670	XA000671	XA000672	XA000673	XA000674	XA000675	XA000676	XA000677	XA000678	XA000679	XA000680	XA000681	XA000682	XA000683	XA000684	XA000685	XA000686	XA000687	XA000688	XA000689	XA000690	XA000691	XA000692	XA000693	XA000694	XA000695	XA000696	XA000697	XA000698	XA000699	XA000700	XA000701	XA000702	XA000703	XA000704	XA000705	XA000706	XA000707	XA000708	XA000709	XA000710	XA000711	XA000712	XA000713	XA000714	XA000715	XA000716	XA000717	XA000718	XA000719	XA000720	XA000721	XA000722	XA000723	XA000724	XA000725	XA000726	XA000727	XA000728	XA000729	XA000730	XA000731	XA000732	XA000733	XA000734	XA000735	XA000736	XA000737	XA000738	XA000739	XA000740	XA000741	XA000742	XA000743	XA000744	XA000745	XA000746	XA000747	XA000748	XA000749	XA000750	XA000751	XA000752	XA000753	XA000754	XA000755	XA000756	XA000757	XA000758	XA000759	XA000760	XA000761	XA000762	XA000763	XA000764	XA000765	XA000766	XA000767	XA000768	XA000769	XA000770	XA000771	XA000772	XA000773	XA000774	XA000775	XA000776	XA000777	XA000778	XA000779	XA000780	XA000781	XA000782	XA000783	XA000784	XA000785	XA000786	XA000787	XA000788	XA000789	XA000790	XA000791	XA000792	XA000793	XA000794	XA000795	XA000796	XA000797	XA000798	XA000799	XA000800	XA000801	XA000802	XA000803	XA000804	XA000805	XA000806	XA000807	XA000808	XA000809	XA000810	XA000811	XA000812	XA000813	XA000814	XA000815	XA000816	XA000817	XA000818	XA000819	XA000820	XA000821	XA000822	XA000823	XA000824	XA000825	XA000826	XA000827	XA000828	XA000829	XA000830	XA000831	XA000832	XA000833	XA000834	XA000835	XA000836	XA000837	XA000838	XA000839	XA000840	XA000841	XA000842	XA000843	XA000844	XA000845	XA000846	XA000847	XA000848	XA000849	XA000850	XA000851	XA000852	XA000853	XA000854	XA000855	XA000856	XA000857	XA000858	XA000859	XA000860	XA000861	XA000862	XA000863	XA000864	XA000865	XA000866	XA000867	XA000868	XA000869	XA000870	XA000871	XA000872	XA000873	XA000874	XA000875	XA000876	XA000877	XA000878	XA000879	XA000880	XA000881	XA000882	XA000883	XA000884	XA000885	XA000886	XA000887	XA000888	XA000889	XA000890	XA000891	XA000892	XA000893	XA000894	XA000895	XA000896	XA000897	XA000898	XA000899	XA000900	XA000901	XA000902	XA000903	XA000904	XA000905	XA000906	XA000907	XA000908	XA000909	XA000910	XA000911	XA000912	XA000913	XA000914	XA000915	XA000916	XA000917	XA000918	XA000919	XA000920	XA000921	XA000922	XA000923	XA000924	XA000925	XA000926	XA000927	XA000928	XA000929	XA000930	XA000931	XA000932	XA000933	XA000934	XA000935	XA000936	XA000937	XA000938	XA000939	XA000940	XA000941	XA000942	XA000943	XA000944	XA000945	XA000946	XA000947	XA000948	XA000949	XA000950	XA000951	XA000952	XA000953	XA000954	XA000955	XA000956	XA000957	XA000958	XA000959	XA000960	XA000961	XA000962	XA000963	XA000964	XA000965	XA000966	XA000967	XA000968	XA000969	XA000970	XA000971	XA000972	XA000973	XA000974	XA000975	XA000976	XA000977	XA000978	XA000979	XA000980	XA000981	XA000982	XA000983	XA000984	XA000985	XA000986	XA000987	XA000988	XA000989	XA000990	XA000991	XA000992	XA000993	XA000994	XA000995	XA000996	XA000997	XA000998	XA000999	XA001000
10 Approval:	Non-hazardous area	A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

- 1) German WHG only in combination with certificate ZE00244F/00/DE.
- 2) Fully insulated antenna; note safety instructions (XA) (electrostatic charging)!
- 3) Note safety instructions (XA) (electrostatic charging)!
- 4) Envelope curve display on site.
- 5) Via communication.
- 6) Separate conn. compartment.
- 7) OVP = overvoltage protection.

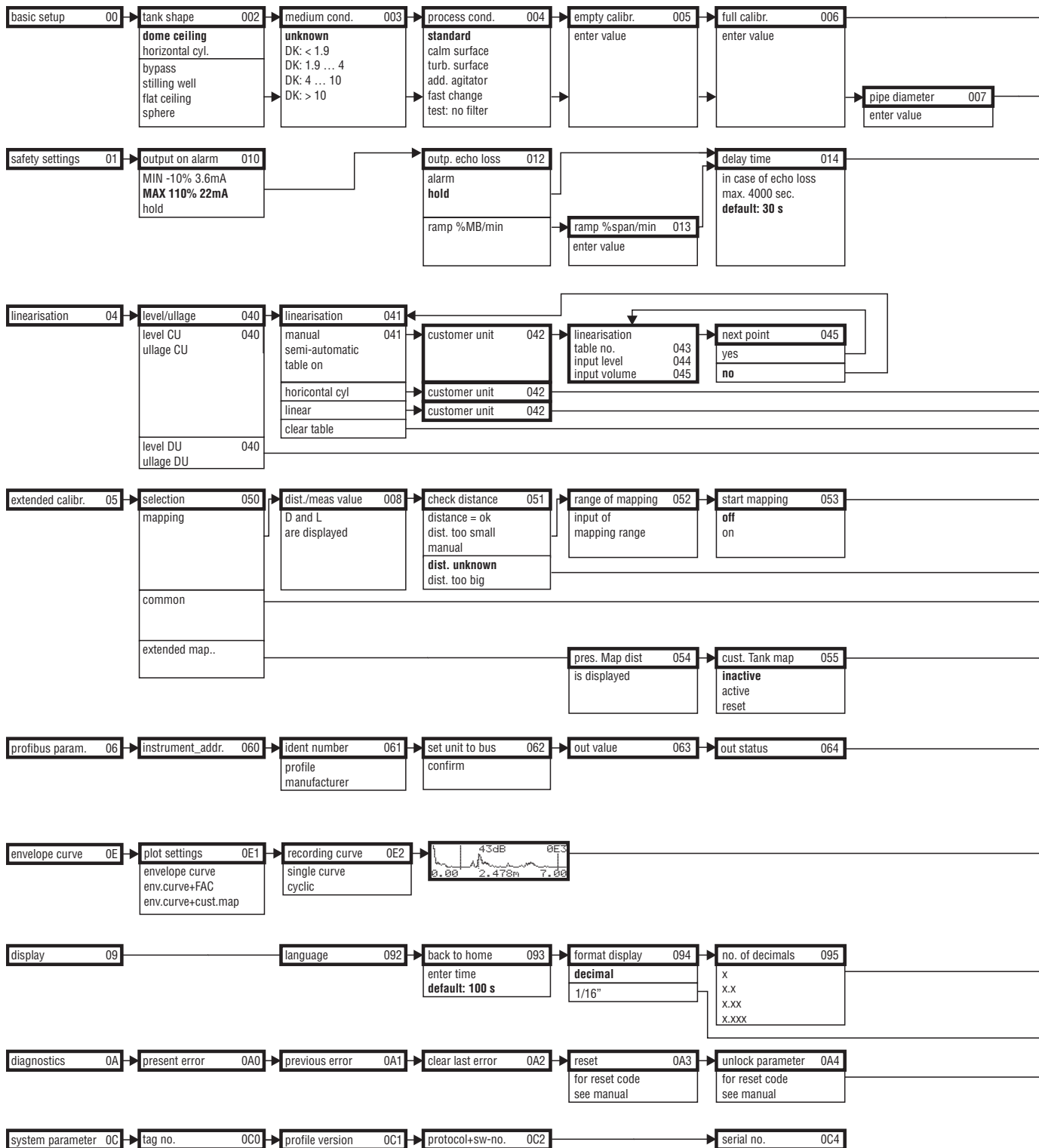
10.1.8 Supplementary Documentation

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

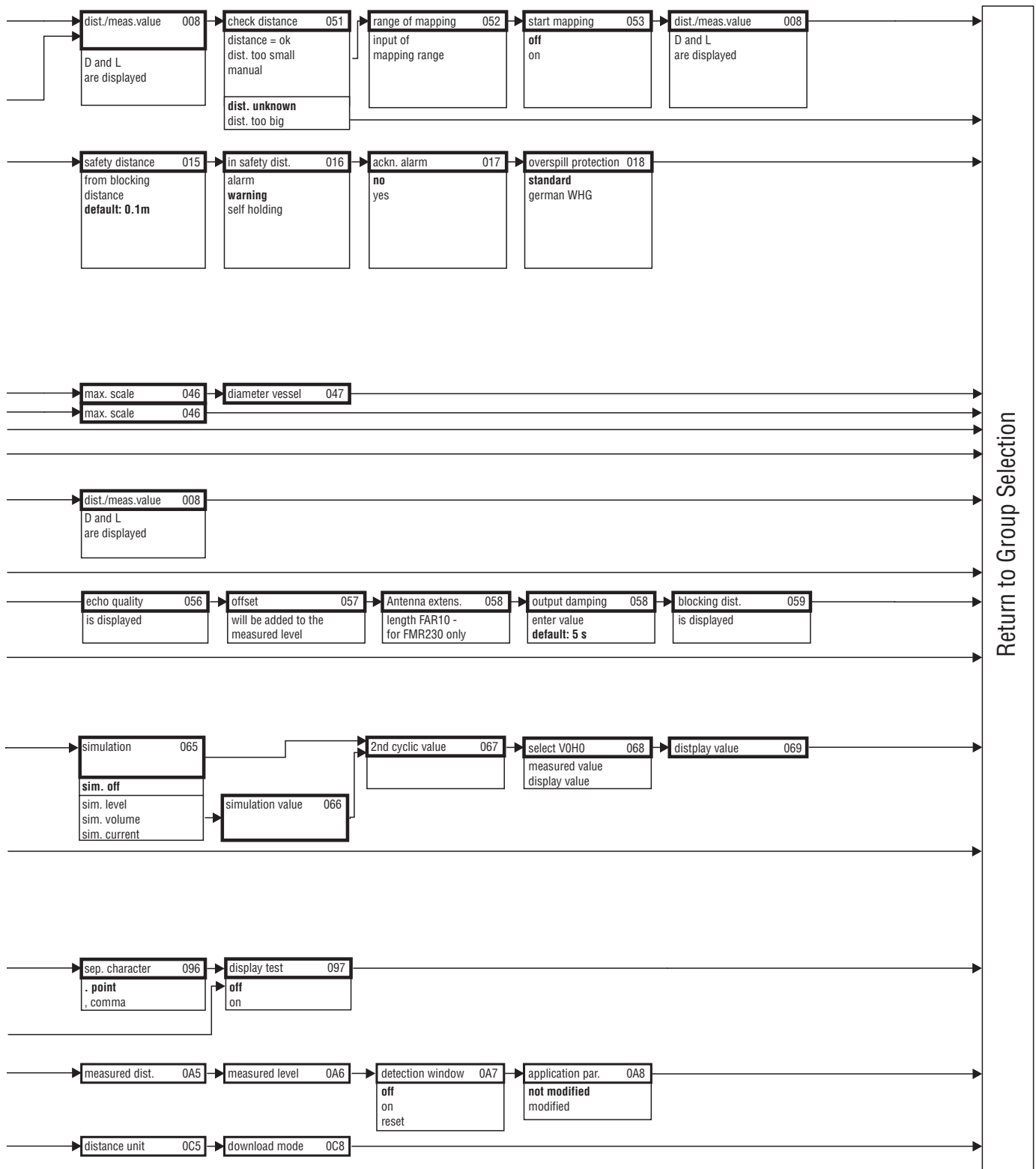
- Technical Information (TI00345F/00/EN)
- Operating Instructions "Description of instrument functions" (BA00221F/00/EN)
- Safety Manual "Functional Safety Manual" (SD00150F/00/EN).
- Certificate "German WHG" (ZE00244F/00/DE).
- Brief operating instructions (KA01004F/00/EN)

11 Appendix

11.1 Operating menu PA (display modul)



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



11.2 Patents

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

- US 5,387,918 \cong EP 0 535 196
- US 5,689,265 \cong EP 0 626 063
- US 5,659,321
- US 5,614,911 \cong EP 0 670 048
- US 5,594,449 \cong 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

A

accessories 68
alarm 34
antenna size 12
application errors..... 73

B

basic setup 51, 53, 63
beam angle 15
bypass..... 57

C

CE mark 9
commissioning 50
connecting 24
connection 25

D

declaration of conformity..... 9
declaration of contamination 78
degree of protection 25
designated use..... 4
dielectric constant..... 17, 54
dimensions 12
display 29
disposal..... 78
distance 51, 57–58

E

echo mapping..... 59
echo quality 75–76
empty calibration 51, 56, 64
engineering hints..... 14
envelope curve 60, 65
error messages 34
Ex approval..... 87
exterior cleaning..... 67

F

F12 housing 21
F23 housing 21
FHX40 69
fieldbus plug connectors 23
full calibration..... 51, 56, 64
function groups..... 27
functions..... 27

H

HART 35

I

installation in stilling well 10
installation in tank..... 10, 18
interference echo 75
interference echoes 58

K

key assignment 30

L

level 51
lock..... 31–32

M

maintenance 67
mapping 58–59, 65
maximum measured error 80
Measurement in a plastic tank 15
measuring conditions..... 16
medium property..... 54, 64
mounting 10

N

nameplate 6
notes on safety conventions and symbols 5

O

operating menu 27
operation..... 26, 31
operation menu..... 26
operational safety..... 4
optimisation 75
ordering structure 7
orientation..... 10, 75

P

pipe diameter 57
process conditions..... 55
product class 17

R

repairs..... 67
repairs to Ex-approved devices..... 67
replacement 67
replacing seals 67
Reset..... 33
return 78
RF approvals 86

S

safety distance 51
safety instructions 4
Service Interface FXA291..... 68
software history..... 78
Spare Parts 77
stilling well 57
system error messages 71

T

T12 housing 22–23
tank installations 14
tank shape..... 53
technical data 79

trouble-shooting 70

trouble-shooting instructions 70

turn housing 10, 20

U

unlock parameter 31–32

V

vessel / silo 64

W

warning 34

weather protection cover 68

wiring 21

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No.

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

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor

Geräte-/Sensortyp

Serial number

Seriennummer

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

Process data/ Prozessdaten

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

Medium and warnings

Warnhinweise zum Medium



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

* explosive; oxidising; dangerous for the environment; biological risk; radioactive

* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.

Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / Fehlerbeschreibung

Company data / Angaben zum Absender

Company / Firma _____	Phone number of contact person / Telefon-Nr. Ansprechpartner: _____
Address / Adresse _____	Fax / E-Mail _____
Your order No. / Ihre Auftragsnr. _____	

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge. We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

(place, date / Ort, Datum)

Name, dept./ Abt. (please print / bitte Druckschrift)

Signature / Unterschrift

www.endress.com/worldwide

Endress + Hauser 
People for Process Automation

