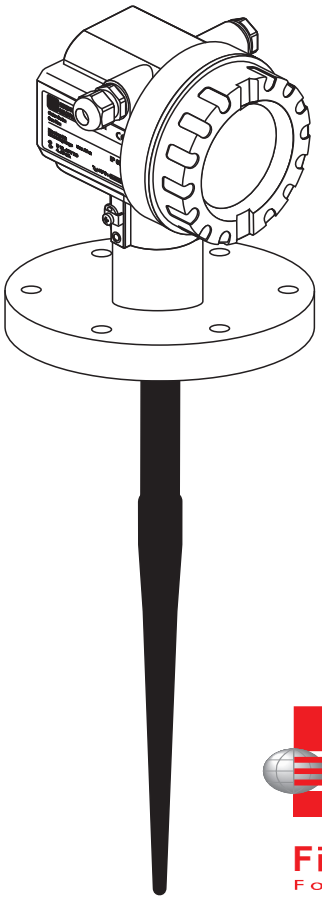
BA 229F/24/ae/03.03
Nr. 52009950
Valid as of software version:
V 01.02.00 (amplifier)
V 1.0 (communication)

micropilot M
FMR 231
Foundation Fieldbus
Level-Radar

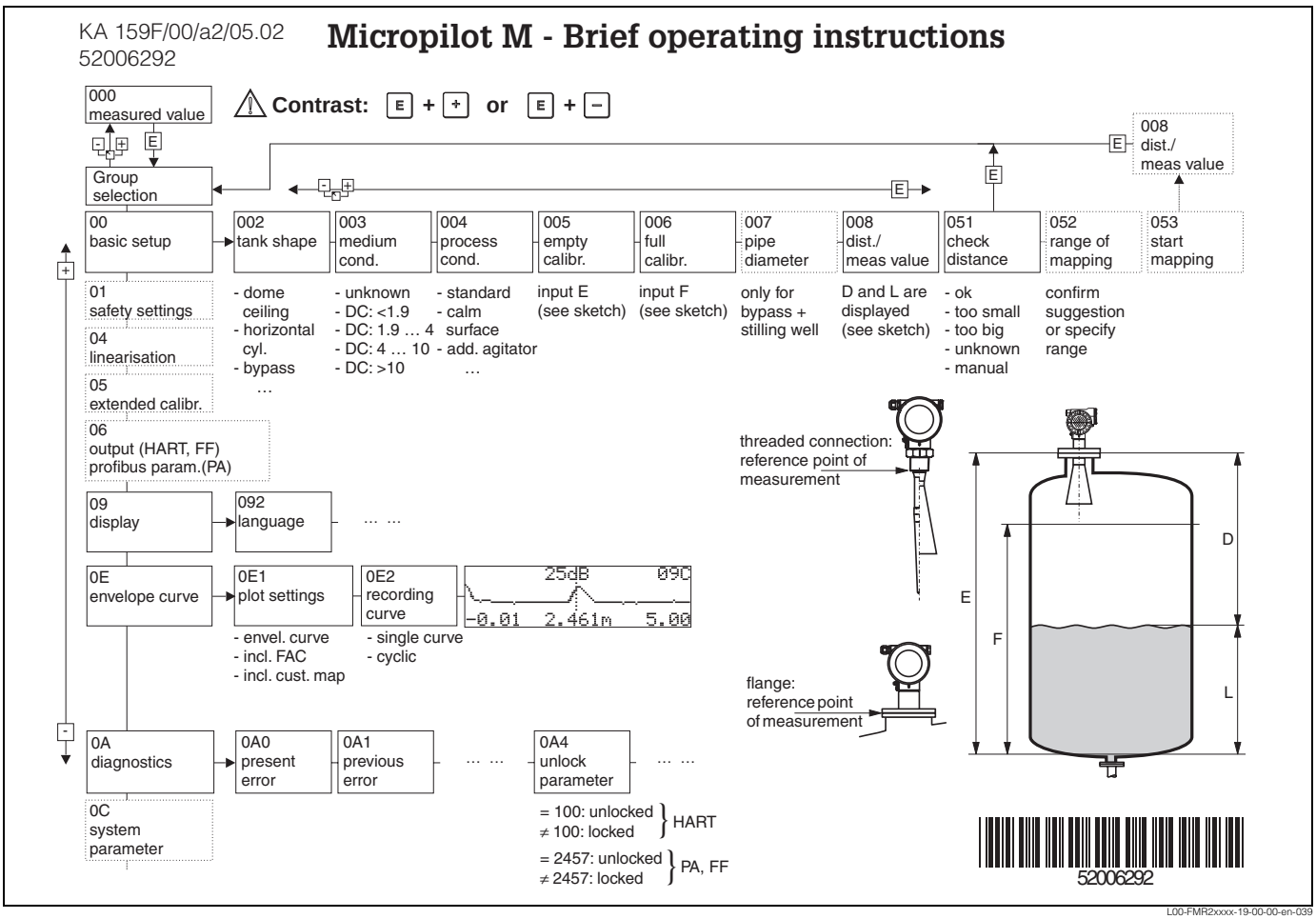
Operating Instructions



Fieldbus™
Foundation

Endress+Hauser
The Power of Know How

Brief operating instructions



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

An **overview of all device functions** can be found on Page 90.

The operating manual BA 221F/00/en provides an **extensive description of all device functions** - Description of the instrument functions for Micropilot M, which can also be found on the enclosed CD-ROM.

Table of contents

1 Safety instructions

1.1 Designated use

The Micropilot M FMR 231 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 1mW (average power output 1 µW). Operation is completely harmless to humans and animals.

1.2 Installation, commissioning and operation

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

1.3 Operational safety

1.3.1 Hazardous areas

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

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

Symbol	Meaning
	**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

	**Device certified for use in explosion hazardous area** If the Micropilot 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

	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

2 Identification

2.1 Device designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:

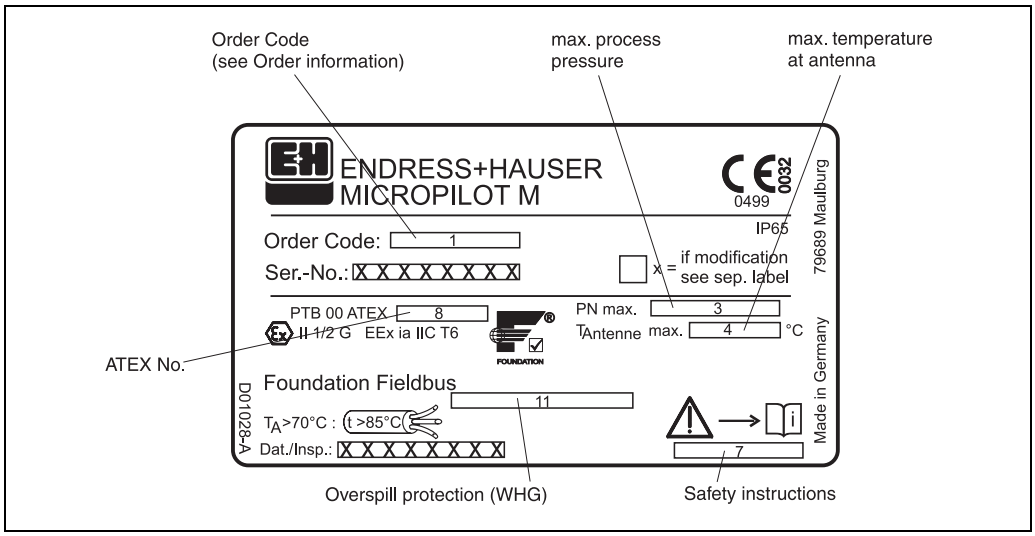


Fig. 1: Information on the nameplate of the Micropilot M with Foundation Fieldbus (example)

2.1.2 Ordering structure

Ordering structure Micropilot M FMR 231 (continued)

10	Certificates		
	A	For non-hazardous areas	
	1	ATEX II 1/2 G	EEx ia IIC T6
	2	ATEX II 1/2 G	EEx ia IIC T6, note safety instruction (XA) for electrostatic charging!
	3	ATEX II 1/2 G	EEx em [ia] IIC T6
	4	ATEX II 1/2 G	EEx d [ia] IIC T6
	5	ATEX II 1/2 G	EEx d [ia] IIC T6, note safety instruction (XA) for electrostatic charging!
	G	ATEX II 3 G	EEx nA II T6
	F	For non-hazardous areas + WHG	
	6	ATEX II 1/2 G	EEx ia IIC T6 + WHG
	7	ATEX II 1/2 G	EEx ia IIC T6 + WHG, note safety instruction (XA) for electrostatic charging!
	8	ATEX II 1/2 G	EEx em [ia] IIC T6 + WHG
	S	FM	IS - Class I, Division 1, Group A-D
	T	FM	XP - Class I, Division 1, Group A-D
	N	CSA	General Purpose
	U	CSA	IS - Class I, Division 1, Group A-D
	V	CSA	XP - Class I, Division 1, Group A-D
	K	TIIS	EEx ia IIC T4
	W	SAA	Ex ib IIC T6
	Y	Special version	

FMR 231-									Product designation (part 2)

Ordering structure Micropilot M FMR 231

20 Type of antenna, O-ring, inactive length

	Type	*Length*	*Material*	*O-ring*	*Nozzle length*
A	Rod antenna	360 mm / 14"	PPS, antistatic	Viton	100 mm / 4"
B	Stabantenne	510 mm / 20"	PPS, antistatic	Viton	250 mm / 10"
E	Stabantenne	390 mm / 15"	PTFE, fully insulated		100 mm / 4"
F	Stabantenne	540 mm / 21"	PTFE, fully insulated		250 mm / 10"
H	Stabantenne	390 mm / 15"	PPS, antistatic + fully insulated		100 mm / 4"
J	Stabantenne	540 mm / 21"	PPS, antistatic + fully insulated		250 mm / 10"
Y	Special version				

30 Process connection, material

	Threaded connection	*Standard*	*Material*
GGJ	1½" BSPT (R 1½")	DIN 2999	SS316L
GGS	1½" BSPT (R 1½")	DIN 2999	PVDF
GNJ	NPT 1½"		SS316L
GNS	NPT 1½"		PVDF
	Flange Dia/Pressure	*Standard*	*Material*
BFJ	DN50 PN16	DIN 2526 Form B	SS316L
BMJ	DN80 PN16	DIN 2526 Form B	SS316L
BNJ	DN80 PN40	DIN 2526 Form B	SS316L
BQJ	DN100 PN16	DIN 2526 Form B	SS316L
BWJ	DN150 PN16	DIN 2526 Form B	SS316L
CFJ	DN50 PN16	DIN 2526 Form C	SS316L
CMJ	DN80 PN16	DIN 2526 Form C	SS316L
CNJ	DN80 PN40	DIN 2526 Form C	SS316L
CQJ	DN100 PN16	DIN 2526 Form C	SS316L
CWJ	DN150 PN16	DIN 2526 Form C	SS316L
CFK	DN50 PN16	DIN 2526 Form C	SS316L, PTFE-clad
CMK	DN80 PN16	DIN 2526 Form C	SS316L, PTFE-clad
CQK	DN100 PN16	DIN 2526 Form C	SS316L, PTFE-clad
CWK	DN150 PN16	DIN 2526 Form C	SS316L, PTFE-clad
	disc made of antistatic PTFE (black)		
AEJ	2"/150 lbs	ANSI B16.5	SS316L
ALJ	3"/150 lbs	ANSI B16.5	SS316L
AMJ	3"/300 lbs	ANSI B16.5	SS316L
APJ	4"/150 lbs	ANSI B16.5	SS316L
AQJ	4"/300 lbs	ANSI B16.5	SS316L
AVJ	6"/150 lbs	ANSI B16.5	SS316L
AEK	2"/150 lbs	ANSI B16.5	SS316L, PTFE-clad
ALK	3"/150 lbs	ANSI B16.5	SS316L, PTFE-clad
APK	4"/150 lbs	ANSI B16.5	SS316L, PTFE-clad
AVK	6"/150 lbs	ANSI B16.5	SS316L, PTFE-clad
	disc made of antistatic PTFE (black)		
KEJ	10 K 50A	JIS B2210	SS316L
KLJ	10 K 80A	JIS B2210	SS316L
KPJ	10 K 100A	JIS B2210	SS316L
KVJ	10 K 150A	JIS B2210	SS316L
KEK	10 K 50A	JIS B2210	SS316L, PTFE-clad
KLK	10 K 80A	JIS B2210	SS316L, PTFE-clad
KPK	10 K 100A	JIS B2210	SS316L, PTFE-clad
KVK	10 K 150A	JIS B2210	SS316L, PTFE-clad
	disc made of antistatic PTFE (black)		
	Sanitary coupling	*Standard*	*Material*
MFJ	DN50 dairy coupling	DIN 11851	SS316L
HFJ	DN50 aseptic	DIN 11864-1 Form A	SS316L
	for tubes according to DIN 11850		
TEJ	2" Tri-clamp	ISO 2852	SS316L
TLJ	3" Tri-clamp	ISO 2852	SS316L
YY9	Special version		

FMR 231- Product designation (part 1)

Ordering structure Micropilot M FMR 231 (continued)

40				**Output and menu based operation**					
				A	4…20 mA HART with VU 331 (4-line alphanumeric display)				
				B	4…20 mA HART				
				K	4…20 mA HART, prepared for FHX40, mounting of remote display (accessoty)				
				C	PROFIBUS PA with VU 331 (4-line alphanumeric display)				
				D	PROFIBUS PA				
				L	PROFIBUS PA, prepared for FHX40, mounting of remote display (accessoty)				
				E	Foundation Fieldbus with VU 331 (4-line alphanumeric display)				
				F	Foundation Fieldbus				
				M	Foundation Fieldbus, prepared for FHX40, mounting of remote display (accessoty)				
				Y	Special version				
50					**Housing**				
					A	Aluminium F12-housing, coated, IP65			
					B	316L F23-housing, IP65/NEMA 4x			
					C	Aluminium T12-housing with separate connection compartment, coated, IP65			
					Y	Special version			
60						**Gland / Entry**			
						2	M20x1.5 cable gland (for EEx d: cable entry)		
						3	G ½ cable entry		
						4	½ NPT cable entry		
						5	PROFIBUS PA M12 plug		
						6	7/8" FF plug		
						9	Special version		
70							**Gastight feed through**		
							A	without gastight feed through	
							C	with gastight feed through	
80								**Additional options**	
								A	Additional options not selected
								B	3.1.B material, wetted parts 316L, Inspection Certificate EN 10204, acc. specification 52005759
								S	GL (German Lloyd) marine certificate
								Y	Special version
FMR 231-									Complete product designation

2.2 Scope of delivery

Caution!
It is essential to follow the instructions concerning the unpacking, transport and storage of measuring instruments given in the chapter "Incoming acceptance, transport, storage" on Page 11!

The scope of delivery consists of:
- Assembled instrument
- 2 ToF Tool CD-ROMs:
  – CD 1: ToF Tool Program
  – CD 2: Device descriptions (device drivers) and documentation for all Endress+Hauser devices wich are operable using ToF Tool
- Accessories (→ Chap. 8)

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

2.3 Certificates and approvals

CE mark, declaration of conformity
The instrument 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 instrument complies with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". The instrument described in this manual thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the instrument by affixing to it the CE mark.

2.4 Registered trademarks

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

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

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

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

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

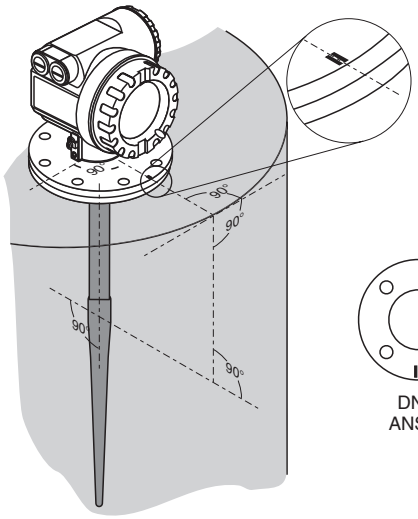
Foundation™ Fieldbus
Registered trademark of Fieldbus Foundation Austin, Texas, USA

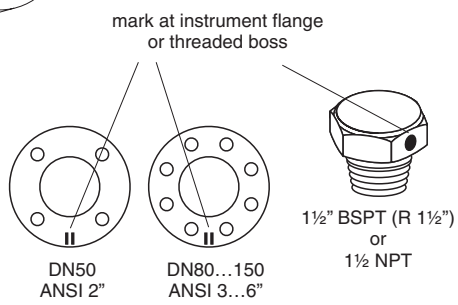
3 Mounting

3.1 Quick installation guide

Observe orientation when installing!

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

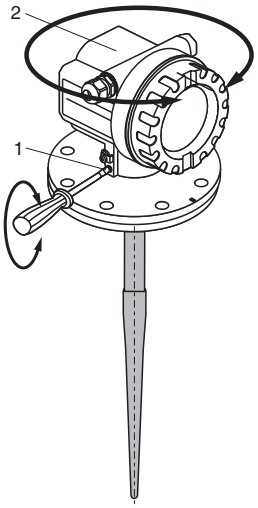




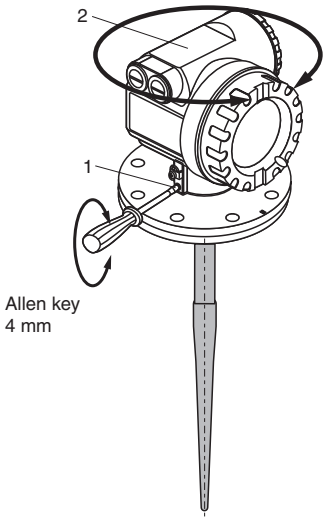
Turn housing

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

F12/F23 housing



T12 housing



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3.2 Incoming acceptance, transport, storage

3.2.1 Incoming acceptance

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

3.2.2 Transport

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

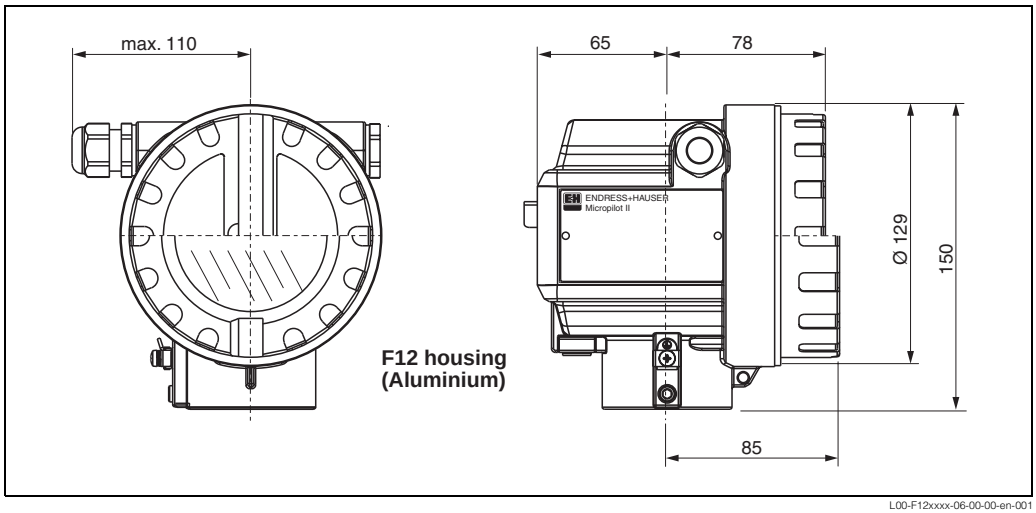
3.2.3 Storage

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

3.3 Installation conditions

3.3.1 Dimensions

Housing dimensions



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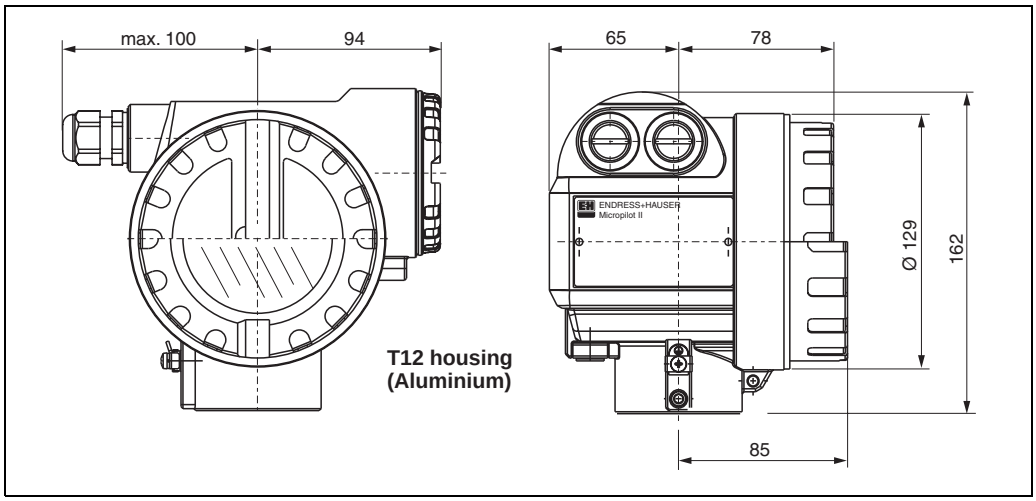

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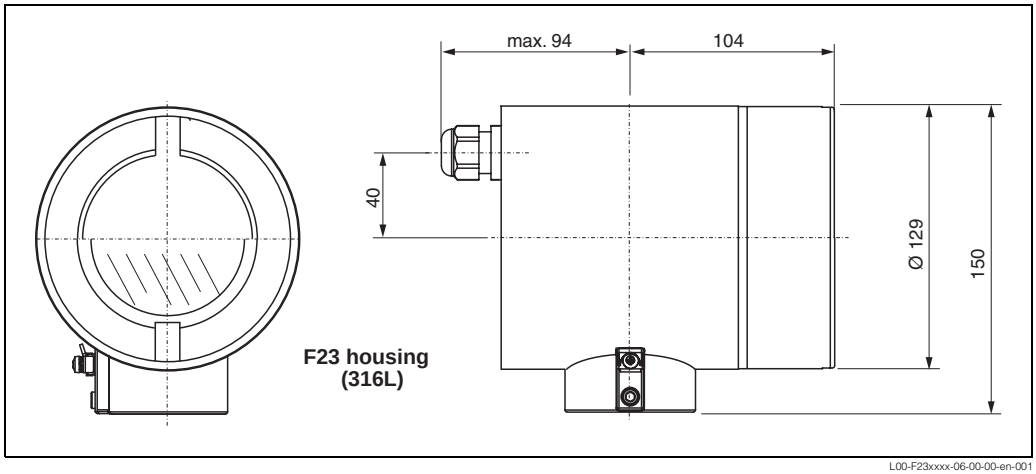

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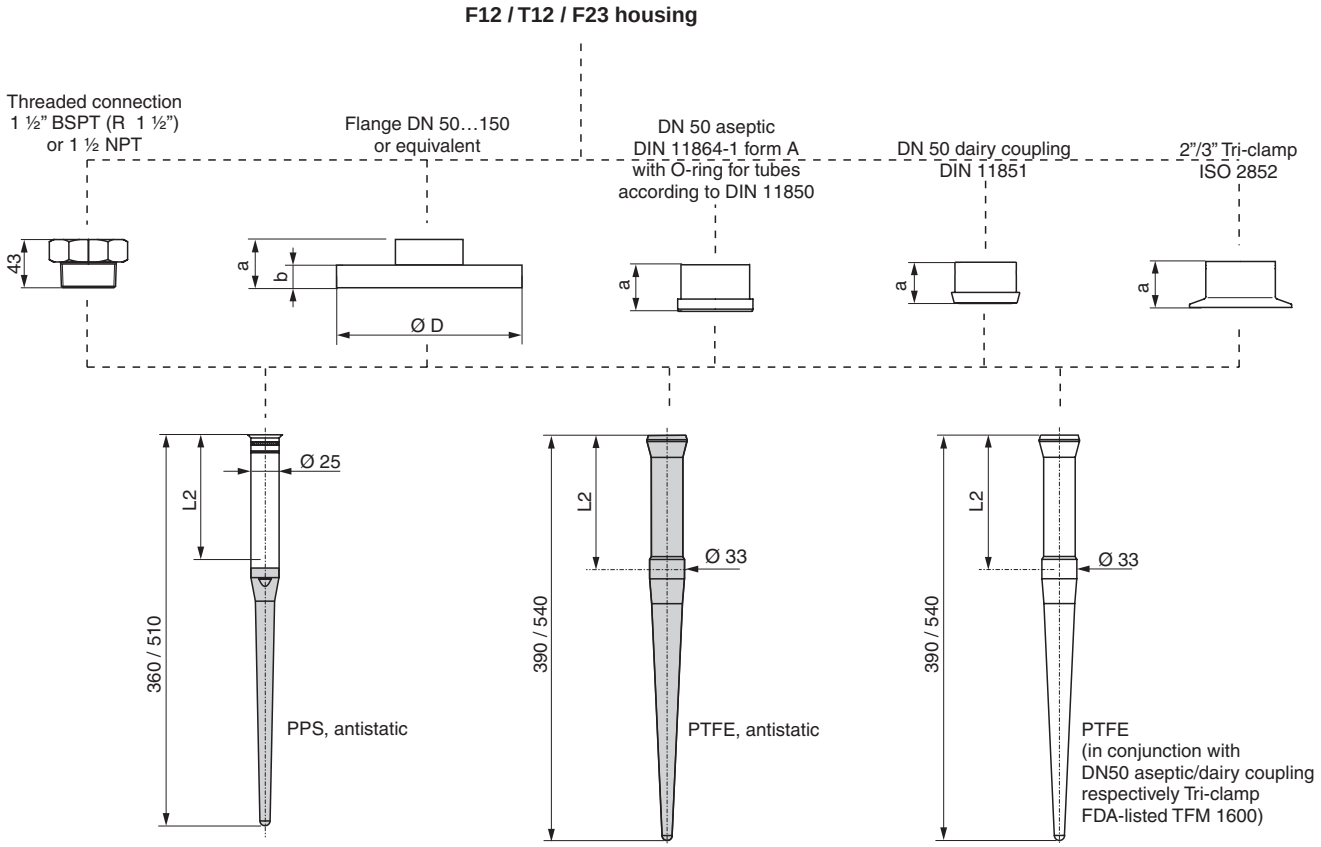
Micropilot M FMR 231 - process connection, type of antenna



Process connection	Flange DN 50…150	DN 50 aseptic coupling	DN 50 diary coupling	2"/3" Tri-clamp
a [mm] without gastight feedthrough	41	44.5	41	41
a [mm] with gastight feedthrough	77	80.5	77	77

Flange to DIN 2526

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

for PN 16 (for PN 40)

Flange to ANSI B16.5

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

for 150 lbs (for 300 lbs)

Flange to JIS B2210

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

for 10K

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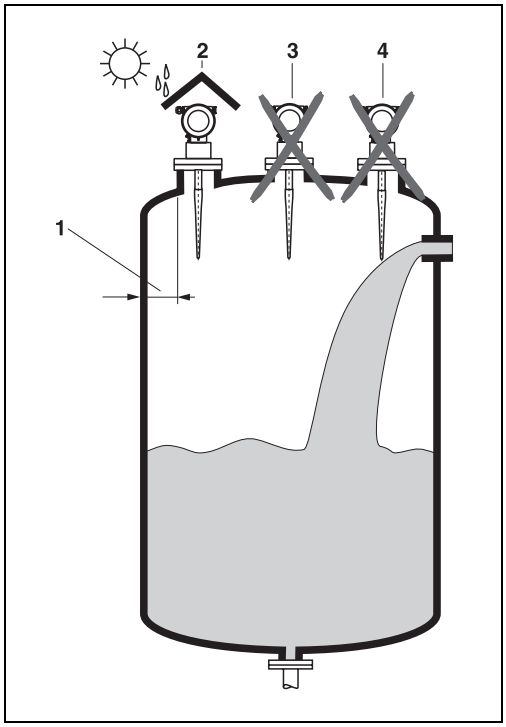
3.3.2 Engineering hints

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~1/6 of tank diameter (FMR 231: min. 30 cm (12“)).
- Not in the centre (3), interference can cause signal loss.
- Not above the fill stream (4).
- It is recommended to use a weather protection cover (2) in order to protect the transmitter from direct sun or rain. Assembly and disassembly is simply done by means of a tension clamp (→ Chap. 8 on Page 73).



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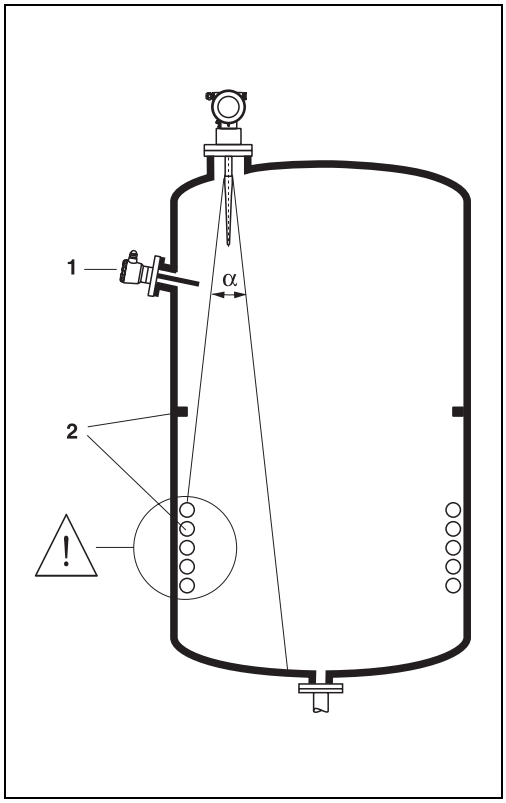
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (refer to beam angle see "Beam angle" on Page 15).
- 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" (see Page 18).
- Stilling well: a stilling well respectively a Wave Guide antenna can always be used to avoid interference.

Please contact Endress+Hauser for further information.



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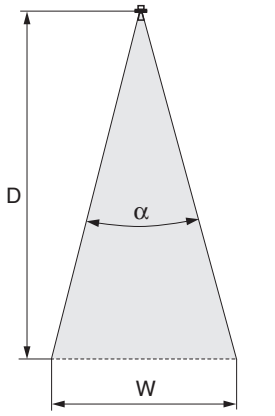
Beam angle

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

Antenna	**FMR 231** Rod
Beam angle α	30°

Measuring distance (D)	**Beam diameter (W)** Rod
3 m / 10 ft	1,61 m / 5.36 ft
6 m / 20 ft	3,22 m / 10.72 ft
9 m / 30 ft	4,83 m / 16.08 ft
12 m / 40 ft	6,43 m / 21.44 ft
15 m / 49 ft	8,04 m / 26.26 ft
20 m / 65 ft	10,72 m / 34.83.ft



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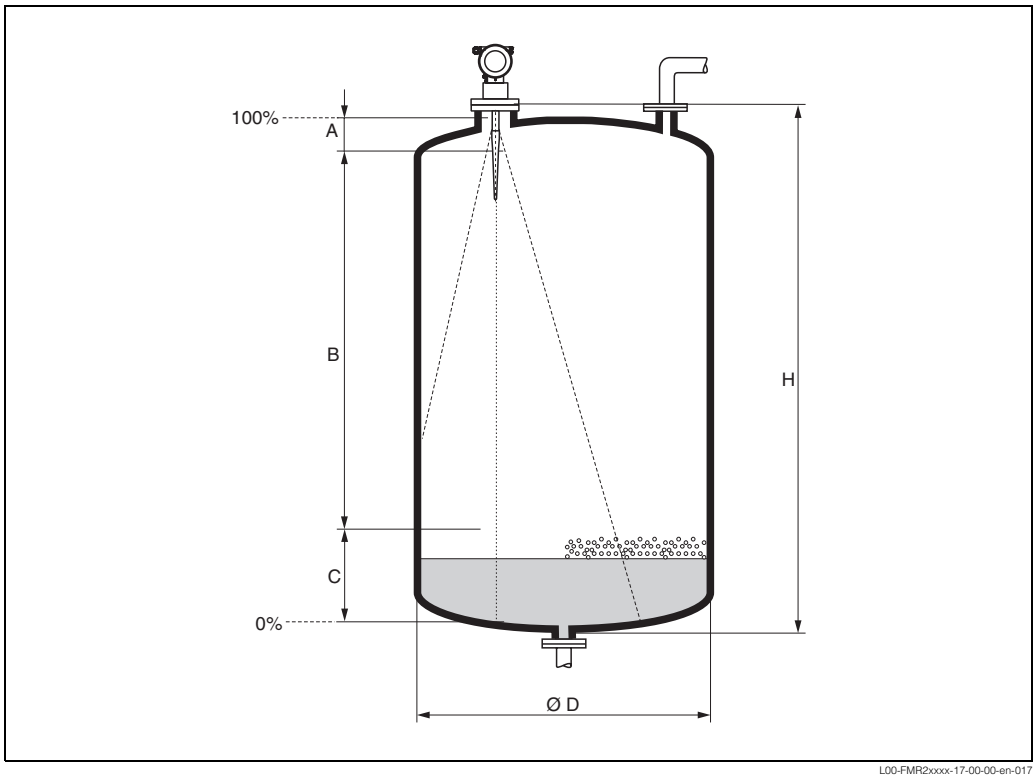
Measuring conditions

Note!

Please use FMR 230 in stilling well for the measurement of ammonia NH_3.

- 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. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the tank bottom (see Fig.).
- In principle it is possible to measure up to the tip of the antenna with FMR 230/231/240. 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.
- 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.).
- Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions.



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	A [mm/inch]	B [m/inch]	C [mm/inch]	D [m/inch]	H [m/ft]
FMR 231	50 / 2	> 0.5 / > 20	150...300/6...12	> 1 / > 40	> 1,5 / > 5

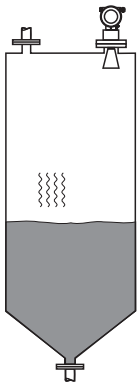
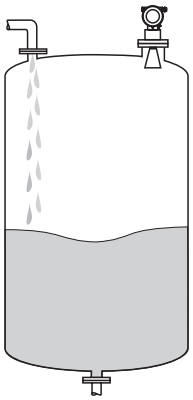
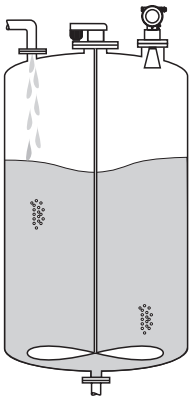
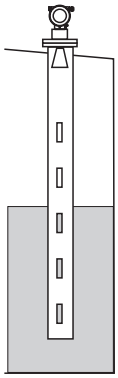
Measuring range

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

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

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

Measuring range depending on vessel type, conditions and product for Micropilot M FMR 231

Product class		Storage tank Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes).	Buffer tank Moving surfaces (e.g. continuous filling, from above, mixing jets).	Process tank with agitator Turbulent surface. Single stage agitator <60 RPM.	Stilling well	Bypass
						
		Measuring range	Measuring range	Measuring range	Measuring range	Measuring range
	FMR 231:	Rod antenna	Rod antenna	Rod antenna	Rod antenna	Rod antenna
A	DK(εr)=1,4...1,9	to use a stilling well (20 m / 67 ft) or Wave Guide antenna[1] (3.8 m /12.5 ft)			Use FMR 230, FMR 240,FMR 244 resp. FMR 245	Use FMR 230, FMR 240,FMR 244 resp. FMR 245
B	DK(εr)=1,9...4	10 m	5 m	4 m		
C	DK(εr)=4...10	15 m	7,5 m	6 m		
D	DK(εr)>10	20 m	10 m	8 m		

1) In the event of horizontal stress, mechanical support is required or provide the Wave Guide antenna with a protective pipe.

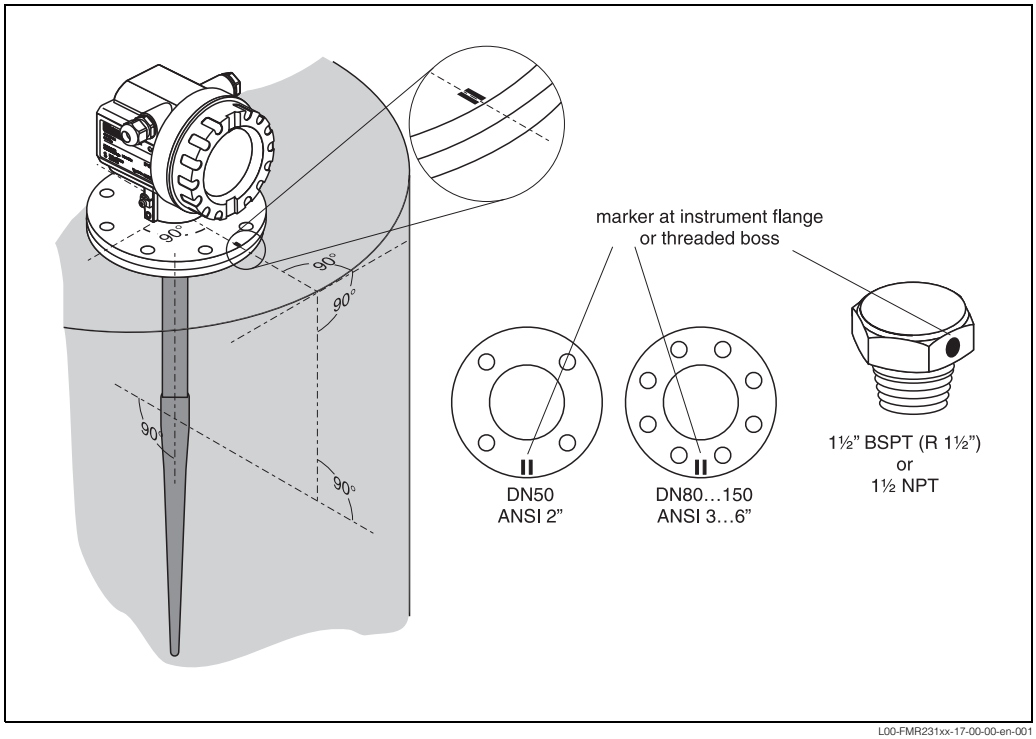
3.4 Installation instructions

3.4.1 Mounting kit

In addition to the tool needed for flange mounting, you will require the following tool:
- 4 mm/0.1" Allen wrench for turning the housing.

3.4.2 Installation in tank (free space)

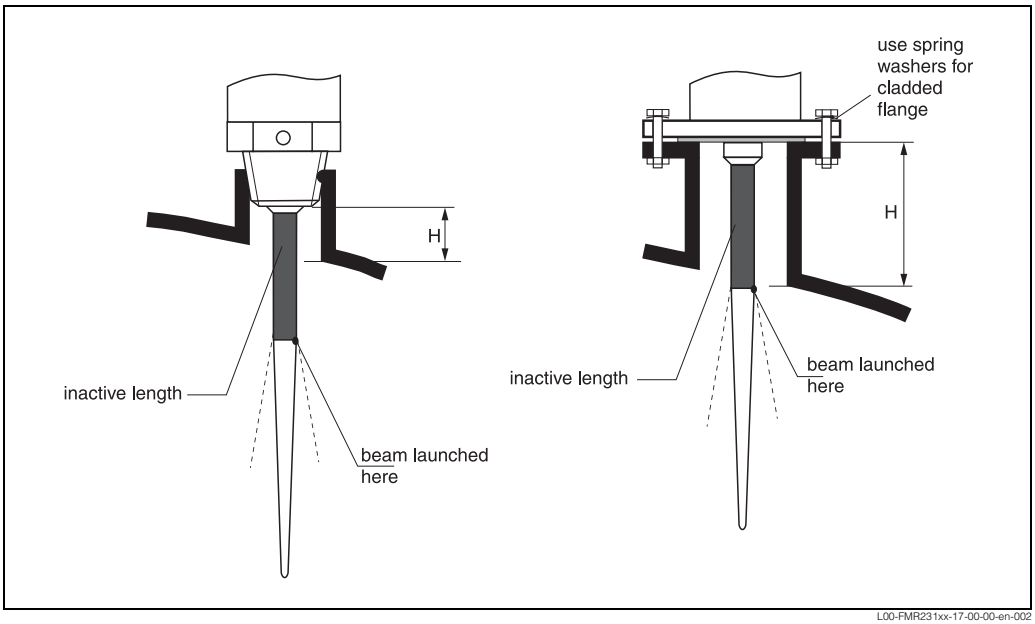
Optimum mounting position



Standard installation

For installations in a stilling well, follow the engineering hints on Page 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.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The rod antenna must be aligned vertically.

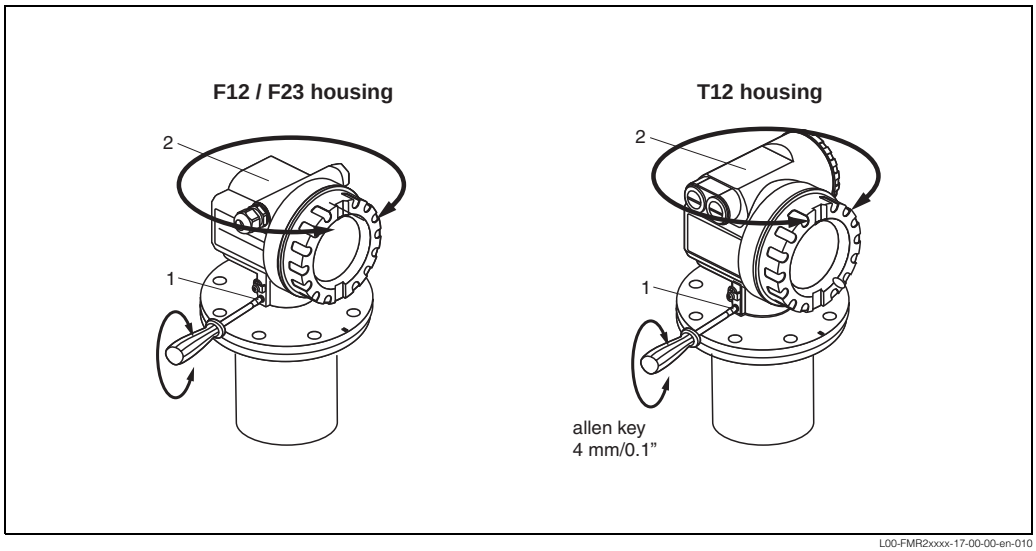
Note!
The inactive part of the rod antenna must extend below the nozzle.



Material	PPS		PTFE	
Antenna length [mm / inch]	360 / 14	510 / 20	390 / 15	540 / 21
H [mm/inch]	< 100 / < 4	< 250 / < 10	< 100 / < 4	< 250 / < 10

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)



3.5 Post-installation check

After the measuring instrument has been installed, perform the following checks:
- Is the measuring instrument damaged (visual check)?
- Does the measuring instrument correspond to the measuring point specifications such as process temperature/pressure, ambient temperature, measuring range, etc.?
- Is the flange marking correctly aligned? (→ Page 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 (→ Page 73)?

4 Wiring

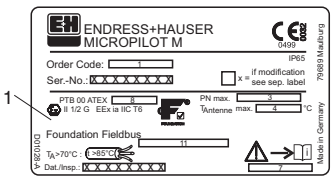
4.1 Quick wiring guide

Wiring in F12/F23 housing

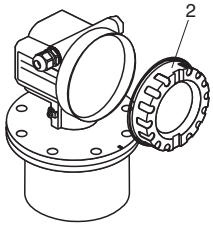
Caution!

Before connection please note the following:

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



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



EX

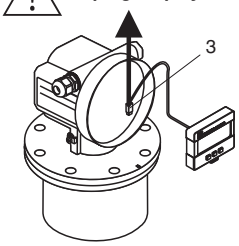
On devices supplied with a certificate, the explosion protection is designed as follows:

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

Connect up the Micropilot M as follows:

- Unscrew housing cover (2).
- Remove any display (3) if fitted.
- Remove cover plate from terminal compartment (4).
- Pull out terminal module slightly using pulling loop.
- Insert cable (5) through gland (6).
  Use screened, twisted wire pair.

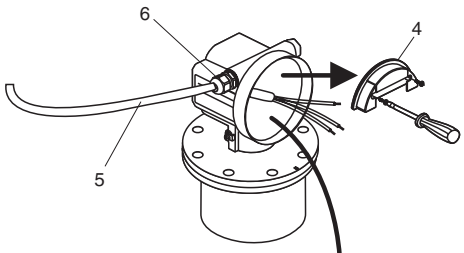
Unplug display connector!

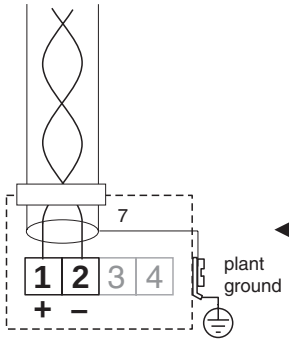


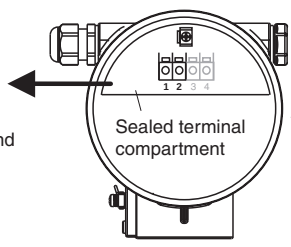
EX

Only earth screen conductor (7) on sensor side.

- Make connection (see pin assignment).
- Re-insert terminal module.
- Tighten cable gland (6).
- Tighten screws on cover plate (4).
- Insert display if fitted.
- Screw on housing cover (2).







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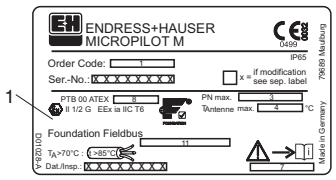
Wiring in T12 housing

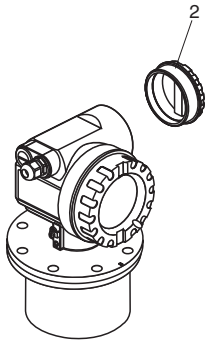
Caution!

Before connection please note the following:

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



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



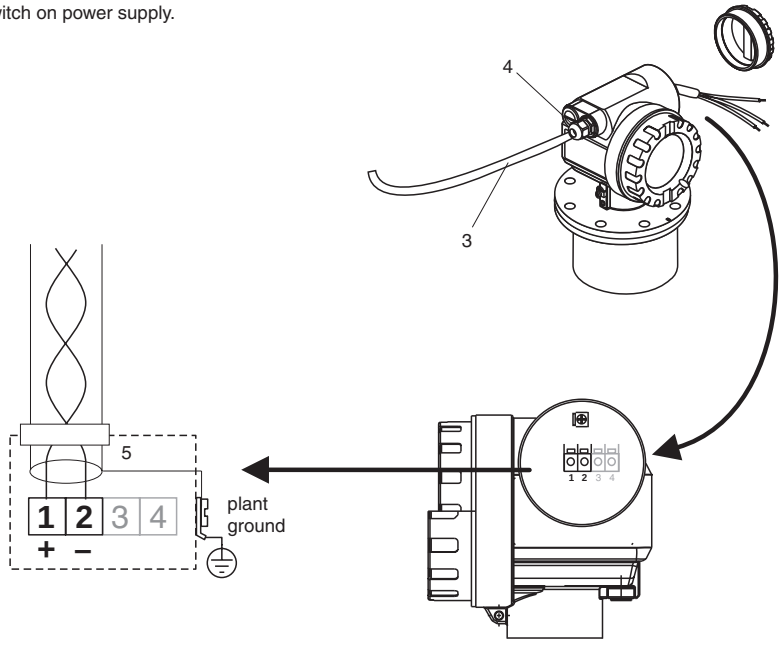
Connect up the Micropilot M as follows:

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

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

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

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



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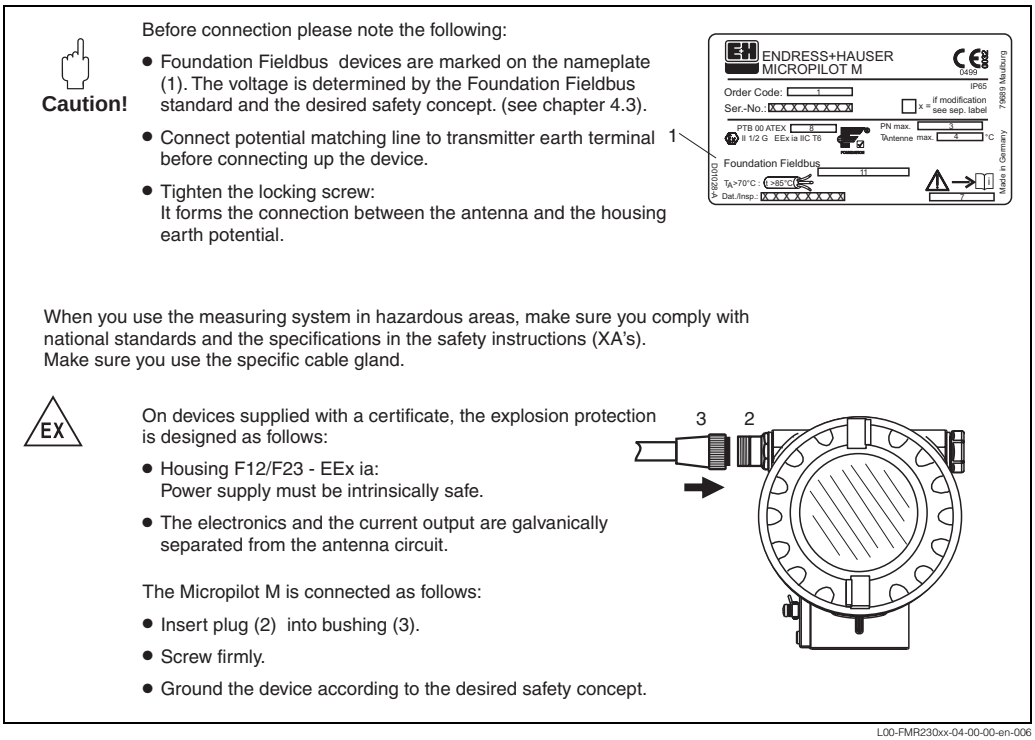
Wiring with Foundation Fieldbus connector



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

4.1.1 Cable specification Foundation Fieldbus

Twisted, shielded pairs must be used. The cable specifications can be taken from the FF specification or IEC 61158-2. The following have been found suitable:

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

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

4.2 Connecting the measuring unit

Supply voltage

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

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

Current consumption

The current consumption approx 15 mA for the range of voltages given above.

4.3 Recommended connection

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

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

4.4 Degree of protection

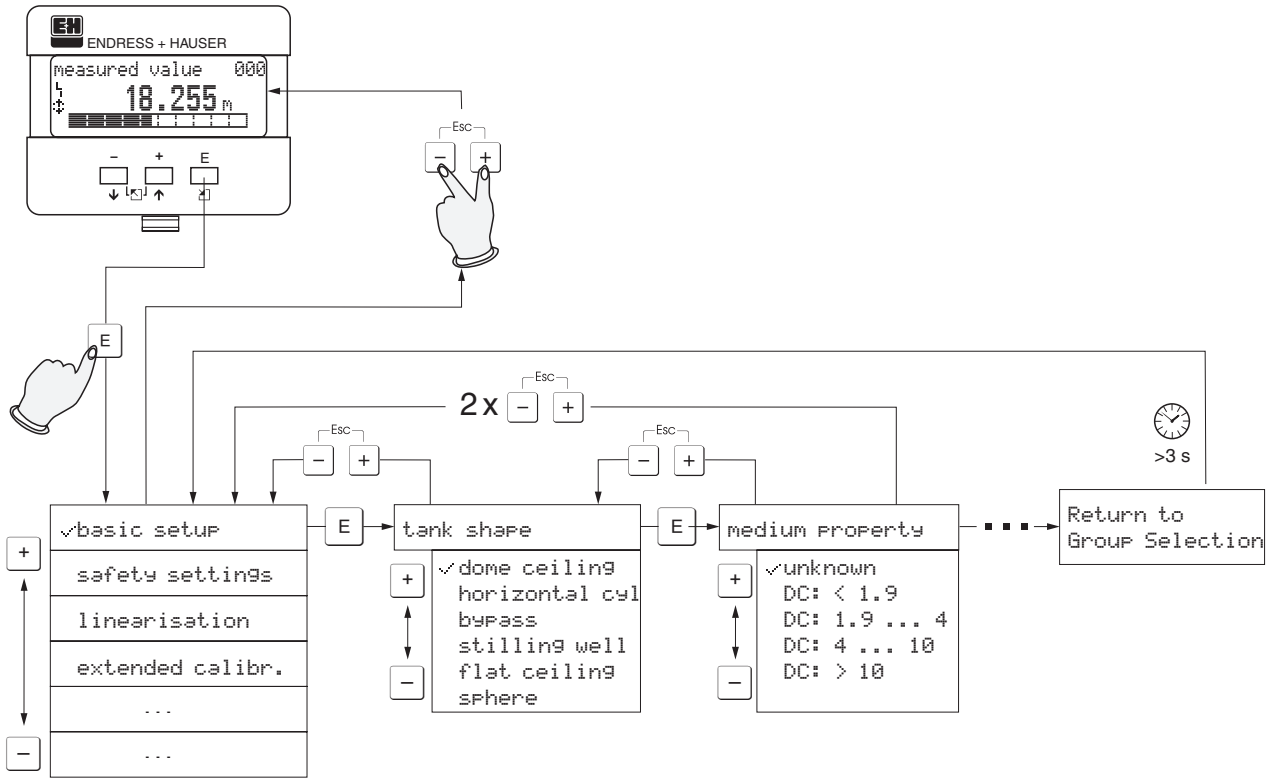
- housing: IP 65, NEMA 4X (open housing and pulled out display: IP20, NEMA 1)
- antenna: IP 68 (NEMA 6P)

4.5 Post-connection check

After wiring the measuring instrument, perform the following checks:
- Is the terminal allocation correct (→ Page 21 and Page 23)?
- Is the cable gland tight?
- Is the Foundation Fieldbus connector screwed tight?
- Is the housing cover screwed tight?
- If auxiliary power is available:
  Is the instrument ready for operation and does the liquid crystal display show any value?

5 Operation

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**

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5.1.1 General structure of the operating menu

The operating menu is made up of two levels:

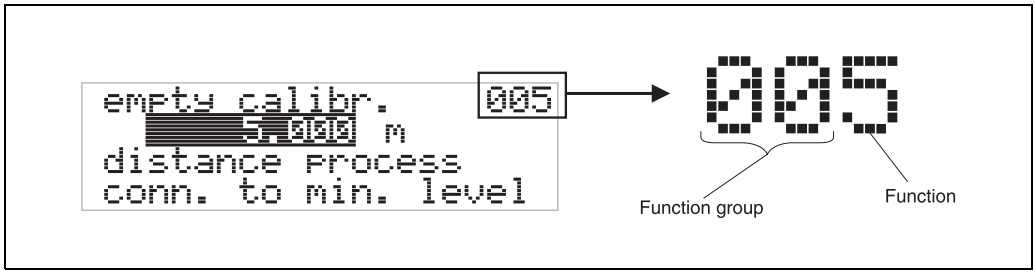
- **Function groups (00, 01, 03, ..., 0C, 0D):** The individual operating options of the instrument are split up roughly into different function groups. The function groups that are available include, e.g.: "**basic setup**", "**safety settings**", "**output**", "**display**", etc.
- **Functions (001, 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 (see Page 90 ff.), 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

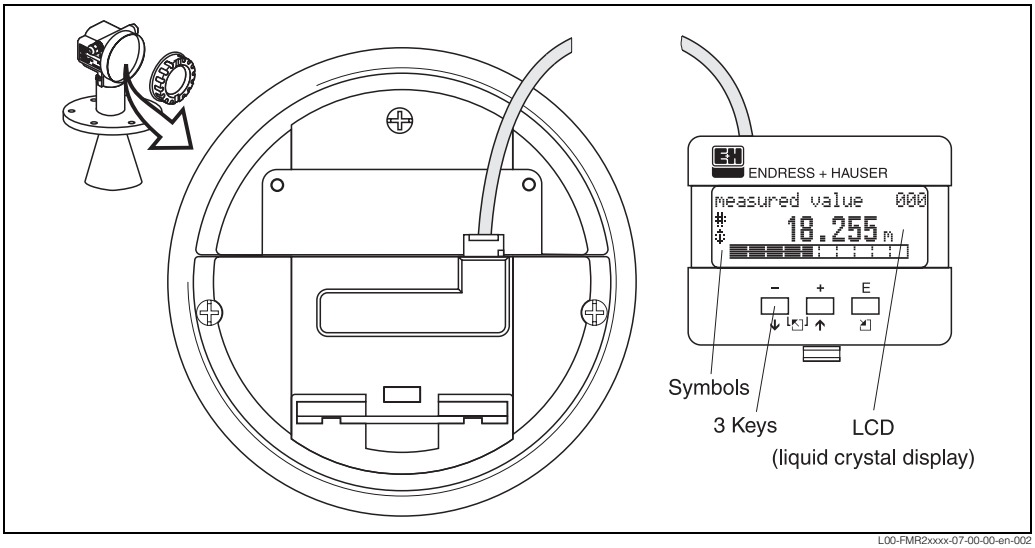


Fig. 2: Layout of the display and operating elements

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

5.2.1 Display

Liquid crystal display (LCD):

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

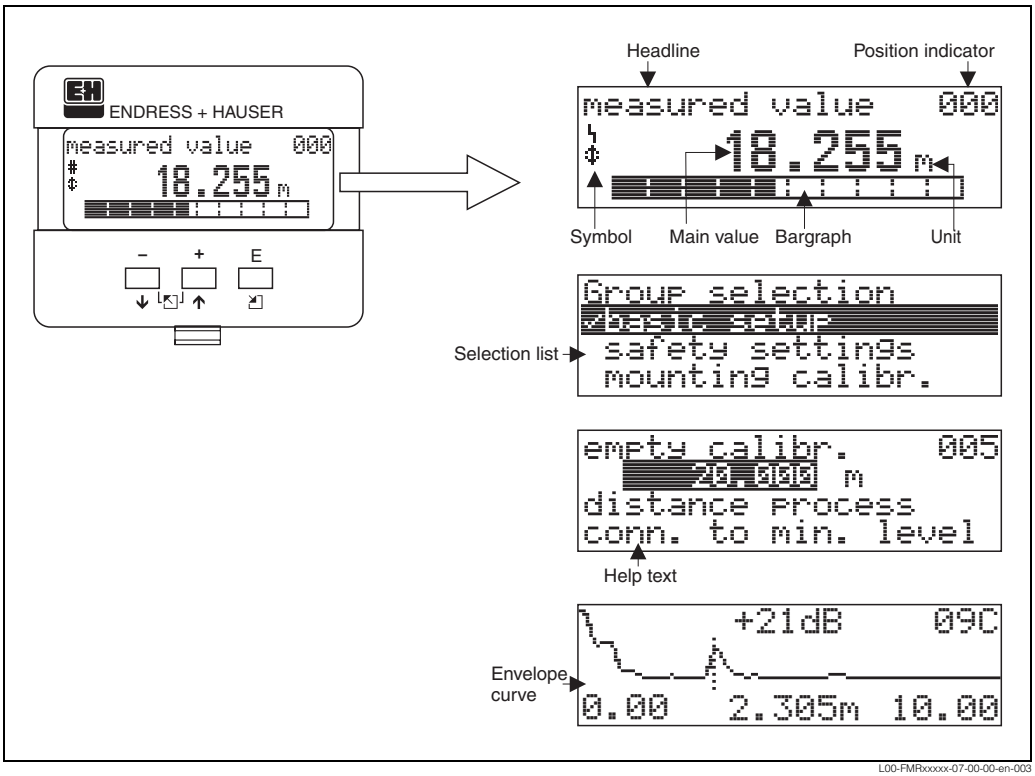


Fig. 3: Display

5.2.2 Display symbols

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

Sybmol	Meaning
	**ALARM_SYMBOL** This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	**LOCK_SYMBOL** This lock symbol appears when the instrument is locked,i.e. if no input is possible.
	**COM_SYMBOL** This communication symbol appears when a data transmission via e.g. HART, PFOFIBUS-PA or Foundation Fieldbus is in progress.
	**SIMULATION_SWITCH_ENABLE** This communication symbol appears when simulation in FF is enabled via the DIP switch.

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
Esc − + or	Navigate to the left within a function group
E	Navigate to the right within a function group, confirmation.
+ and E or − and E	Contrast settings of the LCD
+ and − and E	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

5.3 Local operation

5.3.1 Locking of the configuration mode

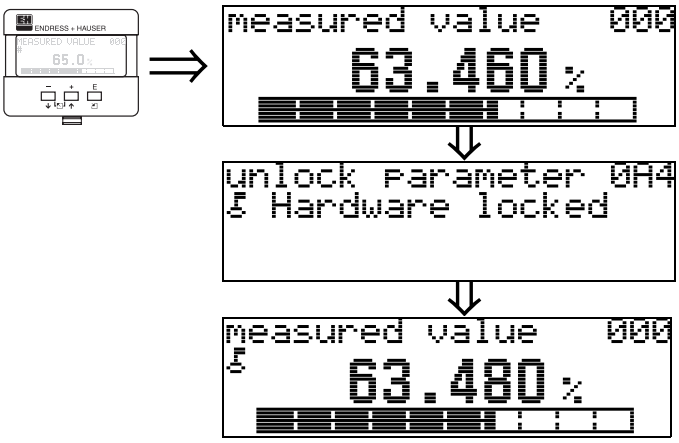
The Micropilot can be protected in two ways against unauthorised changing of instrument data, numerical values or factory settings:

"unlock parameter" (0A4):

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

Hardware lock:

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



[+] and [−] and [E] press simultaneous

The LOCK_SYMBOL appears on the LCD.

5.3.2 Unlocking of configuration mode

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

unlock parameter" (0A4):

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

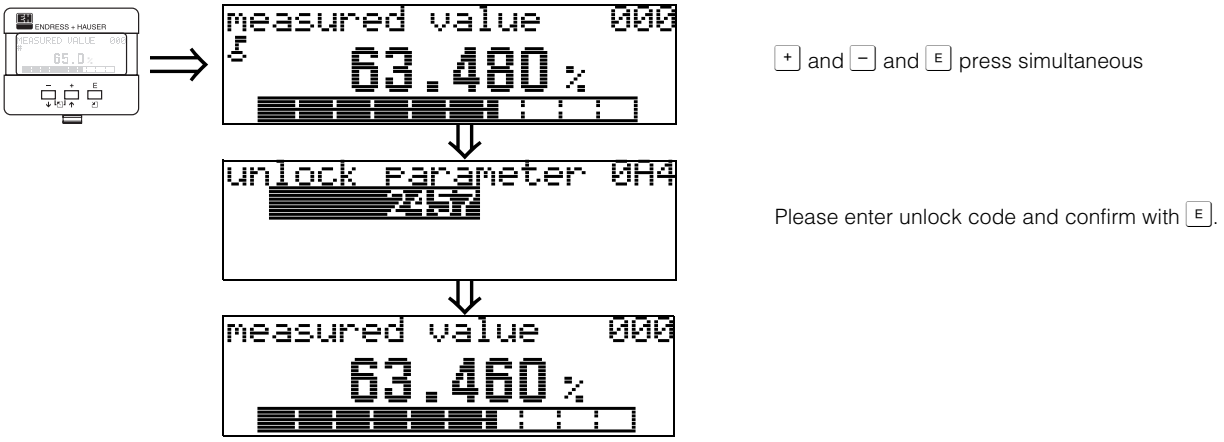
2457 = for Foundation Fieldbus devices

the Micropilot is released for operation.

Hardware unlock:

After pressing the [+] and [–] and [E] keys at the same time, the user is asked to enter the unlock parameter

2457 = for Foundation Fieldbus 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 E+H service organization. Please contact Endress+Hauser if you have any questions.

5.3.3 Factory settings (Reset)

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

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

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

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

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

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

5.4 Display and acknowledging error messages

Type of error

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

The measuring system distinguishes between two types of error:

- **A (Alarm):**
  Instrument goes into a defined state (e.g. + 99999)
  Indicated by a constant ↯ symbol.
  (For a description of the codes, see Page 76)
- **W (Warning):**
  Instrument continue measuring, error message is displayed.
  Indicated by a flashing ↯ symbol.
  (For a description of the codes, see Page 76)
- **E (Alarm / Warning):**
  Configurable (e.g. loss of echo, level within the safety distance)
  Indicated by a constant/flashing ↯ symbol.
  (For a description of the codes, see Page 76)

5.4.1 Error messages

Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of the error codes is given on Page 76.

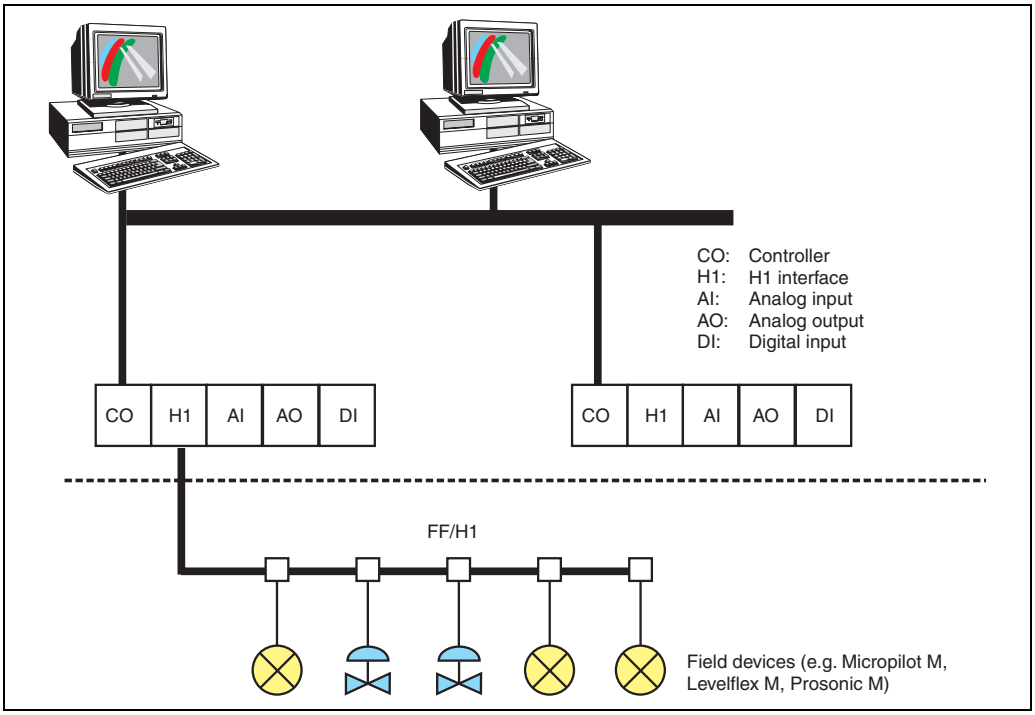
- The "**diagnostics**" **(0A)** function group can display current errors as well as the last errors that occurred.
- If several current errors occur, use ⊞ or ⊟ to page through the error messages.
- The last occurring error can be deleted in the "**diagnostics**" **(0A)** function group with the funktion"**clear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

5.5 Fondation Fieldbus communication

5.5.1 Synopsis

There are two possibilities of connecting up a Foundation Fieldbus:

Direct connection to a FF/H1 card



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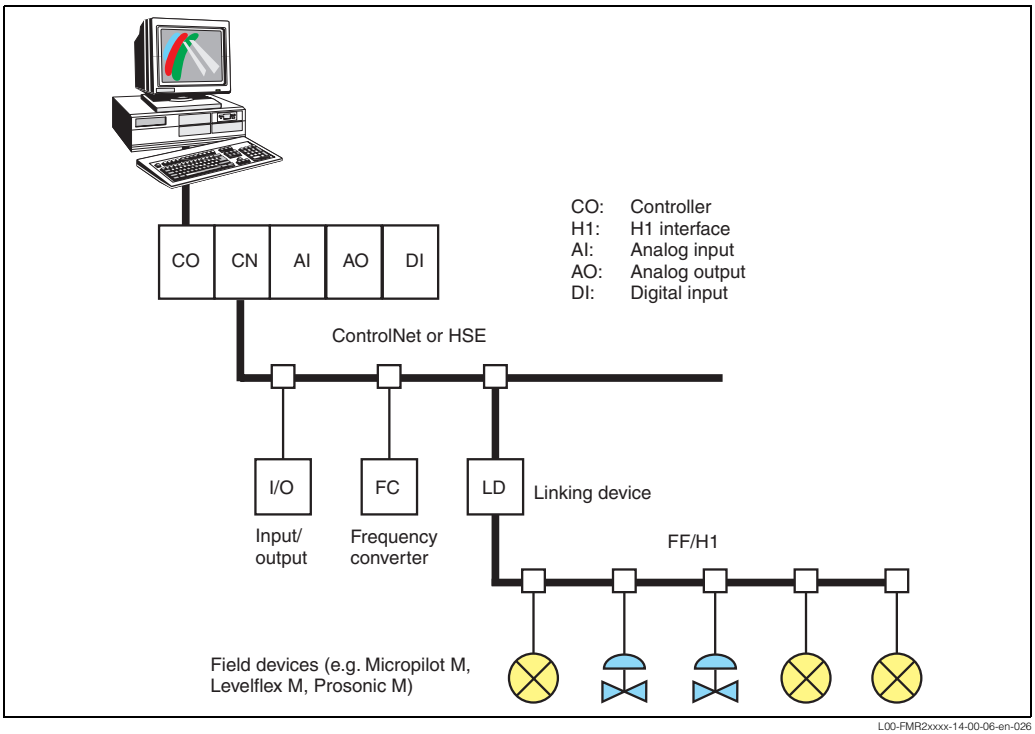
Indirect connection via a linking device



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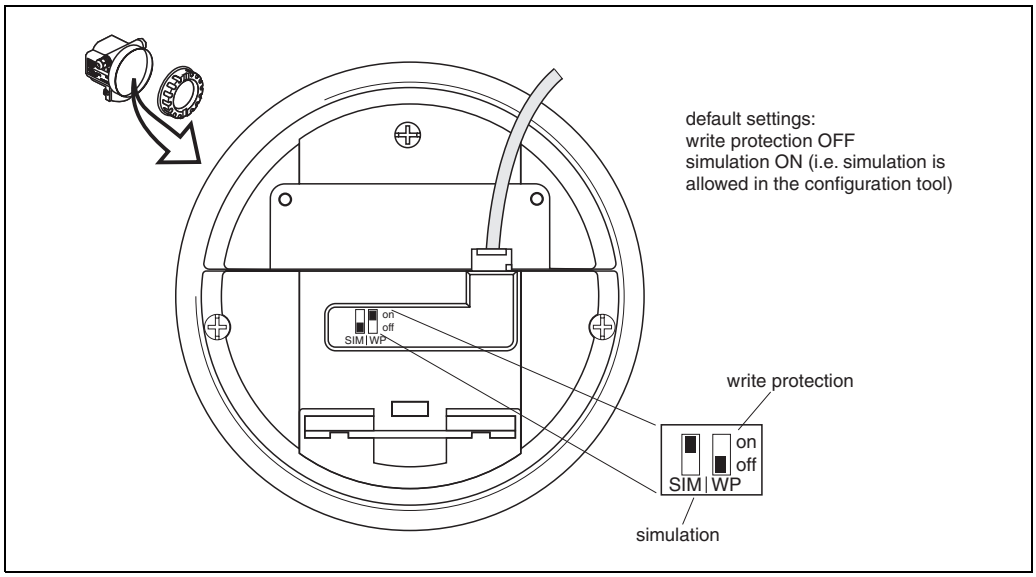
5.5.2 Hardware settings

A DIP-switch in the connection compartment of the instrument allows the write protection and simulation functions to be set via hardware.

- If "SIM" is switched off, the simulation function is not accesible in the configuration tool.
- If "WP" is switched on, parameter access is disabled



L00-FMxxxxxx-19-00-00-en-002

Device identification

Foundation Fieldbus identifies the device by its identification code and automatically allocates an appropriate field address. There is no separate hardware switch for this purpose.

5.5.3 Network configuration

During the configuration of the FF network the device description (DD) of the Micropilot M must be downloaded into the directory foreseen for it.

- Start the interface configuration tool.
- Configure the interface.
- Call the DD download routine.
- Download the device descriptions (.ffo and .sym files) to the directory offered.
- When the configuration is complete, close the tool and the FF stack (if open).

The Micropilot M device descriptions can be ordered direct from Endress+Hauser or downloaded from our website "**www.endress.com**". They contain all data necessary to operate Endress+Hauser Foundation Fieldbus devices.

Example: Start-up using the NI-Fieldbus configurator

Start the bus configuration tool. After start-up, the tool shows the network configuration in the form of an expandable tree. If the Micropilot M has been connected correctly, it can now be identified:

E+H_MICROPILOT_M_XXXXXXXX

A double click on the name reveals the device data:

PD_TAG	the physical name of the device
DEVICE_ID	the unique device identifier
NODE_ADDRESS	the fieldbus node to which the device is connected (is automatically allocated by the Configurator)

The device ID is made up of the following components:

Device_ID = 452B48100F-XXXXXXXX

whereby:

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

A right-hand mouse click on the name opens up a menu from which the PD_TAG and NODE_ADDRESS can be changed

A click on the name expands the device tree to show the function blocks available for it:

E+H_MICROPILOT_M_XXXXXXXX
- RESOURCE_XXXXXX (RB2)
- TRANSDUCER_XXXXXX (TBRL)
- ANALOG_INPUT_1_XXXXXX (AI)
- ANALOG_INPUT_2_XXXXXX (AI)
- PID_XXXXXX(PID)
- AR_XXXXXX (AR)
- IS_XXXXXX (IS)
- SC_XXXXXX (SC)
- IT_XXXXXX (IT)

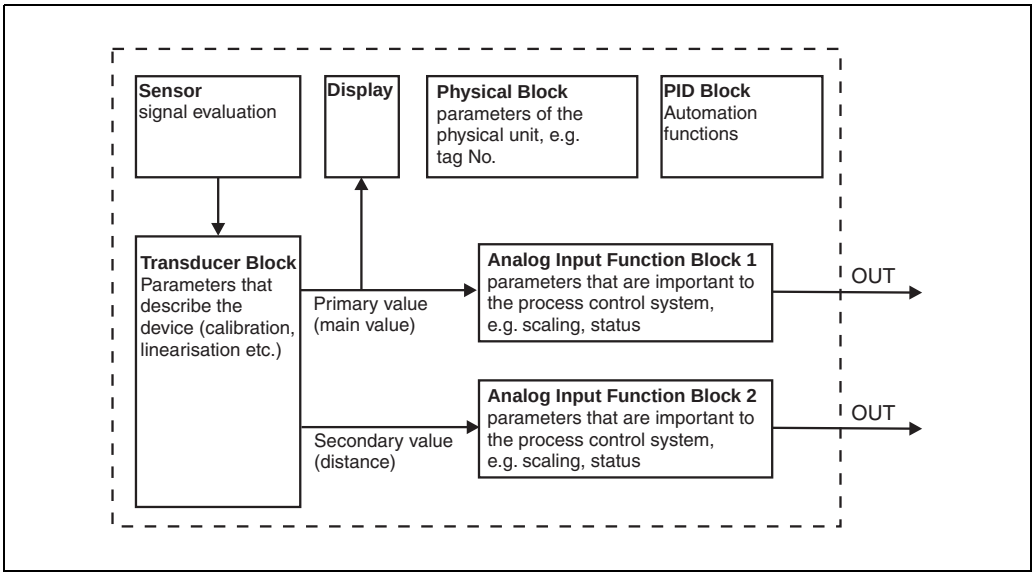
5.5.4 Block model of the Micropilot M

The Micropilot M contains the follwoing blocks:

- **Resource Block (RB2)**
  s. Operating Instructions BA 013S: "Foundation Fieldbus - Overview"
- **Transducer Block (TB)**
  contains the parameters relevant to the measurement
- **Analog-Input-Block 1 bzw. 2 (AI)**
  scale the signal of the Transducer Block and transmit them to the PLCS
- **PID Block (PID)**
  s. Operating Instructions BA 013S: "Foundation Fieldbus - Overview"
- **Arithmetic Block (AR)**
  s. Operating Instructions BA 013S: "Foundation Fieldbus - Overview"
- **Input Selector Block (IS)**
  s. Operating Instructions BA 013S: "Foundation Fieldbus - Overview"
- **Signal Characterizer Block (SC)**
  s. Operating Instructions BA 013S: "Foundation Fieldbus - Overview"
- **Integrator Block (IT)**
  s. Operating Instructions BA 013S: "Foundation Fieldbus - Overview"

Default Block configuration

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



5.5.5 Resource block

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

Operation

The resource block is opened by a click on the resource line.

E+H_MICROPILOT_M_XXXXXXXX
RESOURCE_XXXXXX (RB2)
TRANSDUCER_XXXXXX (TBRL)
ANALOG_INPUT_1_XXXXXX (AI)

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

Parameters

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

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

5.5.6 Transducer block

The transducer block contains the parameters required to calibrate the device. These parameters can also be addressed by using the VU 331 display module. The calibration of the device is described in Chapter 5.5.5 to Chapter 5.5.7

Operation

The resource block is opened by a click on the resource line.

E+H_MICROPILOT_M_XXXXXXXX
RESOURCE_XXXXXX (RB2)
TRANSDUCER_XXXXXX (TBRL)
ANALOG_INPUT_1_XXXXXX (AI)

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

Block administration parameters

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

Output values

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

Configuration parameters

The transducer block also contains the configuration parameters, which are used to commission and calibrate the instrument. They are identical to the functions of the operating menu, except for the service parameters which are not accessible on the bus. Thus, the calibration procedure via the display module (Chapter 6.4) is equally valid for a calibration via a network configuration tool.
A complete list of the configuration parameters can be found in the "Description of Instrument Functions", BA 221F/00/en.

Methods

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

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

Most of these methods are identical to the respective function group in the operating menu. A detailed description of them can be found in the "Description of Instrument functions", BA 221F/00/en.

Profile code of Transducer Block

The current profile code of the Micropilot M Transducer Block is 0x8002

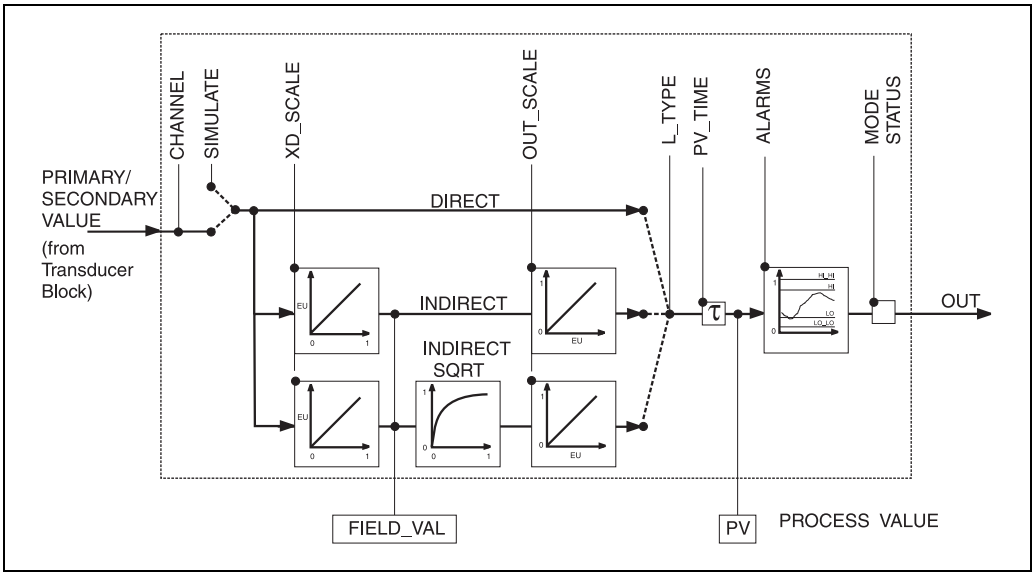
Parameter list of the Micropilot M Transducer Block

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Read	Write	Storage Class
		0	EH_RADARLEVEL_CAL_BASIC_2					
Standard Parameter								
ST_REV		1	ST_REV	2	UNSIGNED16	X		non-vol.
TAG_DESC		2	TAG_DESC	32	OCTET_STRING	X	X	static
STRATEGY		3	STRATEGY	2	UNSIGNED16	X	X	static
ALERT_KEY		4	ALERT_KEY	1	UNSIGNED8	X	X	static
MODE_BLK		5	MODE_BLK	4	DS-69	X	X	static
BLOCK_ERROR		6	BLOCK_ERROR	2	BIT_STRING	X		dynamic
UPDATE_EVT		7	UPDATE_EVT	16	DS-73	X	X	dynamic
BLOCK_ALM		8	BLOCK_ALM	18	DS-72	X	X	dynamic
Transducer Directory Entry		9	TRANSDUCER_DIRECTORY	2	UNSIGNED16	X		non-vol.
Transducer Type		10	TRANSDUCER_TYPE	2	UNSIGNED16	X		non-vol.
Transducer Error		11	XD_ERROR	1	UNSIGNED8	X		dynamic
Collection Directory		12	COLLECTION_DIRECTORY	4	UNSIGNED32	X		non-vol.
Primary Value Type		13	PRIMARY_VALUE_TYPE	2	UNSIGNED16	X		static
Primary Value		14	PRIMARY_VALUE	5	DS-65	X		dynamic
Primary Value Range		15	PRIMARY_VALUE_RANGE	11	DS-68	X		non-vol.
Secondary Value		15	SECONDARY_VALUE	5	DS-65	X		dynamic
Secondary Value Unit		17	SECONDARY_VALUE_UNIT	2	UNSIGNED16	X	X	static
E+H Parameter								
measured value	000	18	PARMEASUREDVALUE	4	FLOAT	X		dynamic
tank shape	002	19	PARTANKSHAPE	1	UNSIGNED8	X	X	static
medium property	003	20	PARDIELECTRICCONSTANT	1	UNSIGNED8	X	X	static
process cond.	003	21	PARPROCESSCONDITION	1	UNSIGNED8	X	X	static
empty calibr.	004	22	PAREMPTYCALIBRATION	4	FLOAT	X	X	static
full calibr.	005	23	PARFULLCALIBRATION	4	FLOAT	X	X	static
pipe diameter	006	24	PARTUBEDIAMETER	4	FLOAT	X	X	static
echo quality	056	25	PARECHOQUALITYFMP	1	UNSIGNED8	X		dynamic
check distance	051	26	PARCHECKDISTANCE	1	UNSIGNED8	X	X	static
range of mapping	052	27	PARSUPPRESIONDISTANCE	4	FLOAT	X	X	static
start mapping	053	28	PARSTARTMAPPINGRECORD	1	UNSIGNED8	X	X	static
pers. map dist.	054	29	PARPRESMAPRANGE	4	FLOAT	X	X	static
cust. tank map	055	30	PARCUSTTANKMAP	1	UNSIGNED8	X	X	static
offset	057	31	PAROFFSETOFMEASUREDDISTANCE	4	FLOAT	X	X	static
antenna extens.	0C9	32	PARANTENNAEXTENSIONLENGTH	4	FLOAT	X	X	static
output damping	058	33	PAROUTPUTDAMPING	4	FLOAT	X	X	static
blocking dist.	059	34	PARHIGHBLOCKINGDISTANCE	4	FLOAT	X	X	static
output on alarm	010	35	PAROUTPUTONALARM	1	UNSIGNED8	X	X	static

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Read	Write	Storage Class
outp. echo loss	012	36	PARREACTIONLOSTECHO	1	UNSIGNED8	X	X	static
ramp %span/min	013	37	PARRAMPINPERCENTPERMIN	4	FLOAT	X	X	static
delay time	014	38	PARDELAYTIMEONLOSTECHO	2	UNSIGNED16	X	X	static
safety distance.	015	39	PARLEVELWITHINSAFETYDISTANCE	4	FLOAT	X	X	static
in safety dist.	016	40	PARINSAFETYDISTANCE	1	UNSIGNED8	X	X	static
ackn. alarm	017	41	PARACKNOWLEDGEALARM	1	UNSIGNED8	X	X	static
level/ullage	040	42	PARLEVELULLAGEMODE	1	UNSIGNED8	X	X	static
linearisation	041	43	PARLINEARISATION	1	UNSIGNED8	X	X	static
customer unit	042	44	PARCUSTOMERUNIT	2	UNSIGNED16	X	X	static
table no.	043	45	PARTABLENUMBER	1	UNSIGNED8	X	X	non-vol.
input level semi-automatic	044	46	PARINPUTLEVELHALFAUTOMATIC	4	FLOAT	X		dynamic
input level	044	47	PARINPUTLEVELMANUAL	4	FLOAT	X	X	static
input volume	045	48	PARINPUTVOLUME	4	FLOAT	X	X	static
max. scale	046	49	PARMAXVOLUME	4	FLOAT	X	X	static
diameter vessel	047	50	PARCYLINDERVESSEL	4	FLOAT	X	X	static
simulation	065	51	PARSIMULATION	1	UNSIGNED8	X	X	static
simulation value level	066	52	PARSIMULATIONVALUELEVEL	4	FLOAT	X	X	non-vol.
simulation value volume	066	53	PARSIMULATIONVALUEVOLUME	4	FLOAT	X	X	non-vol.
language	092	54	PARALANGUAGE	1	UNSIGNED8	X	X	non-vol.
back to home	093	55	PARBACKTOHOME	2	UNSIGNED16	X	X	non-vol.
format display	094	56	PARFORMATDISPLAYFT	1	UNSIGNED8	X	X	non-vol.
no.of decimals	095	57	PARNOOFDECIMALS	1	UNSIGNED8	X	X	non-vol.
sep. character	096	58	PARSEPARATIONCHARACTER	1	UNSIGNED8	X	X	non-vol.
present error	0A0	59	PARACTUALERROR	2	UNSIGNED16	X		dynamic
previous error	0A1	60	PARLASTERROR	2	UNSIGNED16	X		dynamic
clear last error	0A2	61	PARCLEARLASTERROR	1	UNSIGNED8	X	X	static
reset	0A3	62	PARRESET	2	UNSIGNED16	X	X	static
unlock parameter	0A4	63	PAROPERATIONCODE	2	UNSIGNED16	X	X	static
measured dist.	0A5	64	PARMEASUREDDISTANCE	4	FLOAT	X		dynamic
measured level	0A6	65	PARMEASUREDLEVEL	4	FLOAT	X		dynamic
application par..	0A8	66	PARAPPLICATIONPARAMETER	1	UNSIGNED8	X		dynamic
protocol+sw-no.	0C2	67	PARPROTSOFTVERSIONSTRING	16	OCTET_STRING	X		dynamic
distance unit	0C5	68	PARDISTANCEUNIT	1	UNSIGNED8	X	X	static
download mode	0C8	69	PARDOWNLOADMODE	1	UNSIGNED8	X	X	static
max. meas. dist.	0D84	70	PARABSMAXMESSDIST	4	FLOAT	X		dynamic
max sample dist.	0D88	71	PAREDITRANGEMAXSAMPLEDIST	4	FLOAT	X		dynamic

5.5.7 Analog input block

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



Operation

The resource block is opened by a click on the resource line.

E+H_MICROPILOT_M_XXXXXXXX
RESOURCE_XXXXXX (RB2)
TRANSDUCER_XXXXXX (TBRL)
ANALOG_INPUT_1_XXXXXX (AI)

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

Block administration parameters

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

Output values

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

Scaling parameters

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

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

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

The L_TYPE parameter influences the signal conversion:
- Direct:

$$PV = CHANNEL\_VALUE$$

- Indirect:

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

- Indirect square root:

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

Output response parameters

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

Alarm parameters

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

Alarm priorities

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

Alarm status

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

Simulation

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

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

5.5.8 Checklist for commissioning

The following checklist refers to the configuration via the NI-Fieldbus configurator. In general, the operation is rather similar for other network design tools.

1. Configure the network and integrate the device.
   – Identify the device by means of the device ID and serial number.
   – If appropriate, assign a new PD_TAG.
2. Configure the resource block.
   – Check the position of the hardware switch in WRITE_LOCK
   – If "locked" is displayed, change the position of the DIP-switch.
   – If appropriate, change the block tag (right-hand click on tree).
   – Set MODE_BLK_TARGET to Out-of-Service.
   – Reset the device to factory values by using the function RESTART => Defaults (this function may also be available with a right-hand click on the device name)
   – If appropriate, assign a tag description (TAG_DESC).
   – Set MODE_BLK_TARGET to Auto.
3. Configure the transducer block.
   – If appropriate, change the block tag (right-hand click on tree).
   – Set MODE_BLK_TARGET to Out-of-Service.
   – If appropriate, assign a tag description (TAG_DESC)
   – Configure the device as described in Chapter 6.4.
   – Set MODE_BLK_TARGET to Auto.
4. Configure the analog input block.
   – If appropriate, change the block tag (right-hand click on tree).
   – Set MODE_BLK_TARGET to Out-of-Service.
   – If appropriate, assign a tag description (TAG_DESC).
   – Set Channel to measured value or distance.
   – Set L_TYPE to "DIRECT" if the OUT value is to be in technical units e.g. ft to "INDIRECT" if the OUT value is to be scaled.
   – Set the desired output damping in PV_TIME.
   – If appropriate, set the advisory and critical alarms.
   – Set MODE_BLK_TARGET to Auto.
5. Link the function blocks in the function block editor.
6. Download the configuration (menu configure).
7. If appropriate, check the configuration by using the SIMULATE function.

5.5.9 List of start indices

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

Object	Start Index
Object Dictionary	298

Object	Start Index
Resource Block	300
Analog Input 1 Function Block	350
Analog Input 2 Function Block	390
PID Function Block	430
Arithmetic Function Block	500
Input Selector Function Block	550
Signal Characterizer Function Block	600
Integrator Function Block	650
Transducer Block	700

Object	Start Index
Link Objects	1000
Alert Objects	1030
Trend Objects	1040

Object	Start Index
View Objects Resource Block	1500
View Objects Analog Input 1 Function Block	1505
View Objects Analog Input 2 Function Block	1510
View Objects PID Function Block	1515
View Objects Arithmetic Function Block	1520
View Objects Input Selector Function Block	1525
View Objects Signal Characterizer Function Block	1530
View Objects Integrator Function Block	1535
View Objects Transducer Block	1540

5.5.10 ToF Tool operating program

The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle. It is used to support commissioning, securing of data, signal analysis and documentation of the instruments. It is compatible with the following operating systems: Win95, Win98, WinNT4.0 and Win2000.

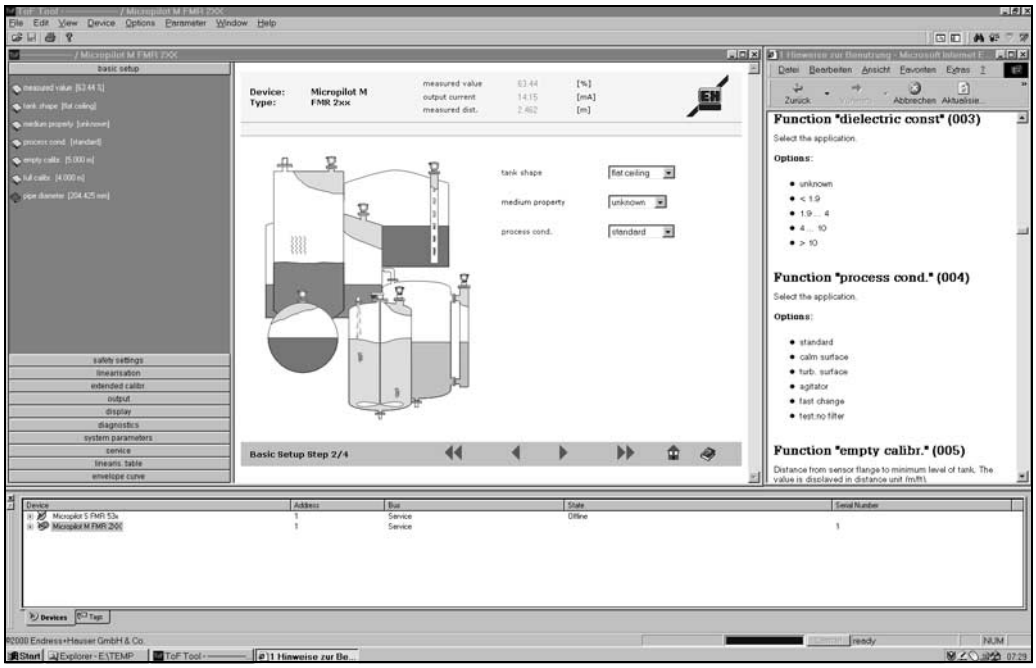
The ToF Tool supports the following functions:
- Online configuration of transmitters
- Signal analysis via envelope curve
- Tank linearisation
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

Note!
The parameters of the Analog-Input block are presently not accessible via ToF Tool.

Note!
ToF Tool operation of the Micropilot M is not possible via Foundation Fieldbus. Instead, the PC or Laptop must be connected via the interface FXA 193 to the service adapter, to which normally the display is connected.

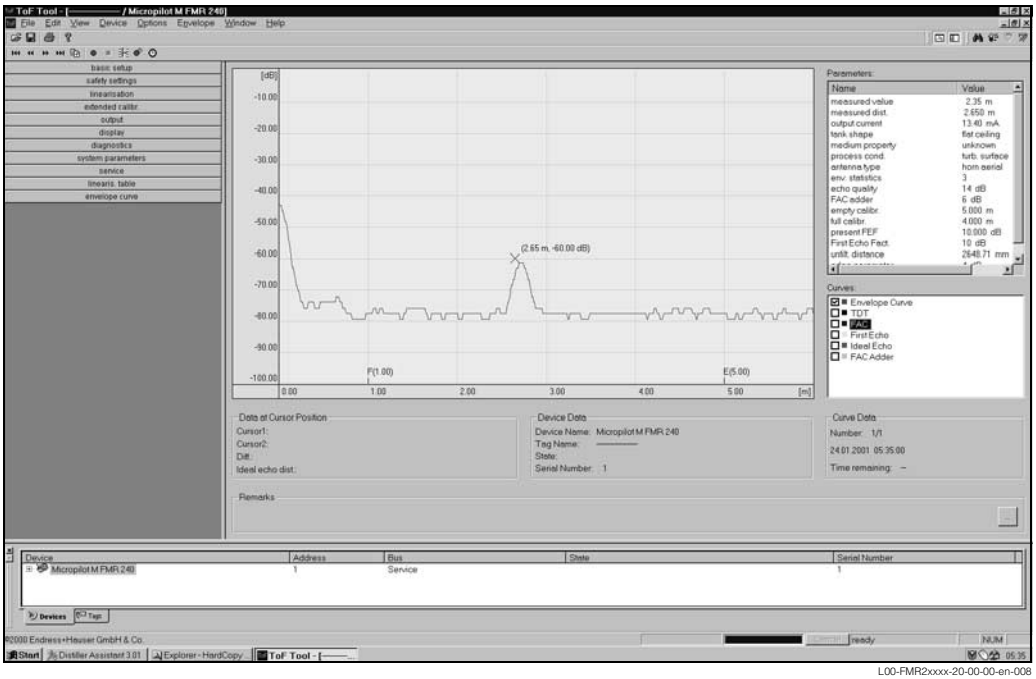
Note!
Further information you may find on the CD-ROM, which is enclosed to the instrument.

Menu-guided commissioning



L00-FMR2xxxx-20-00-00-en-002

Signal analysis via envelope curve:



L00-FMR2xxxx-20-00-00-en-008

Connection options

- Service-interface with adapter FXA 193

Hinweis!
The Micropilot M can also be operated locally using the keys. If operation is prevented by the keys being locked locally, parameter entry via communication is not possible either.

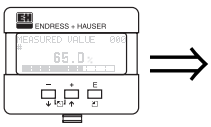
6 Commissioning

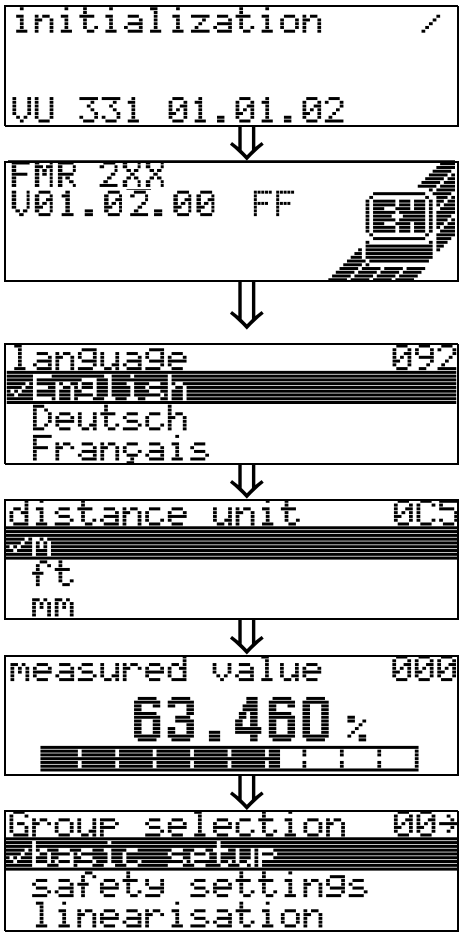
6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist “Post installation check” (see Page 20).
- Checklist “Post connection check” (see Page 24).

6.2 Switching on the measuring device

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





After 5 s, the following message appears

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

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

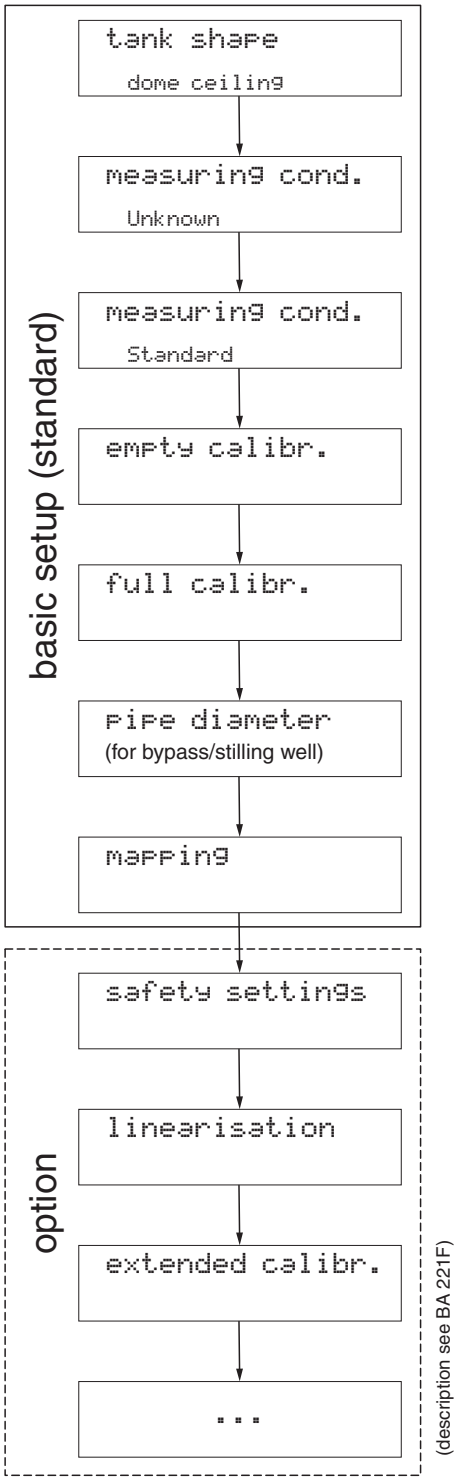
Select the basic unit (this message appears the first time the instrument is switched on)

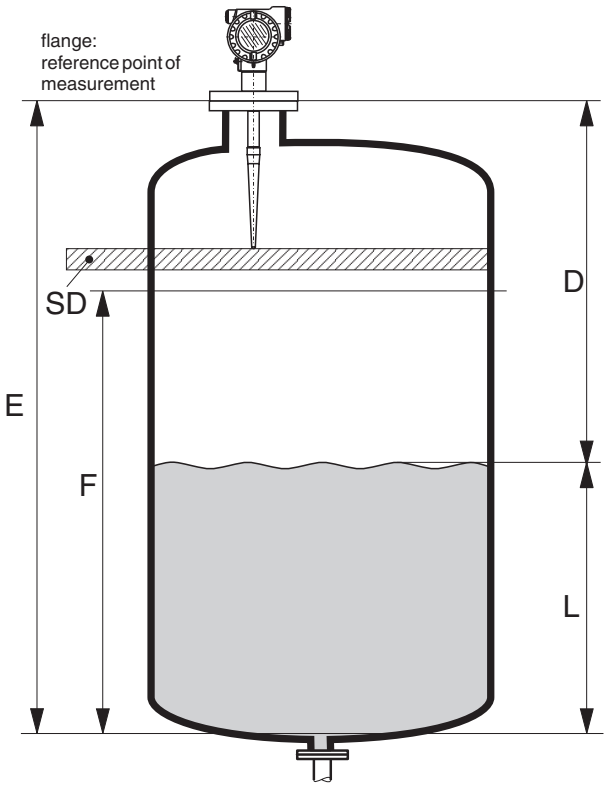
The current measured value is displayed

After [E] is pressed, you reach the group selection.

This selection enables you to perform the basic setup

6.3 Basic Setup





E = empty calibr. (= zero point)
setting in 005
F = full calibr. (= span)
setting in 006
D = distance (distance flange / product)
display in 0A5
L = level
display in 0A6
SD = safety distance
setting in 015

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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 BA 221F.

Comply with the following instructions when configuring the functions in the "**basic setup**" **(00)**:
- Select the functions as described on Page 25.
- 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 [E] to confirm. The function is now started.
- If you do not press a key during a configurable time period (→function group "**display**" **(09)**), an automatic return is made to the home position (measured value display).

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

Caution!
All functions are described in detail, as is the overview of the operating menu itself, in the manual "**Description of the instrument functions –BA 221F**", which is a separate part of this operating manual.

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

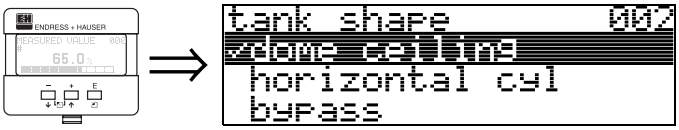
6.4 Basic Setup with the VU 331

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.

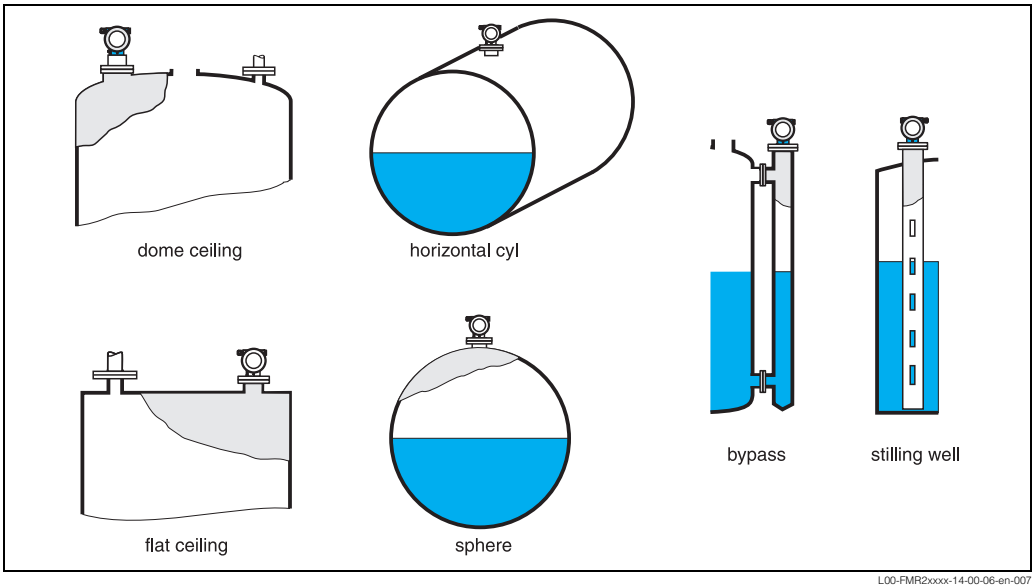
6.4.1 Function group "basic setup" (00)

Function "tank shape" (002)



This function is used to select the tank shape.

Selection:
- **dome ceiling**
- horizontal cyl
- bypass
- stilling well, **also for Wave Guide antenna use.**
- flat ceiling
- sphere



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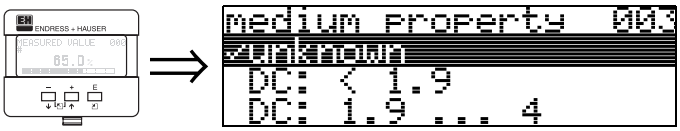
Function "medium property" (003)



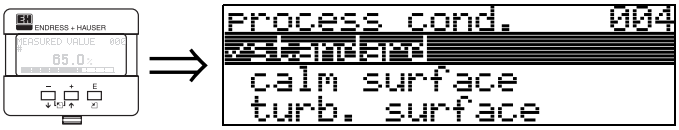
This function is used to select the dielectric constant.

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

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

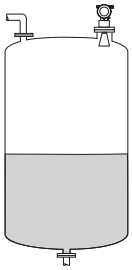
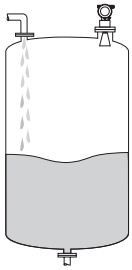
1) Treat Ammonia NH3 as a medium of group A, i.e. use FMR 230 in a stilling well.

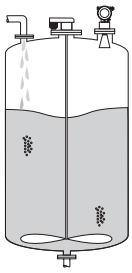
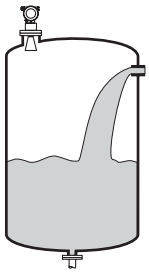
Function "process cond." (004)



This function is used to select the process conditions.

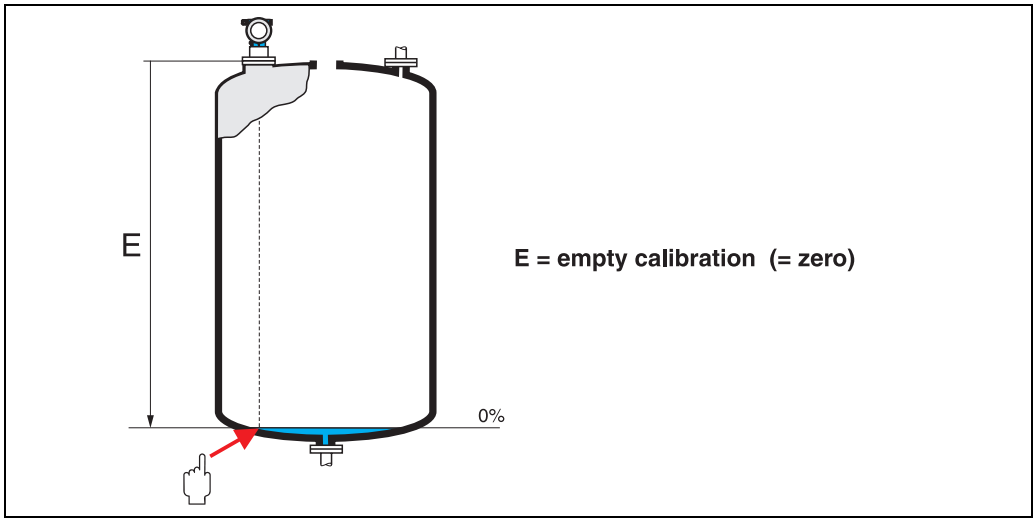
Selection:
- **standard**
- calm surface
- turb. surface
- agitator
- fast change
- test:no filter

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.

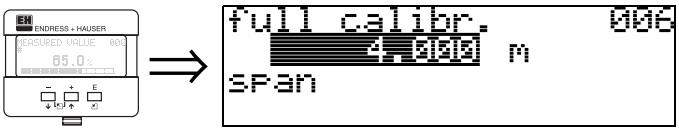
Function "empty calibr." (005)

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

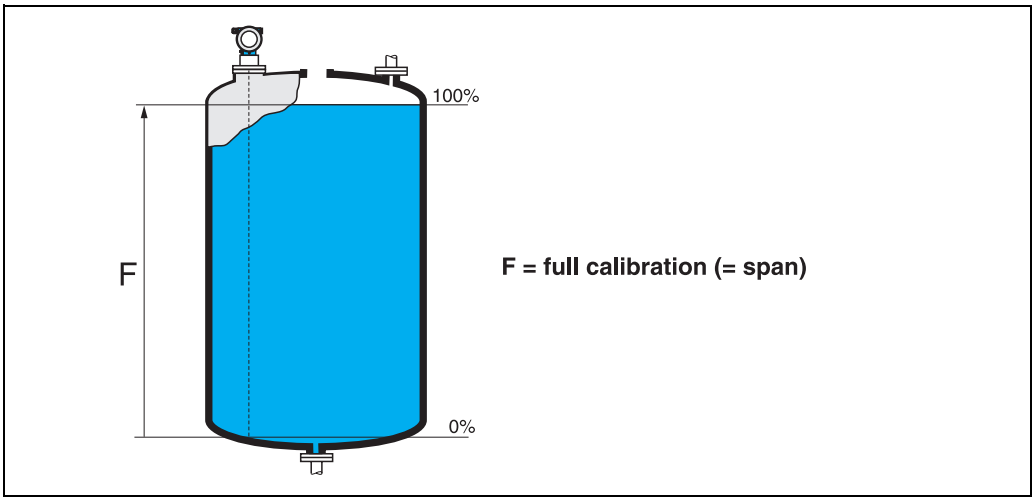


Caution!
For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the tank.

Function "full calibr." (006)



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

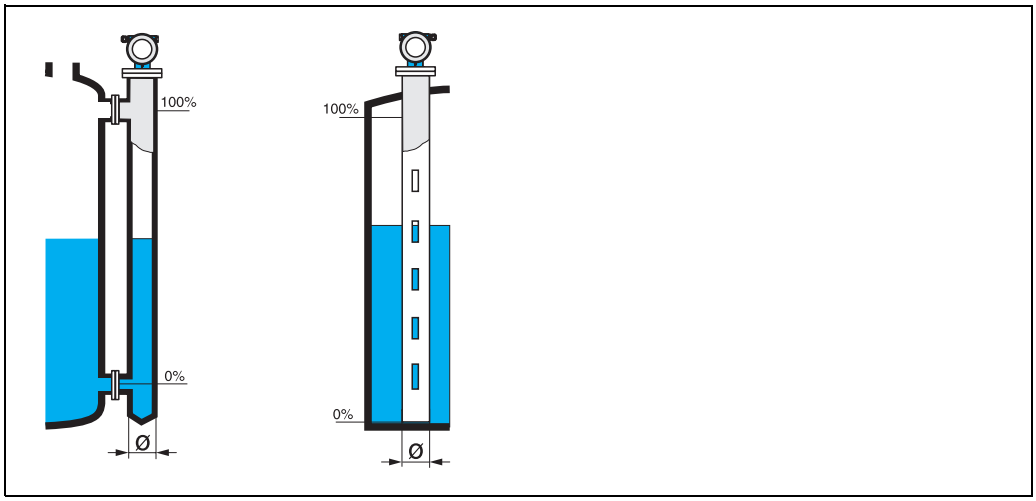


Note!
If **bypass** or **stilling well** was selected in the "**tank shape**" **(002)** function, the pipe diameter is requested in the following step.

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

Function "pipe diameter" (007)

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



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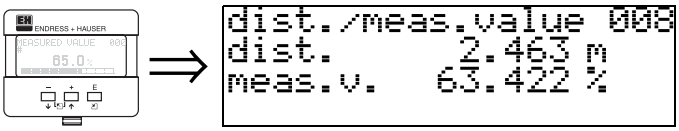
Microwaves propagate more slowly in pipes than in free space. This effect depends on the inside diameter of the pipe and is automatically taken into account by the Micropilot. It is only necessary to enter the pipe diameter for applications in a bypass or stilling well.

display (008)



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

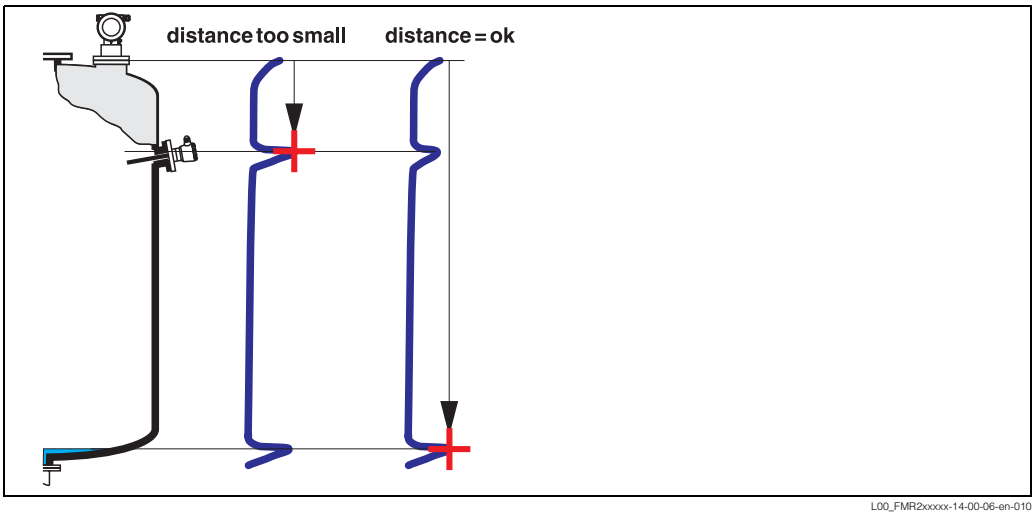
- Distance correct –level correct →continue with the next function, "**check distance**" **(051)**
- Distance correct –level incorrect →Check "**empty calibr.**" **(005)**
- Distance incorrect –level incorrect →continue with the next function, "**check distance**" **(051)**

Function "check distance" (051)

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

Selection:

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



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distance = ok

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

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

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

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

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

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

Function "range of mapping" (052)

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (→ Page 53 ff.). This value can be edited by the operator.
For manual mapping, the default value is 0 m.

Function "start mapping" (053)

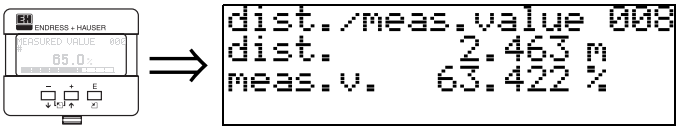
This function is used to start the interference echo mapping up to the distance given in "**range of mapping**" **(052)**.

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

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

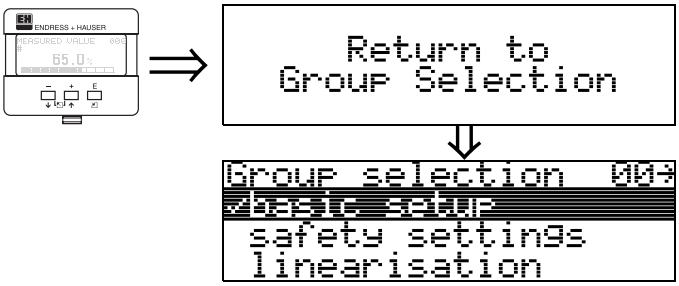
Caution!
A mapping will be recorded only, if the device is not in alarm-state.

display (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)**

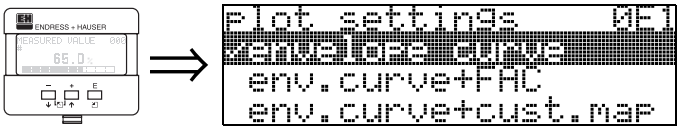


After 3 s, the following message appears

6.4.2 Envelope curve with VU 331

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

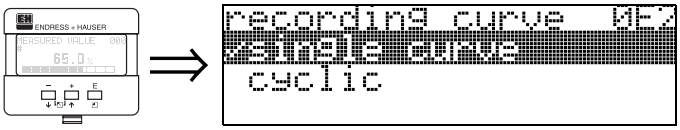
Function "plot settings" (0E1)



Select which information will be displayed in the LCD:
- **envelope curve**
- env.curve+FAC (on FAC see BA 221F)
- 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.

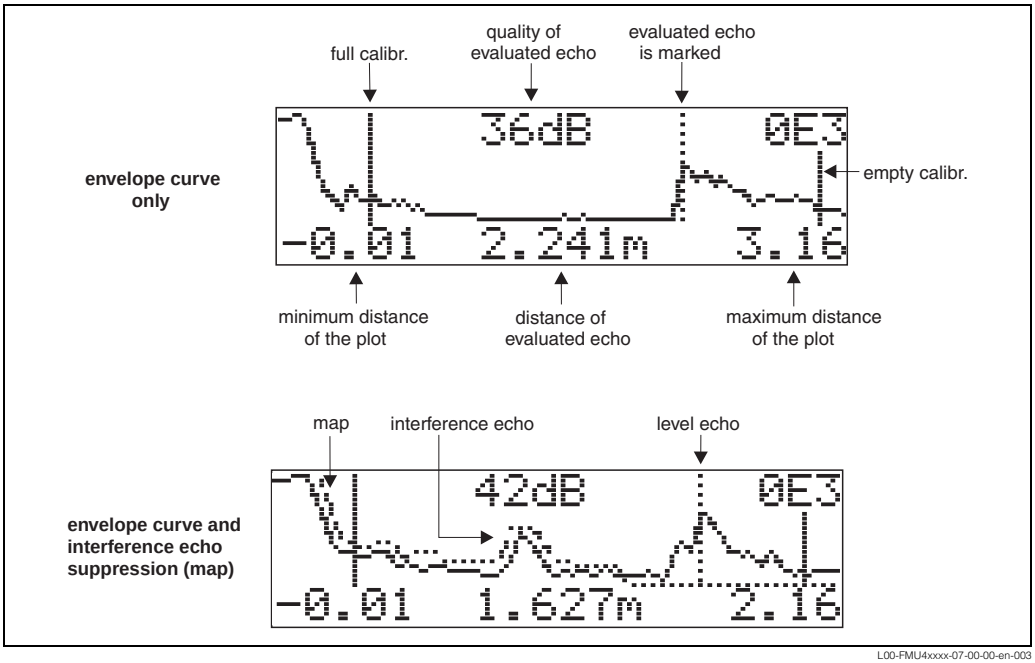


Note!
If the cyclical envelope curve is active in the display, the measured value is refreshed in a slower cycle time. It is therefore recommended to exit the envelope curve display after optimising the measuring point.

Note!
An **orientation** of the Micropilot can help to optimise measurement in applications with very weak level echos or strong interference echos by increasing the useful echo/ reducing the interference echo (see "Orientation of the Micropilot" on Page 80).
When using the Wave Guide antenna **no** orientation is required!

Function "envelope curve display" (0E3)

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



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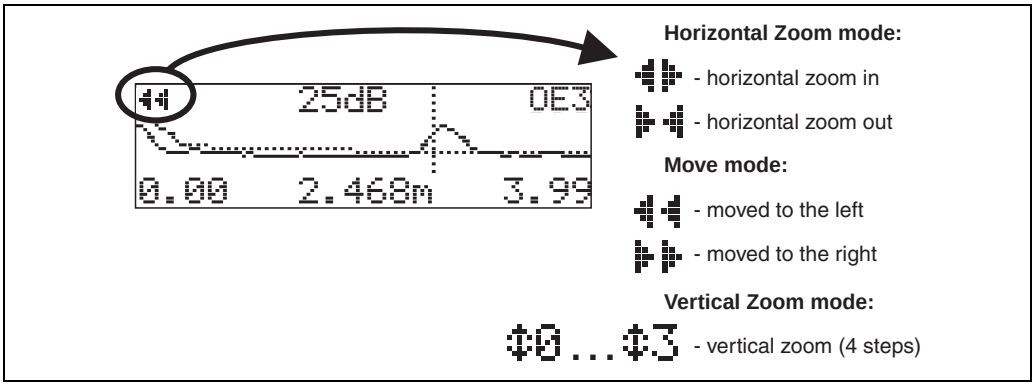
Navigating in the envelope curve display

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.



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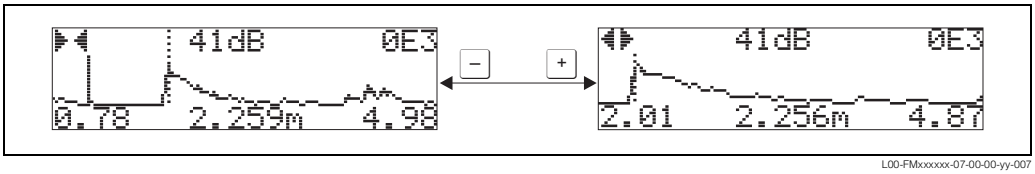
Horizontal Zoom mode

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

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



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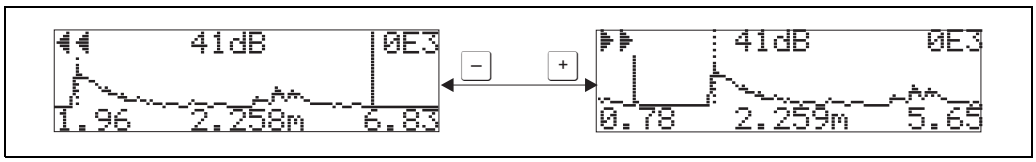
Move mode

Then press E to switch to Move mode. Either ⇤⇥ or ⇥⇤ is displayed.
- + shifts the curve to the right.
- − shifts the curve to the left.



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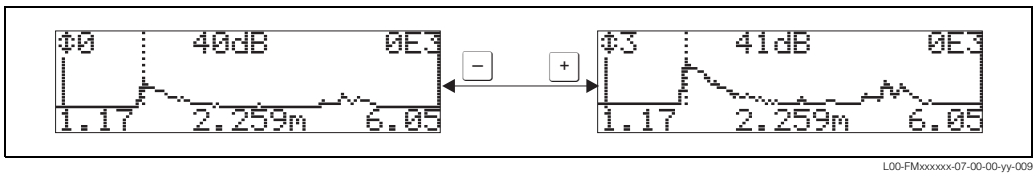
Vertical Zoom mode

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

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



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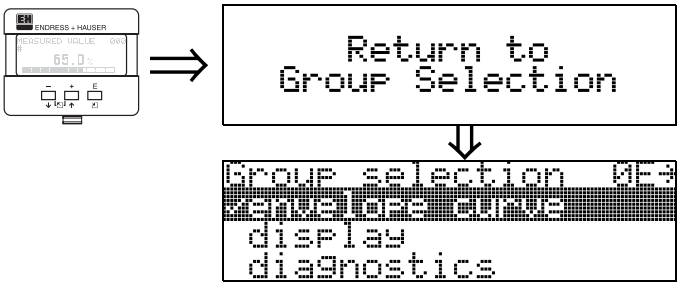
Exiting the navigation

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



After 3 s, the following message appears

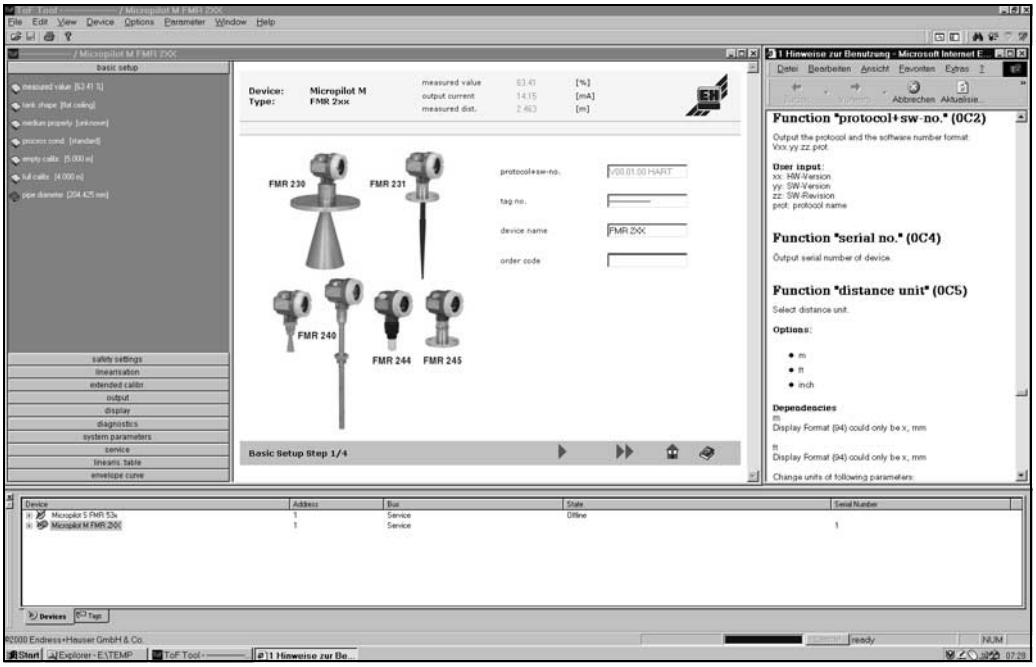
6.5 Basic Setup with the ToF Tool

To carry out the basic setup with the ToF Tool operating program, proceed as follows:
- Start the ToF Tool operating program and establish a connection
- Select the "**basic setup**" function group in the navigation bar

The following display appears on the screen:

Basic Setup step 1/4:

- Status image
- Enter the measuring point description (TAG number).



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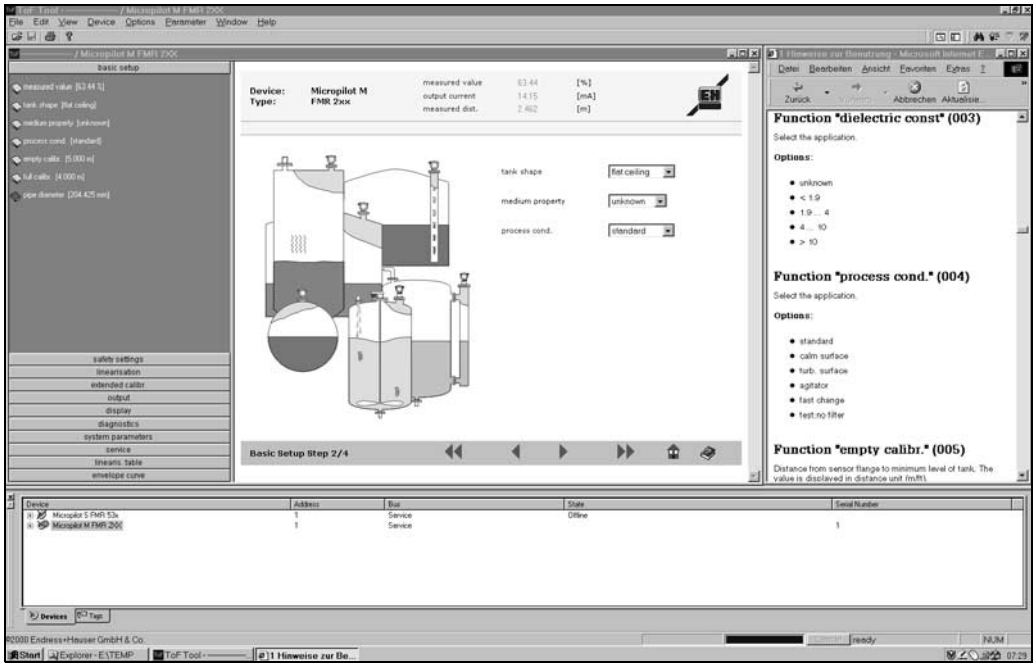
Note!
- Each parameter that is changed must be confirmed with the **RETURN** key!
- The "**Next**" button moves you to the next screen display:

Basic Setup step 2/4:

- Enter the application parameters:
  – tank shape (for a description, see Page 55)
  – medium property (for a description, see Page 56)
  – process cond. (for a description, see Page 57)



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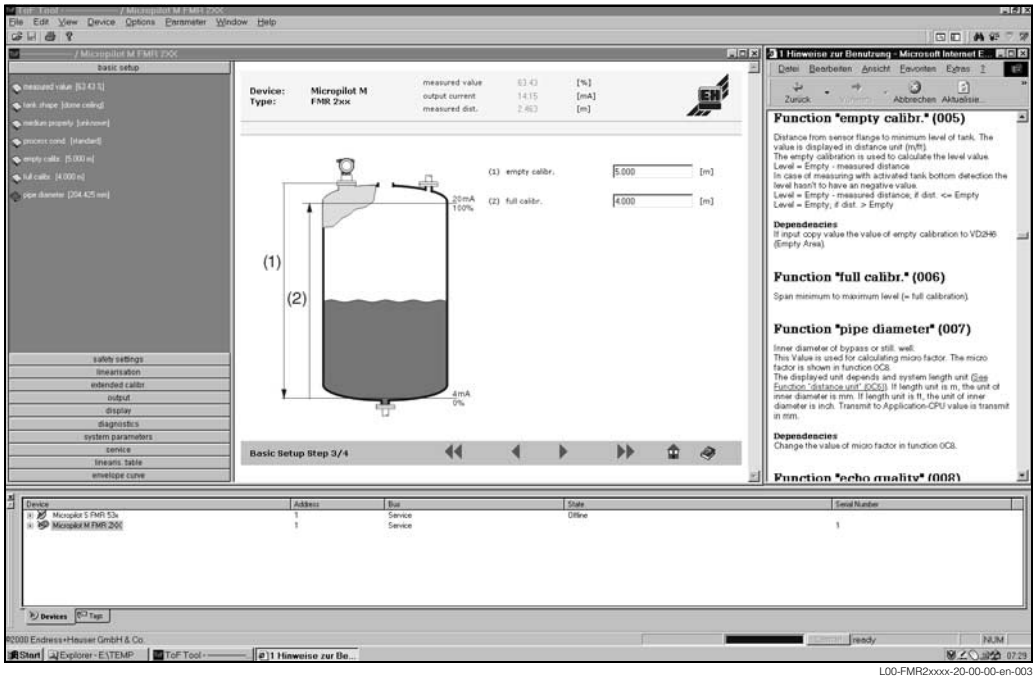
Basic Setup step 3/4:

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

- empty calibr. (for a description, see Page 58)
- full calibr.(for a description, see Page 59)



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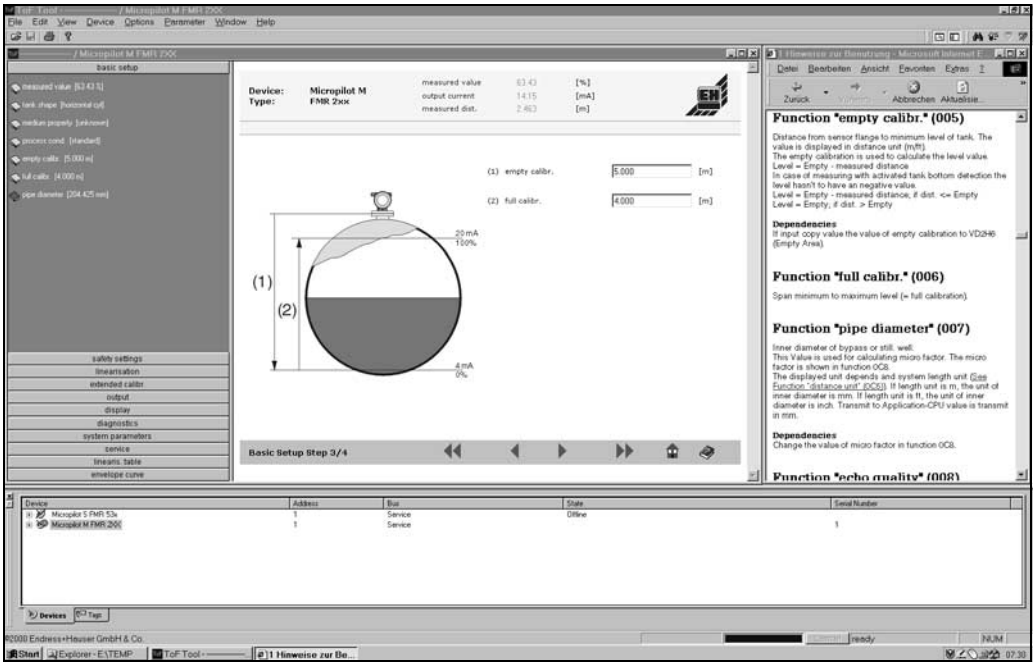
If "**horizontal cyl**" or "**sphere**" is selected in the "**tank shape**" function, the following display appears on the screen:
- empty calibr. (for a description, see Page 58)
- full calibr.(for a description, see Page 59)



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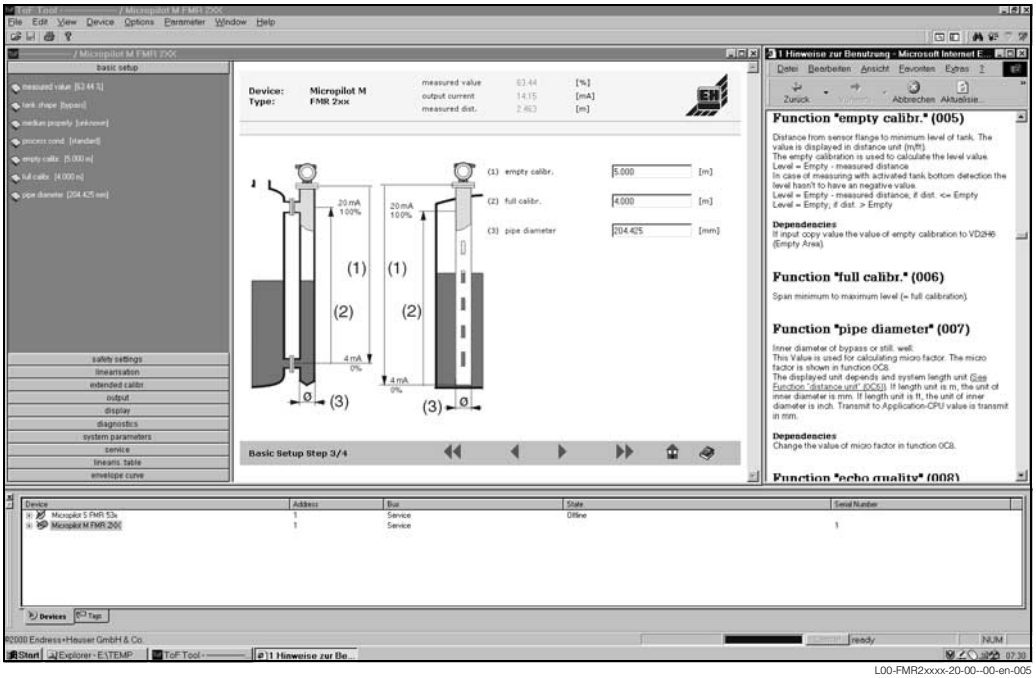
If "**stilling well**" or "**bypass**" is selected in the "**tank shape**" function, the following display appears on the screen:
- empty calibr. (for a description, see Page 58)
- full calibr.(for a description, see Page 59)
- diameter of bypass / stilling well (for a description, see Page 60)



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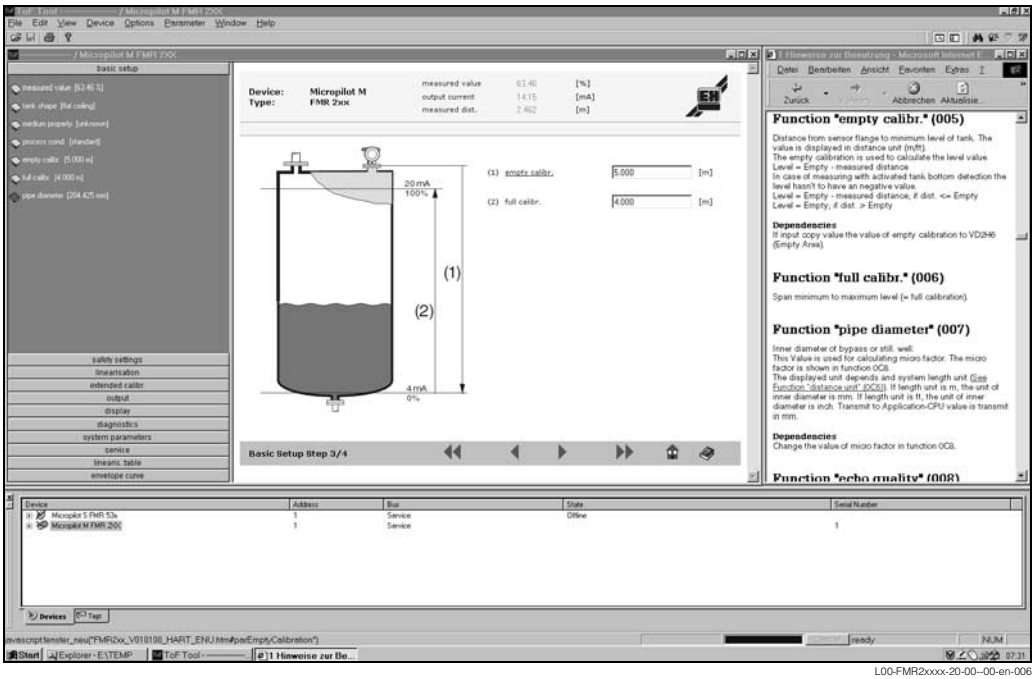
Note!
You can also specify the pipe diameter in this display.

If "**flat ceiling**" is selected in the "**tank shape**" function, the following display appears on the screen:
- empty calibr. (for a description, see Page 58)
- full calibr.(for a description, see Page 59)



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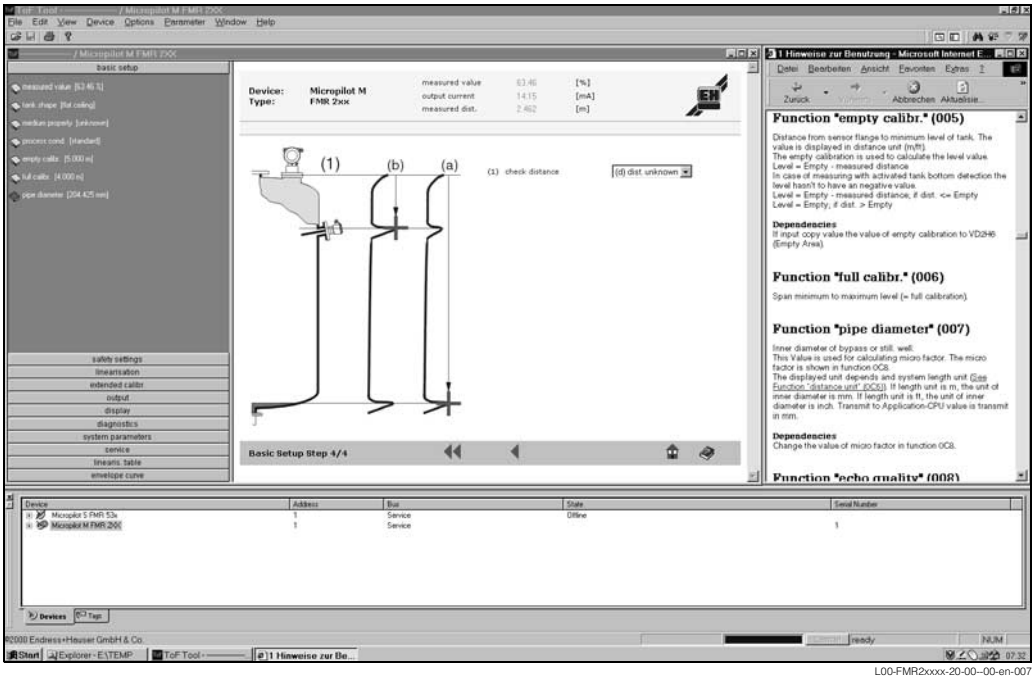
Basic Setup step 4/4:

- This step starts the tank mapping
- The measured distance and the current measured value are always displayed in the header
- A description is given on Page 61



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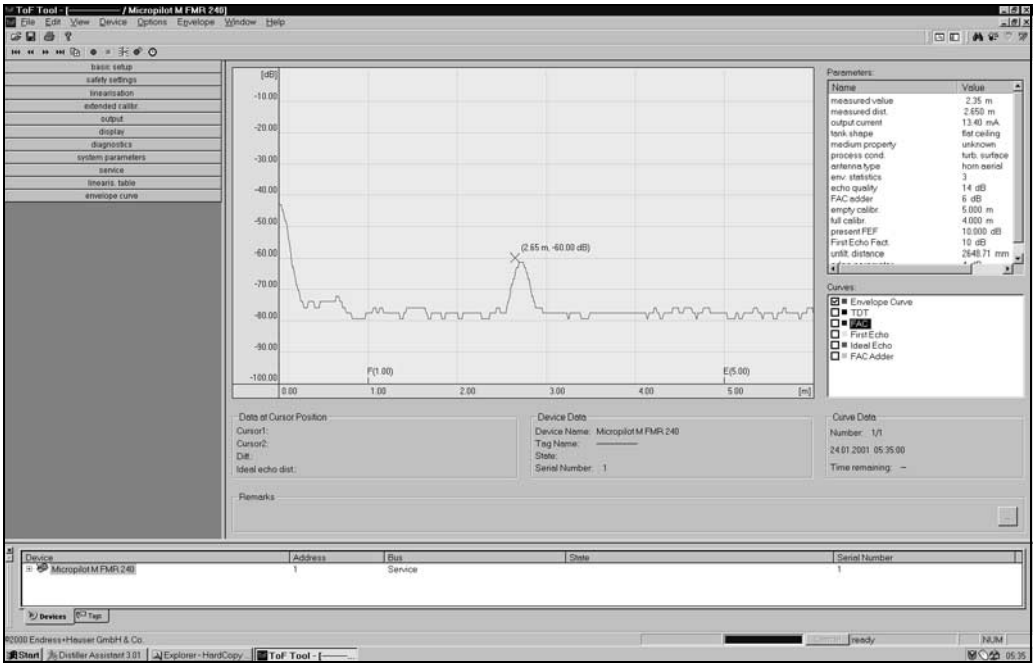
6.5.1 Envelope curve with the ToF Tool

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



L00-FMR2xxxx-20-00--00-en-008

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) (see "Orientation of the Micropilot" on Page 80). When using the Wave Guide antenna **no** orientation is required!

6.5.2 User-specific applications (operation)

For details of setting the parameters of user-specific applications, see separate documentation BA 221F/00/en - description of the instrument functions of the Micropilot M.

7 Maintenance

The Micropilot M measuring instrument requires no special maintenance.

Exterior cleaning

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

Replacing seals

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

Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves. Spare parts are contained in suitable kits. They contain the related replacement instructions. All the spare parts kits which you can order from Endress+Hauser for repairs to the Micropilot M are listed with their order numbers on Page 82 and Page 83. Please contact Endress+Hauser Service for further information on service and spare parts.

Repairs to Ex-approved devices

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

Replacement

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

- You may have to activate linearisation (see BA 221F)
- You may need to record the tank map again (see Basic Setup)

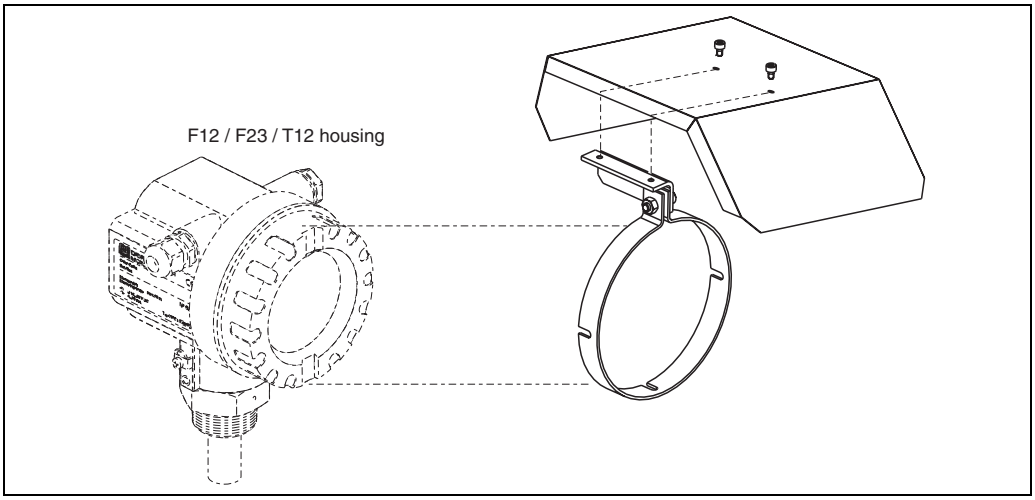
After an antenna component or electronic has been replaced, a new calibration must be carried out. This is described in the repair instructions.

8 Accessories

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

Weather protection cover

A Weather protection cover made of stainless steel is available for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



L00-FMR2xxxx-00-00-06-en-001

Service Interface FXA 193

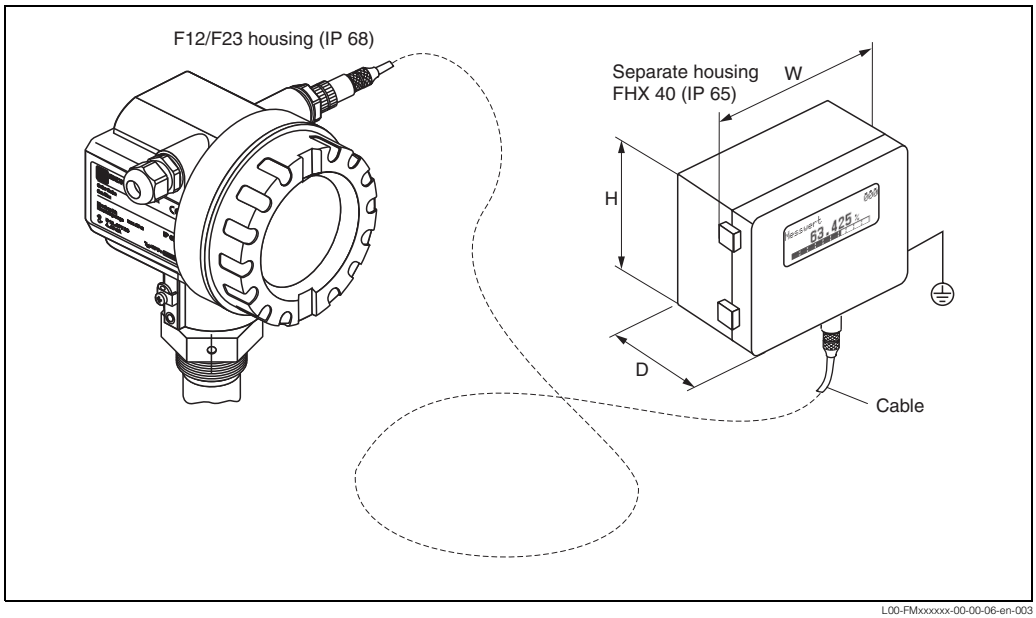
For communication with ToF Tool via the display connector.

Ordering structure:
- FXA 193-A: for use in non-hazrdous area
- FXA 193-B: for use in hazardous area (ATEX, CSA, FM)

The connection to a ToF device needs an additional FXA connection cable (order code.: 50095566).

Remote display FHX 40

Dimensions



L00-FMxxxxxx-00-00-06-en-003

Technical data:

Max. cable length	20 m (65 ft)
Temperature range	-30 °C...+70 °C (-22 °F...158 °F)
Degree of protection	IP65 acc. to EN 60529 (NEMA 4)
Material for housing	Alloy of Aluminium AL Si 12
Dimensions [mm] / [inch]	122x150x80 (HxBxT) / 4.8x5.9x3.2

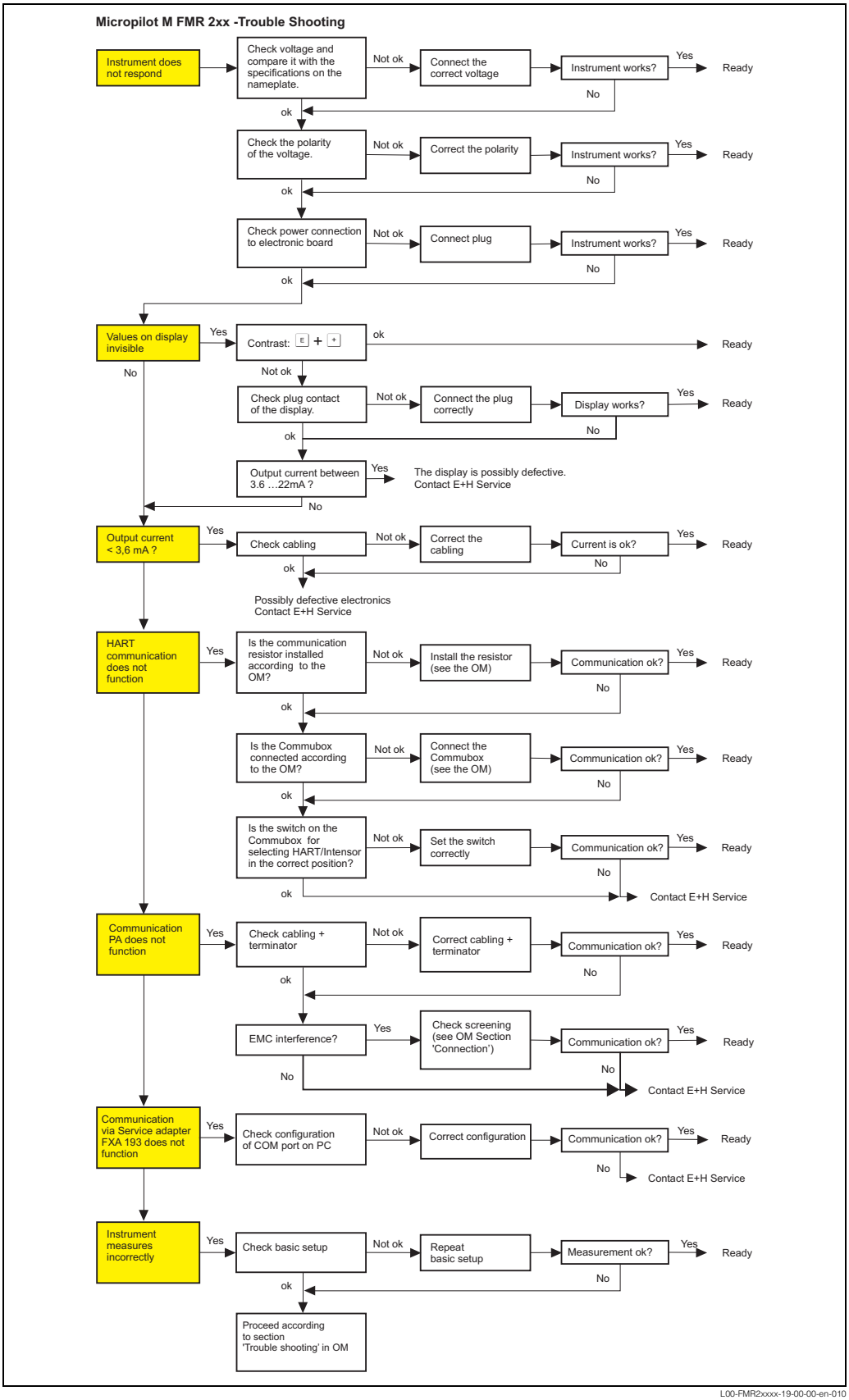
EMC version with conductive sealing

Ordering structure

	Certificates				
	A	For non-hazardous area			
	1	ATEX II 2 G EEx ia IIC T6, ATEX II 3D			
	S	FM IS Class I Div. 1, Groups A,B,C,D (in preparation)			
	U	CSA IS Class I, Div. 1, Groups A,B,C,D (in preparation)			
	N	CSA General Purpose (in preparation)			
		Cable length			
		1	20 m cable		
			Additional option		
			A	Additional option not selected	
			B	Mounting bracket 1" or 2" pipe	
FHX 40 -					Complete product designation

9 Trouble-shooting

9.1 Trouble-shooting instructions



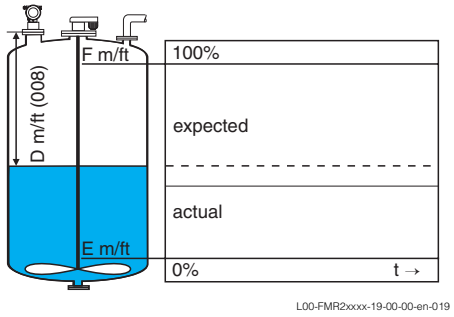
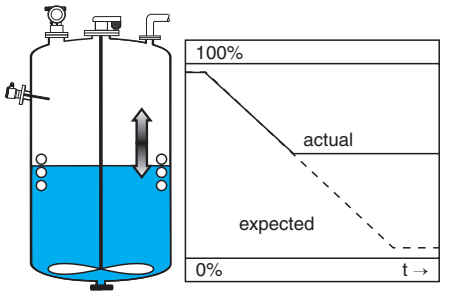
L00-FMR2xxxx-19-00-00-en-010

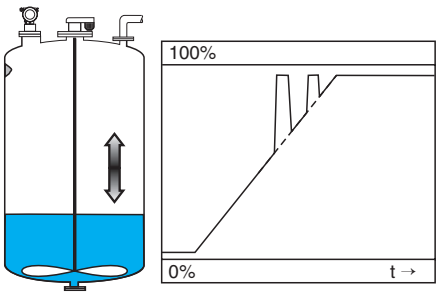
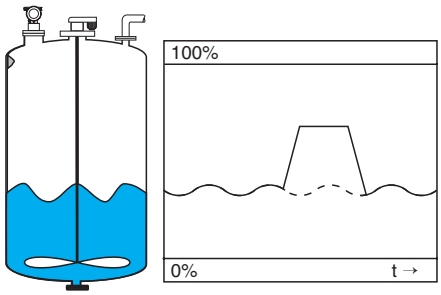
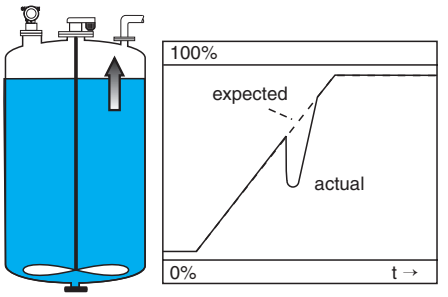
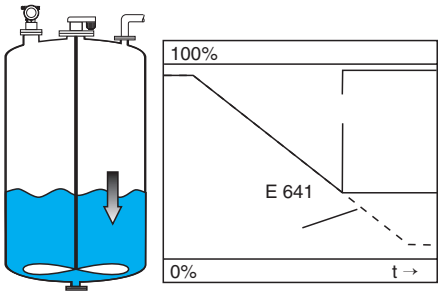
9.2 System error messages

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; E^2PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising - please wait	E^2PROM 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; E^2PROM 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	E^2PROM 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; EPROM defective	contact service
W153	initialising - please wait	initialisation of electronics	wait some seconds; if warning prevails, power off device and power on again
A155	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A160	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E^2PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A164	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A171	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A231	sensor 1 defect check connection	HF module or electronics defective	exchange HF module or electronics
W511	no factory calibration ch1	factory calibration has been deleted	record new factory calibration
A512	recording of mapping please wait	mapping active	wait some seconds until alarm disappears
A601	linearisation ch1 curve not monotone	linearisation not monotonously increasing	correct linearisation table
W611	less than 2 linearisation points for channel 1	number of entered linearisation points < 2	correct linearisation table

Code	Description	Possible cause	Remedy
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...21.5 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 (see Page 76)		1. See table of error messages (see Page 76)
Measured value (00) is incorrect	 L00-FMR2xxxx-19-00-00-en-019	Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: →level/ullage (040) →max. scale (046) →diameter vessel (047) →Check table
		no ↓		
		Measurement in bypass or stilling well?	yes →	1. Is bypass or stilling well selected in tank shape (002)? 2. Is the pipe diameter (007) correct?
		no ↓		
		Is an offset (057) active?	yes →	1. offset (057) correctly set?
		no ↓		
		An interference echo may have been evaluated.	yes →	1. Carry out tank mapping →basic setup
No change off measured value on filling/emptying	 L00-FMR2xxxx-19-00-00-en-014	Interference echo from installations, nozzle or extension on the antenna		1. Carry out tank mapping →basic setup 2. If necessary, clean antenna 3. If necessary, select better mounting position (see Page 14)

Error	Output	Possible cause		Remedy
If the surface is not calm (e.g. filling, emptying, agitator running), the measured value jumps sporadically to a higher level	 L00-FMR2xxxx-19-00-00-en-015  L00-FMR2xxxx-19-00-00-en-016	Signal is weakened by the rough surface – the interference echoes are sometimes stronger		1. Carry out tank mapping → basic setup 2. Set the process cond. (004) to "turb. surface" or "agitator" 3. Increase the output damping (058) 4. Optimise the orientation (see Page 80) 5. If necessary, select a better mounting position and/or larger antenna (see Page 14)
During filling/ emptying the measured value jumps ownwards	 L00-FMR2xxxx-19-00-00-en-017	Multiple echoes	yes →	1. Check the tank shape (002), e.g. "dome ceiling" or "horizontal cyl" 2. In the range of the blocking dist. (059) there is no echo evaluation →Adapt the value 3. If possible, do not select central installation position (see Page 14) 4. Perhaps use a stilling well ()
E 641 (loss of echo)	 L00-FMR2xxxx-19-00-00-en-018	Level echo is too weak. Possible causes: • Rough surface due to filling/ emptying • Agitator running • Foam	yes →	1. Check application arameters (002), (003) and (004) 2. Optimise alignment (see Page 80) 3. If necessary, select a better installation position and/or larger antenna (see Page 14)
E 641 (loss of echo) after turn on the power supply	**If the instrument is configured to Hold by loss of echo the output is set to any value/ current.**	noise level during the initialisation phase to high.		Repeat once more empty calibr. (005). Caution! Before conformation change with [+] or [–] to the edit mode.

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 (see Page 10):

- In tanks: to the vessel wall
- In stilling wells: to the slots
- In bypass pipes: vertical to the tank connectors
- When using the Wave Guide antenna **no** orientation is required!

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

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

1. It is best to empty the container so that the bottom is just covered. However, alignment can be carried out even if the vessel is empty.
2. Optimisation is best carried out with the aid of the envelope graph in the display or the ToF Tool.
3. Unscrew the flange or loosen the threaded boss by a half a turn.
4. Turn the flange by one hole or screw the threaded boss by one eighth of a turn. Note the echo quality.
5. Continue to turn until 360° is reached.
6. Optimum alignment:

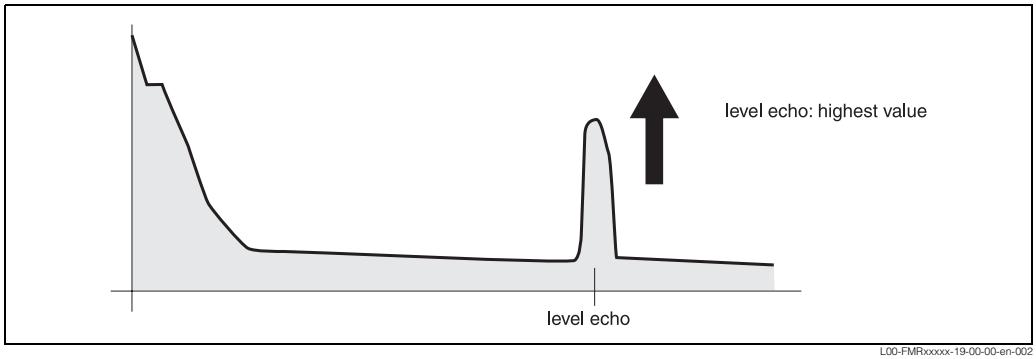


Fig. 4: Vessel partly full, no interference echo obtained

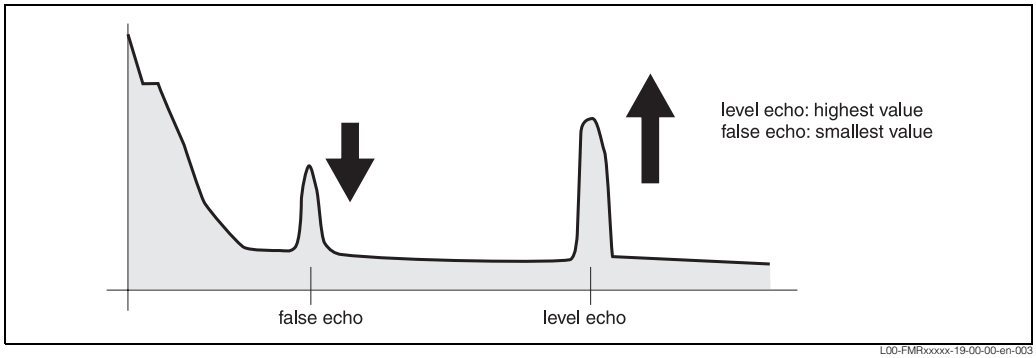


Fig. 5: Vessel partly full, interference echo obtained:

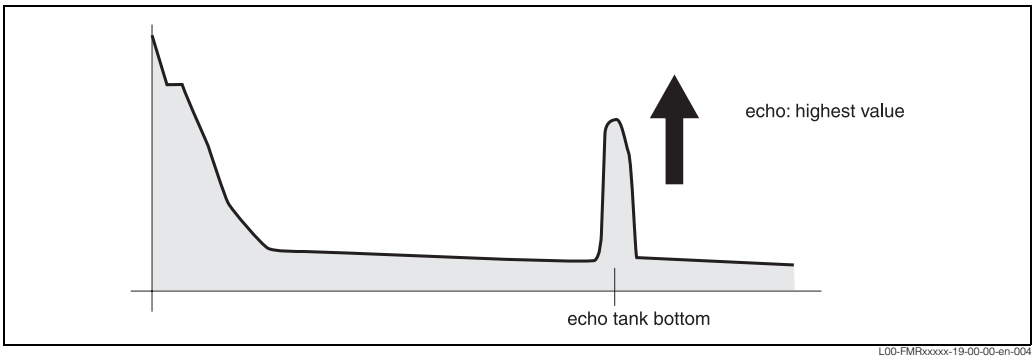


Fig. 6: Vessel empty, no interference echo

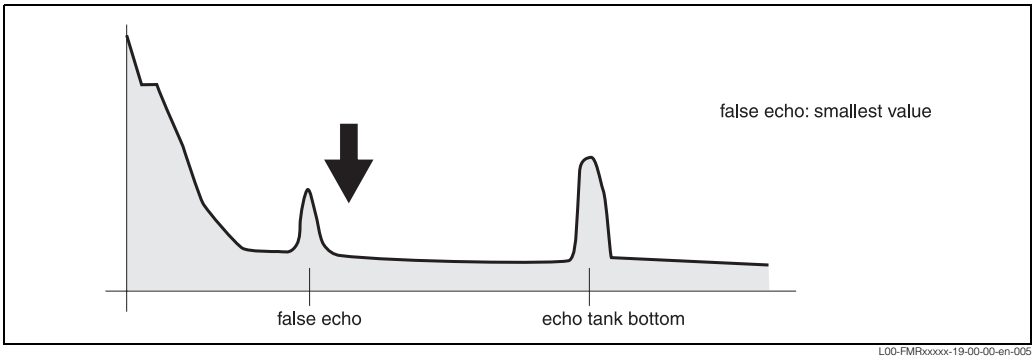


Fig. 7: Vessel empty, interference echo obtained

7. Fix the flange or threaded boss in this position.
   If necessary, replace the seal.
8. Carry out tank mapping, see Page 61.

9.5 Spare parts

Note!
You can order spare parts directly from your E+H service organization by giving the serial number which is printed on the measuring transducer nameplate (see Page 6). The corresponding spare part number also appears on each spare part. Installation instructions are given on the instruction card that is also delivered.

Spare parts Micropilot M FMR 231 with housing F12

Spare parts Micropilot M, FMR 231

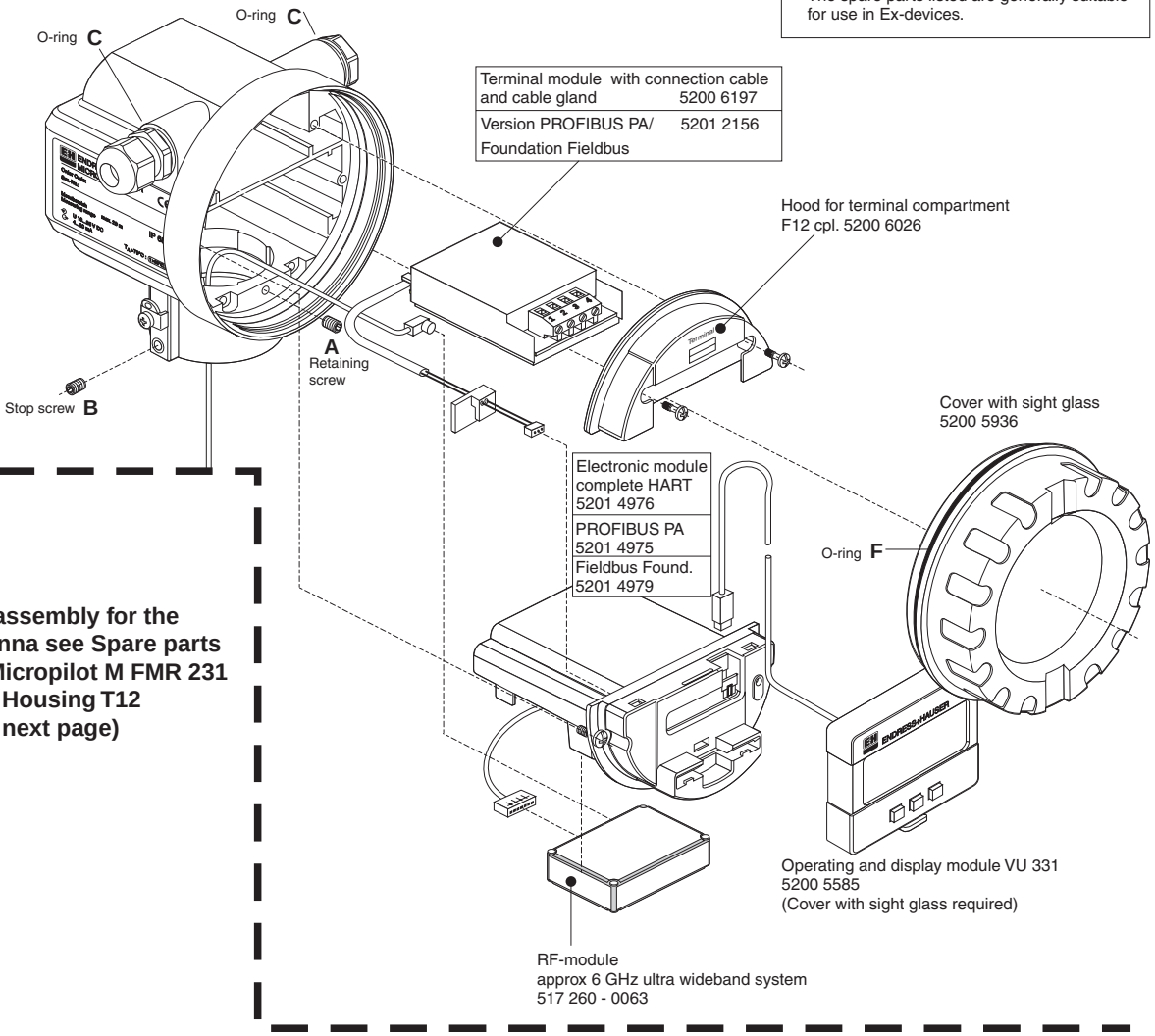
Housing F12 with combined wiring and electronics compartment

Housing F12 standard, complete pre-mounted,
incl. nameplate, cable-gland and Teflon filter

543 120 - 0022	G ½" entry
543 120 - 0023	NPT ½" entry
543 120 - 0024	M20 x 1,5 gland
5200 1992	M12 PROFIBUS PA plug
5200 8556	Foundation Fieldbus plug

FM The customer may exchange modular assemblies in accordance with Endress+Hauser instructions!

The spare parts listed are generally suitable for use in Ex-devices.



L00-FMR231xx-00-00-06-en-001

Spare parts Micropilot M FMR 231 with housing T12

Spare parts Micropilot M, FMR 231

Housing T12 with separate wiring compartment

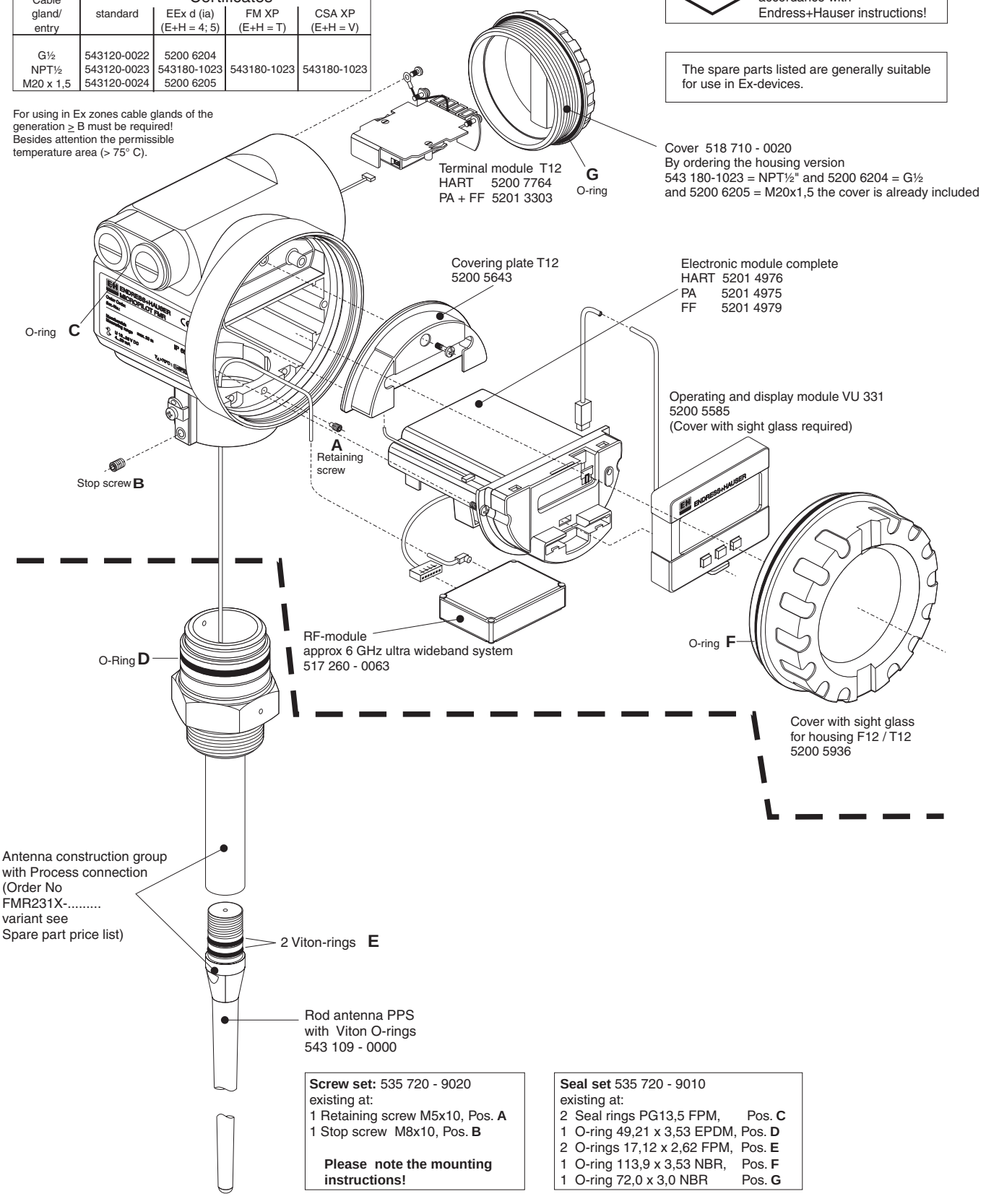
Housing T12 complete pre-mounted, with Cover for wiring compartment

Cable gland/ entry	Certificates standard	EEx d (ia) (E+H = 4; 5)	FM XP (E+H = T)	CSA XP (E+H = V)
G½	543120-0022	5200 6204		
NPT½	543120-0023	543180-1023	543180-1023	543180-1023
M20 x 1,5	543120-0024	5200 6205		

For using in Ex zones cable glands of the generation ≥ B must be required! Besides attention the permissible temperature area (> 75° C).

FM The customer may exchange modular assemblies in accordance with Endress+Hauser instructions!

The spare parts listed are generally suitable for use in Ex-devices.



Screw set: 535 720 - 9020
existing at:
1 Retaining screw M5x10, Pos. **A**
1 Stop screw M8x10, Pos. **B**

Please note the mounting instructions!

Seal set 535 720 - 9010
existing at:
2 Seal rings PG13,5 FPM, Pos. **C**
1 O-ring 49,21 x 3,53 EPDM, Pos. **D**
2 O-rings 17,12 x 2,62 FPM, Pos. **E**
1 O-ring 113,9 x 3,53 NBR, Pos. **F**
1 O-ring 72,0 x 3,0 NBR Pos. **G**

L00-FMR231xx-00-00-06-en-002

Spare parts Micropilot M FMR 231 with housing F23

In preparation.

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 EN 91/155/EEC.

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

9.7 Disposal

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

9.8 Software history

Software version / Date	Software changes	Documentation changes
V 01.01.00 / 12.2000	Original software. Operated via: – ToF Tool from version 1.5 – Commuwin II (from version 2.07-3) – HART communicator DXR 275 (from OS 4.6) withRev. 1, DD 1.	
V 01.02.00 / 05.2002 V 01.02.02 / 03.2003	• Function group: envelope curve display • Katakana (japanese) • current turn down (HART only) • the customer tank map can be edited • length of antenna extension FAR 10 can be entered directly Operated via: – ToF Tool from version 3.1 – Commuwin II (from version 2.07-4) – HART communicator DXR 275 (from OS 4.6) withRev. 2, DD 1.	Description of new functions.

9.9 Contact addresses of Endress+Hauser

The addresses of Endress+Hauser are given on the back cover of this operating manual. If you have any questions, please do not hesitate to contact your E+H 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.

10.1.2 Output

Output signal	Foundation Fieldbus
Signal on alarm	Error information can be accessed via the following interfaces: • Local display: – Error symbol (see Page 28) – Plain text display • Current output • Digital interface
Linearization	The linearization function of the Micropilot M allows the conversion of the measured value into any unit of length or volume. Linearization tables for calculating the volume in cylindrical tanks are pre-programmed. Other tables of up to 32 value pairs can be entered manually or semi-automatically.

10.1.3 Performance characteristics

Reference operating conditions	• temperature = +20 °C (68 °F) ±5 °C (9 °F) • pressure = 1013 mbar abs. (14.7 psia) ±20 mbar (0.3 psi) • relative humidity (air) = 65 % ±20% • ideal reflector • no major interference reflections inside the signal beam
Maximum measured error	Typical statements for reference conditions, include linearity, repeatability, and hysteresis: • FMR 231: up to10 m ±10 mm, off10 m ±0.1% of measuring range
Resolution	Digital / analog in % 4…20 mA • FMR 231: 1mm / 0.03 % of measuring range
Reaction time	The reaction time depends on the parameter settings (min. 1 s). In case of fast level changes, the instrument needs the reaction time to indicate the new value.

Influence of ambiente temperature	The measurements are carried out in accordance with EN 61298-3: • digital output (HART, PROFIBUS PA, Foundation Fieldbus): – **FMR 231** average T_K: 5 mm/10 K, max. 15 mm over the entire temperature range -40 °C...+80 °C

10.1.4 Operating conditions: Environment

Ambient temperature range	Ambient temperature for the transmitter: -40 °C ... +80 °C (-40 °F … +176 °F) The functionality of the LCD display may be limited for temperatures Ta<-20 °C and Ta>+60 °C. A weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight.
Storage temperature	-40 °C … +80 °C (-40 °F … +176°F)
Climate class	DIN EN 60068-2-38 (test Z/AD)
Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: 20…2000 Hz, 1 (m/s)/Hz This value can be reduced for Wave Guide antennas, depending on the length. In the event of horizontal stress, mechanical support is required or provide the Wave Guide antenna with a protective pipe.
Cleaning of the antenna	The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant εr. If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning (eventually connection for cleaning liquid). The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.
Electromagnetic compatibility	• Interference Emission to EN 61326, Electrical Equipment Class B • Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) • A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).

10.1.5 Operating conditions: Process

Antenna	PPS antistatic		PTFE antistatic		
Process connection	Threaded connection	Flange	Threaded connection	Flange	
	metal	unclad	metal	unclad	clad antistatic
Temperature	-20 °C...+120 °C (-4 °F...+248 °F)		-40 °C...+150 °C (-40 °F...+302 °F)		
Pressure	vacuum...16 bar (...232 psi)		vacuum...40 bar (...580 psi)		vacuum...16 bar (...232 psi)
Wetted parts	1.4435 + Viton + PPS		1.4435 + PTFE (TFM 4220, 2% conductive additives)		PTFE (TFM 4220, 2% conductive additives)

Antenna	PTFE					
Process connection	Threaded connection		Flange		Sanitary coupling[1]	
	PVDF (nicht gasdicht)	metal	unclad	clad	Triclamp	Milchrohr Aseptisch
Temperature	-40 °C...+80 °C (-40 °F...+176 °F)	-40 °C...+150 °C (-40 °F...+302 °F)				
Pressure	vacuum...3 bar (...43.5 psi)	vacuum...40 bar (...580 psi)		vacuum...16 bar (...232 psi)	vacuum...16 bar (2") (...232 psi) vacuum...10 bar (3") (...145 psi)	vacuum...25 bar (...362 psi)
Wetted parts	PVDF + PTFE	1.4435 + PTFE		PTFE[2]	1.4435 + PTFE (TFM 1600)	

1) 3A approval, FDA-listed material

2) on DN150, 6" ANSI, JIS 150A the disc is made of antistatic PTFE (= black)

Dielectric constant
- in a stilling well/Wave Guide antenna: $\varepsilon r \geq 1{,}4$
- in free space: $\varepsilon r \geq 1{,}9$

10.1.6 Mechanical construction

Weight
- F12/T12 housing: approx 4 kg + weight of flange
- F23 housing: approx 7.4 kg + weight of flange

10.1.7 Certificates and approvals

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

RF approvals
R&TTE, FCC

Overspill protection
german WHG, see ZE 244F/00/de.
SIL 2, see ASD 150F/00/en "Functional Safety Manual".

External standards and guidelines

EN 60529
Protection class of housing (IP-code)

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

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

NAMUR
Standards committee for measurement and control in the chemical industry

Ex approval

XA 123F-C
Installation Micropilot M FMR 2xx Foundation Fieldbus (F12 / EEx ia IIC T6)
PTB 00 ATEX 2117 X, Equipment marking: (II 1/2 G)

Marine certificate

GL (German Lloyd)
– HART, PROFIBUS PA
– not Wave Guided antenna, not HT antenna

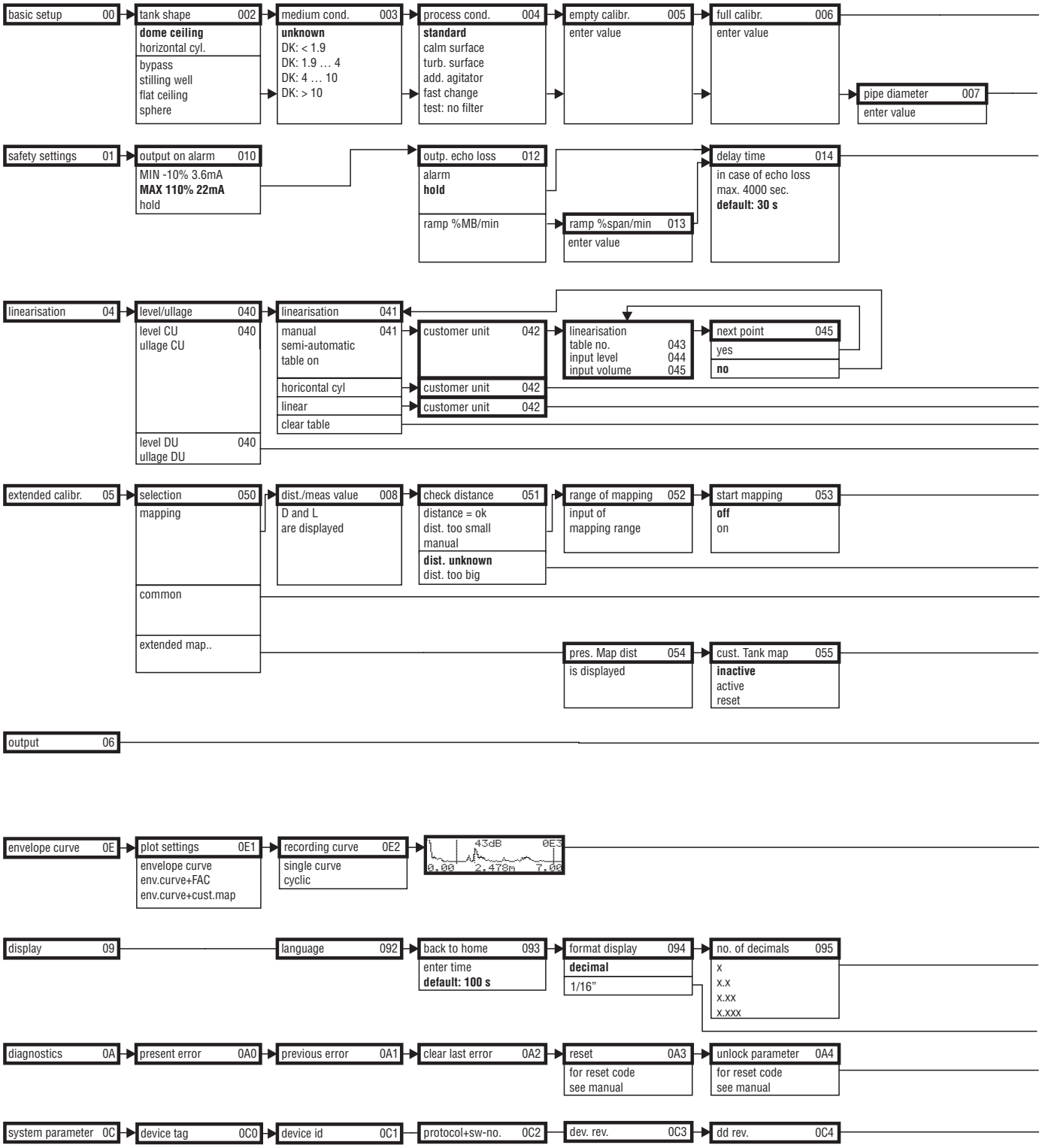
10.1.8 Supplementary Documentation

Supplementary Documentation

- System Information Micropilot (SI 019F/00/en)
- Technical Information (TI 345F/00/en)
- Operating Instructions "Description of instrument functions" (BA 221F/00/en)
- Safety Manual "Functional Safety Manual" (SD 150F/00/en).

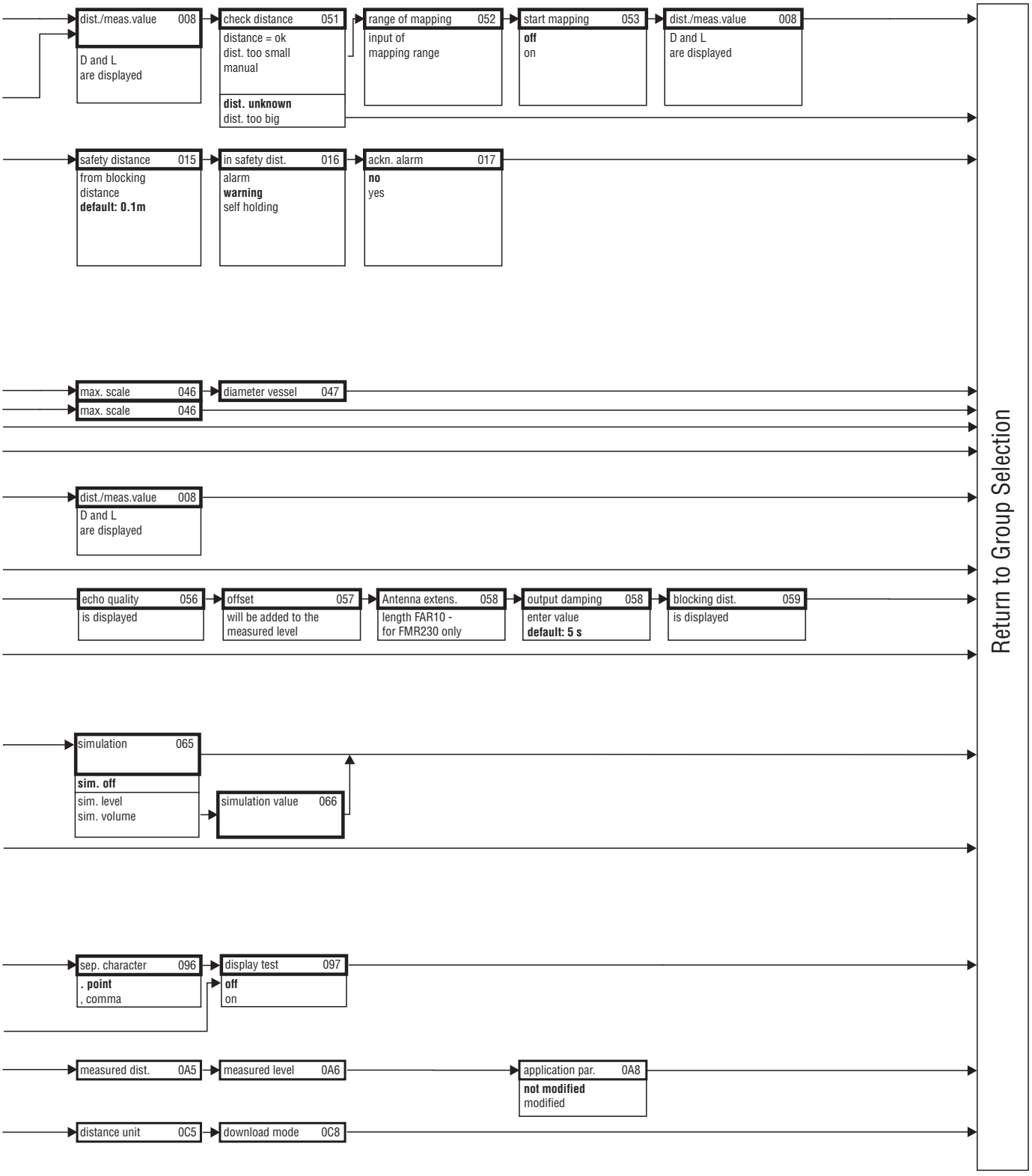
11 Appendix

11.1 Operating menu Foundation Fieldbus, ToF Tool



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

L00-FMR2xxxx-19-00-01-en-038



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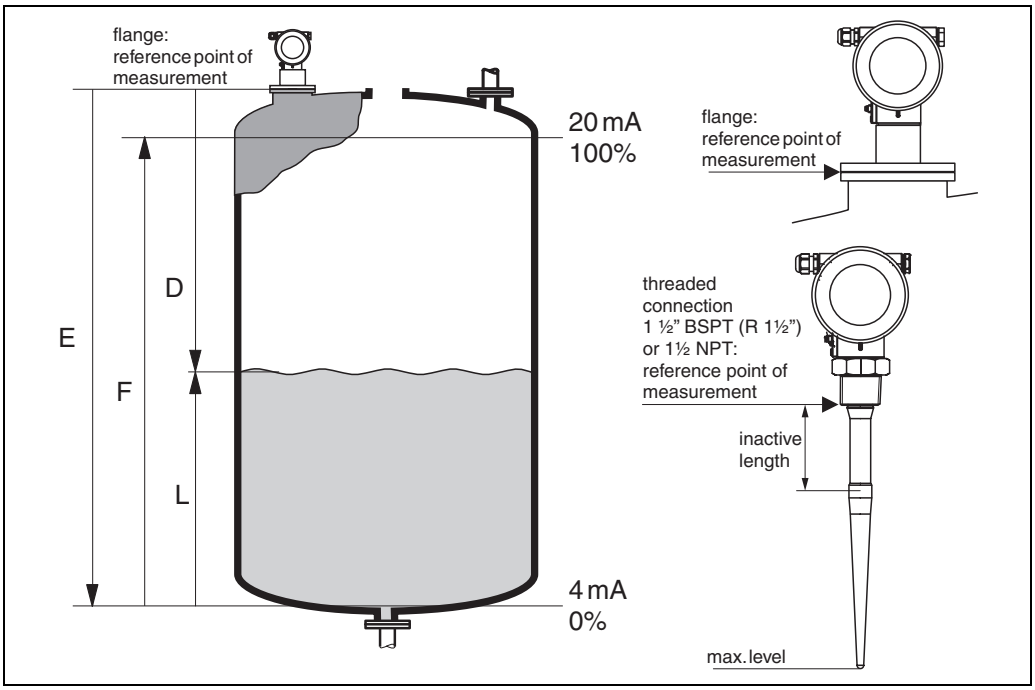
11.2 Description of functions

Note!
A detailed description of the function groups, functions and parameters is given in the documentation BA 221F/00/en - a description of the instrument functions of the Micropilot M.

11.3 Function and system design

11.3.1 Function (Measuring principle)

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



Input

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

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

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

$L = E - D$

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

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

Output

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

11.3.2 Equipment architecture

Stand-alone

The Micropilot M can be used for measurement in a stilling well / bypass as well as in free space.

System integration via Foundation Fieldbus

The system integration via Foundation Fieldbus is described in Chapter 5.5.

On-site operation

- with display and operating module VU 331,
- with a Personal Computer, FXA 193 and the operating software ToF Tool.
  The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle (radar, ultrasonic, guided micro-impulse). It assists with commissioning, securing data, signal analysis and documentation of the measuring point.

Remote operation

- with a Personal Computer, a Fieldbus H1 card (e.g. NI Fieldbus Interface Board) and a network configuration software (e.g. NI-FBUS configurator) and the operating software ToF Tool.

11.3.3 Patents

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

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

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Endress+Hauser must pre-approve and assign a Return Authorization number to any instrument you plan to return. Please identify the Return Authorization number clearly on all shipping cartons and paperwork.

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In order to serve you better, and to protect our employees from any potentially hazardous contaminants, Endress+Hauser must return unopened, at the sender's expense, all items that do not have a Return Authorization number.

To get a Return Authorization number for **credit**, call **888-ENDRESS**

To get a Return Authorization number for **calibration or repair**, call **800-642-8737**

To get a Return Authorization number **in Canada**, call **800-668-3199**

Please be sure to include the following information when requesting a Return Authorization number. This information will help us speed up the repair and return process.

Customer name:
Customer address:
Customer phone number:
Customer contact:
Equipment type:
Original sales order or purchase order number:
Reason for return:
Failure description, if applicable:
Process material(s) to which the equipment has been exposed:

OSHA Hazard Communication Standard 29CFR 1910.1200 mandates that we take specific steps to protect our employees from exposure to potentially hazardous materials. Therefore, all equipment so exposed must be accompanied by a letter certifying that the equipment has been decontaminated prior to its acceptance by Endress+Hauser.

The employees of Endress+Hauser sincerely appreciate your cooperation in following this policy.

Address your equipment to:

Endress+Hauser
2350 Endress Place
Greenwood, IN 46143
Return Authorization number:

In Canada:

Endress+Hauser
1440 Graham's Lane, #1, Burlington
Ont. Canada L7S 1W3
Return Authorization number:

Effective November 1987

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