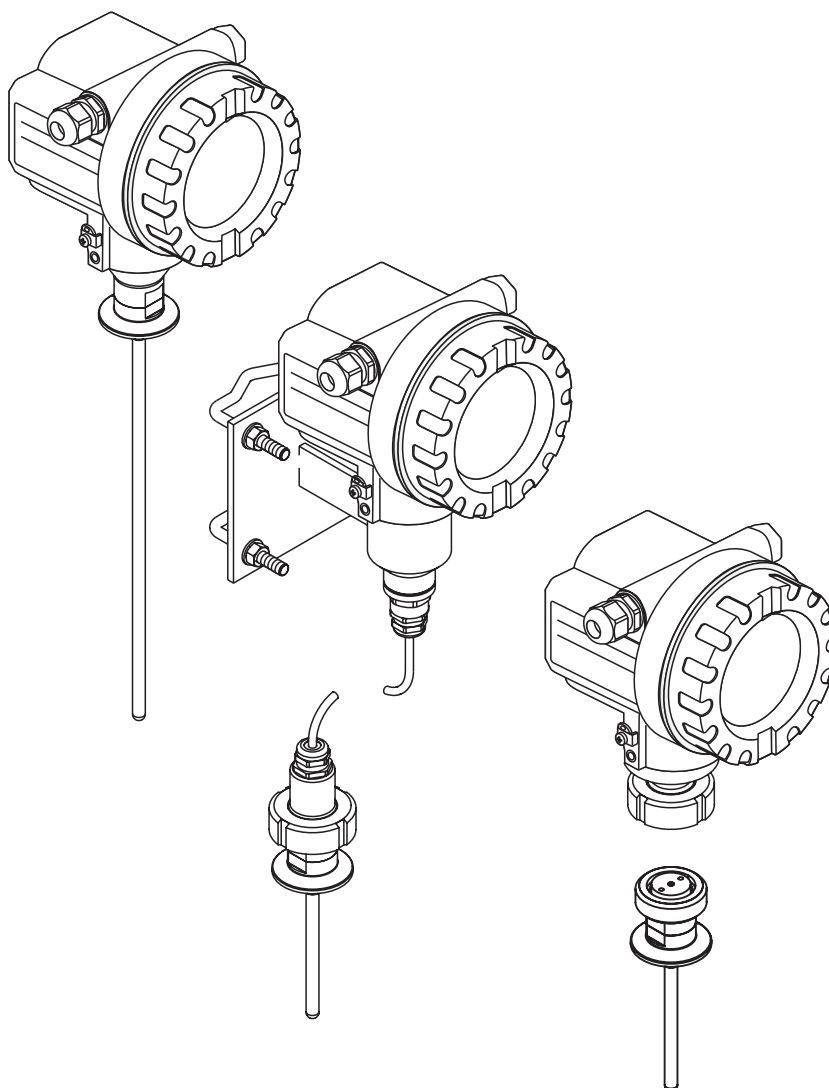| Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions |

Operating Instructions

Levelflex M FMP43

Guided Level–Radar

PROFI BUS ®

Endress+Hauser

People for Process Automation

Brief Operating Instructions

KA189F/00/a2/03.07
52012501

Levelflex M – Brief operating instructions

⚠ Contrast: E + ＋ or E + －

000
measured value

Group selection

008
dist./ meas value

| 00 basic setup | 002 tank properties | 003 medium property | 004 process cond. | 005 empty calibr. | 006 full calibr. | 008 dist./ meas value | 051 check distance | 052 range of mapping | 053 start mapping |

01 safety settings

- standard
- aluminium tank
- plastic tank
- bypass/pipe
- coax-probe
- concrete wall

- unknown
- 1.4 … 1.6
- 1.6 … 1.9
- 1.9 … 2.5
- 2.5 … 4
- 4 … 7
- > 7

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

input E (see sketch)

input F (see sketch)

D and L are displayed

confirm suggestion or specify range

FMP43

FMP40 FMP41C FMP45

reference point of measurement

| 03 length adjustment | 030 end of probe | 031 probe length | 032 probe | 033 probe length | 034 determine length |

04 linearisation

- free
- tie down isolated
- tie down gnd.

If shortened please enter probe length here.

05 extended calibr.

09 display

092 language … …

threaded connection ¾ or 1 ½ BSP (G ¾ or G 1½) ¾ or 1½ NPT: reference point of measurement

0E envelope curve

| 09A plot settings | 09B recording curve |

213mV   0E3

0.00   0.912m   1.31

- envel. curve
- subtracted signal
- mapping

- single curve
- cyclic

UB = upper blocking distance
E = empty distance (= zero)
D = distance

F = measuring span
LN = probe length
L = level

| 0A diagnostics | 0A0 present error | 0A1 previous error | 0A3 reset | | 0A4 unlock parameter |

0C system parameters

(333 = reset customer parameters)

= 100: unlocked
¹ 100: locked

52012501

L00-FMP40xxx-19-00-00-en-012

✎ **Note!**
These Operating Instructions explains how to install and commission the level transmitter.
All the functions that are required for a typical measuring task are taken into account here.
In addition, the Levelflex M provides many other functions for optimizing the measuring point and conventing measured values. These functions are not included in these Operating Instructions.

An **overview of all the device functions** can be found on → 📄 94.

The Operating Instructions BA00245F/00/EN "Description of Instrument Functions" provides an **extensive description of all the device functions** which can be found on the enclosed CD–ROM.

The Operating Instructions can also be found on our homepage: www.endress.com

Table of contents

1   Safety instructions

1.1   Designated use

The Levelflex M is a compact level transmitter for continuous measurement of liquids, measuring prinziple: Guided Level Radar / TDR: **T**ime **D**omain **R**eflectometry.

1.2   Installation, commissioning and operation

The Level M is designed to meet state-of-the-art safety requirements and conforms to applicable standards and EC regulations. If installed incorrectly or used for applications for which it is not intended, however, the device can present a source of application-related danger, e.g. product overflow due to incorrect installation or configuration. For this reason, installation, connection to the electricity supply, commissioning, operation and maintenance of the measuring system must only be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialists must have read and understood these Operating Instructions and must follow the instructions they contain. Modifications and repairs to the device are permissible only when they are expressly approved in the Operating Instructions.

1.3   Operational safety and process safety

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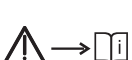
Hazardous area

Applicable national standards must be observed when using the measuring system in hazardous areas. The device is accompanied by separate "Ex documentation", which is an integral part of this documentation. The installation regulations, connection values and safety instructions listed in this document must be observed.

- Ensure that all personnel are suitably qualified.
- Measuring point requirements with regard to measurement and safety must be observed.

1.4 Notes on safety conventions and icons

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

| Safety instructions	
⚠	**Warning!** Indicates an action or procedure which, if not performed correctly, can result in serious personal injury, a safety hazard or the destruction of the device.
☝	**Caution!** Indicates an action or procedure which, if not performed correctly, can result in personal injury or the incorrect operation of the device.
✎	**Note!** Indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.
Explosion protection	
⟨Ex⟩	**Explosion protected, type-examined equipment** If the device has this symbol embossed on its nameplate, it can be used in a hazardous area or a non-hazardous area, according to the approval.
⚠EX	**Explosion hazardous area** This symbol is used in the drawings of these Operating Instructions to indicate hazardous areas. devices in hazardous areas, or cables for such devices, must have appropriate explosion protection.
⚠EX	**Safe area (non-hazardous area)** This symbol is used in the drawings of these Operating Instructions to indicate non-hazardous areas. devices in the non-hazardous area also have to be certified if connecting cables lead into the hazardous area.
Electrical symbols	
⎓	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
∼	**Alternating current** A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded by means of a grounding system.
⏛	**Protective ground connection** A terminal which must be connected to ground prior to making any other connection to the equipment.
⏦	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.
t>85°C	**Temperature resistance of the connecting cables** Indicates that the connecting cables have to withstand a temperature of 85 °C at least.

⚠→ 📖	**Safety instruction** For safety instructions refer to the manual for the appropriate device version.

2   Identification

2.1   Device designation

2.1.1   Nameplate

The following technical data are given on the device nameplate:
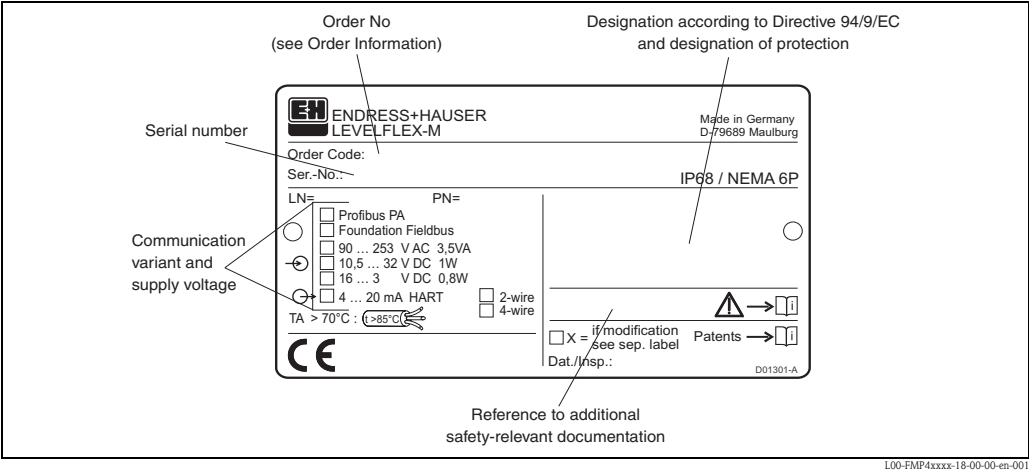
Information on the nameplate of the Levelflex M FMP43

2.1.2   Ordering structure

This overview does not mark options which are mutually exclusive.

10		Approval:
	A	Non-hazardous area
	1	ATEX II 1/2 G Ex ia IIC T6
	7	ATEX II 1/2 G Ex d (ia) IIC T6
	5	ATEX II 1/2 G Ex ia IIC T6, ATEX II 1/3 D
	3	ATEX II 2G Ex emb (ia) IIC T6
	2	ATEX II 1/2 D, Alu blind cover
	4	ATEX II 1/3 D
	M	FM DIP Cl. II Div. 1 Gr. E-G N.I.
	S	FM IS Cl. I, II, III Div. 1 Gr. A-G N.I., zone 0, 1, 2
	T	FM XP Cl. I, II, III Div. 1 Gr. A-G, zone 1, 2
	N	CSA General Purpose
	P	CSA DIP Cl. II Div. 1 Gr. G + coal dust, N. I.
	U	CSA IS Cl. I, II, III Div. 1 Gr. A-D, G + coal dust, N.I., zone 0, 1, 2
	V	CSA XP Cl .I, II, III Div. 1 Gr. A-D, G + coal dust, N.I., zone 1, 2
	K	TIIS Ex ia IIC T4 (in preparation)
	I	NEPSI Ex ia IIC T6 (in preparation)
	Y	Special version, TSP-No. to be spec.

20			Probe:
			300 mm – 4000 mm/12 in – 157 in
	K		..... mm, rod 8 mm, 316L, Ra < 0.76 µm/30 µin
	M		..... in, rod 8 mm 316L, Ra < 0.76 µm/30 µin
	S		..... mm, rod 8 mm, 316L, electropolished Ra < 0.38 µm/15 µin
	T		..... in, rod 8 mm 316L, electropolished Ra < 0.38 µm/15 µin
	Y		Special version, TSP-No. to be spec.

30				O-ring Material; Temperature:
		5		EPDM, FDA, USP Cl. VI; – 20 °C to 130 °C
		6		Kalrez, FDA, USP Cl. VI; – 20 °C to 150 °C
		9		Special version, TSP-No. to be spec.

40				Process Connection:	
					— Threaded boss —
	U1J				Thread M24, 316L, install > accessory weld-in adapter
					— Clamp connections —
	TCJ				Tri-clamp ISO2852 DN25-38 (1 to 1-1/2"), 316L, 3A, EHEDG
	TDJ				Tri-clamp ISO2852 DN40-51 (2"), 316L, 3A, EHEDG
	TFJ				Tri-clamp ISO2852 DN70-76.1 (3"), 316L, 3A, EHEDG
					— Hygienic connections —
	T7J				SMS 1-1/2" PN25, 316L, EHEDG
	TXJ				SMS 2" PN25, 316L, EHEDG
	MAJ				DIN11864-1 A DN25 tube DIN11850, 316L, slotted-nut, EHEDG
	MQJ				DIN11851 DN40 PN40, slotted-nut, 316L, EHEDG
	MRJ				DIN11851 DN50 PN40, slotted-nut, 316L, EHEDG
	S1J				NEUMO BioControl DN25 PN16, 316L, EHEDG
					— ANSI flanges —
	AEJ				1-1/2" 150 lbs RF, 316L flange ANSI B16.5
	AFJ				2" 150 lbs RF, 316L flange ANSI B16.5
	YY9				Special version, TSP-No. to be spec.

50				Power Supply; Output:	
	B				2-wire ; 4-20mA SIL HART
	D				2-wire; PROFIBUS PA
	F				2-wire; FOUNDATION Fieldbus
	G				4-wire 90-250 VAC; 4-20mA SIL HART
	H				4-wire 10.5-32 VDC; 4-20mA SIL HART
	Y				Special version, TSP-No. to be spec.

60				Operation:	
	1				W/o display, via communication
	2				4-line display VU331
	3				Prepared for FHX40
	9				Special version, TSP-No. to be spec.

70				Type of Probe:	
	1				Compact, basic version
	5				Compact, detachable
	6				Remote, cable 3 m, detachable
	7				Remote, cable 6 m, detachable
	9				Special version, TSP-No. to be spec.

80				Housing:	
	A				F12 Alu, coated IP68 NEMA6P
	B				F23, 316L, IP68, NEMA6P
	C				T12 Alu, coated IP68 NEMA6P, separate conn. compartment
	D				T12 Alu, coated IP68 NEMA6P + OVP[1], seperate terminal compartment
	Y				Special version, TSP-No. to be spec.

90				Cable Entry:	
	2				Gland M20 (EEx d > thread M20)
	3				Thread G 1/2
	4				Thread NPT 1/2
	5				Plug M12
	6				Plug 7/8"
	9				Special version, TSP-No. to be spec.

100				Additional Option:	
	A				Basic version
	B				EN10204-3.1 material (316L wetted parts) inspection certificate
	H				5-point linearity protocol, see additional spec.
	J				5-point, 3.1, 5-point linearity protocol, see additional spec., EN10204-3.1 material (316L wetted parts), inspection certificate
	P				CoC-ASME BPE, EN10204-3.1 material (316L wetted parts) inspection certificate
	R				5-point, CoC-ASME BPE, 3.1, 5-point linearity protocol, see additional spec., EN10204-3.1 material (316L wetted parts), inspection certificate
	Y				Special version, TSP-No. to be spec.

995				Marking:	
	1				Tagging (TAG), see additional spec.
	2				Bus address, see additional spec.

FMP43-				Complete product designation

[1] OVP = overvoltage protection

2.2   Scope of delivery

Caution!
It is essential to follow the instructions concerning the unpacking, transport and storage of
measuring devices given in the chapter "Incoming acceptance, transport, storage", → 🖹 9!

The scope of delivery consists of:
- Assembled device
- Accessories (→ 🖹 78)
- Endress+Hauser operating program on the enclosed CD-ROM
- Brief operating instructions KA00189F/00/A2 (basic setup/troubleshooting), housed in the device
- Brief operating instructions KA01048F/00/EN for quick commissioning
- Approval documentation: if this is not included in the operating manual
- CD-ROM with further documentation, e.g.
  - Technical Information
  - Operating Instructions
  - Description of Instrument Functions

2.3   Certificates and approvals

CE mark, declaration of conformity
The device is designed to meet state-of-the-art safety requirements, has been tested and left the
factory in a condition in which it is safe to operate. The device takes into account applicable
standards and regulations which are listed in the EC declaration of conformity and thus meets the
legal requirements of the EC Directives. Endress+Hauser confirms the successful testing of the
device by affixing to it the CE mark.

2.4   Registered trademarks

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

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

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

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

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

3   Installation

3.1   Incoming acceptance, transport, storage

3.1.1   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.

3.1.2   Transport

Caution!
Follow the safety instructions and transport conditions for devices of more than 18 kg.
Do not lift the measuring device by the probe rod in order to transport it.

3.1.3   Storage

Pack the measuring device so that is protect against impact for storage and transport.
The original packing material provides the optimum protection for this.
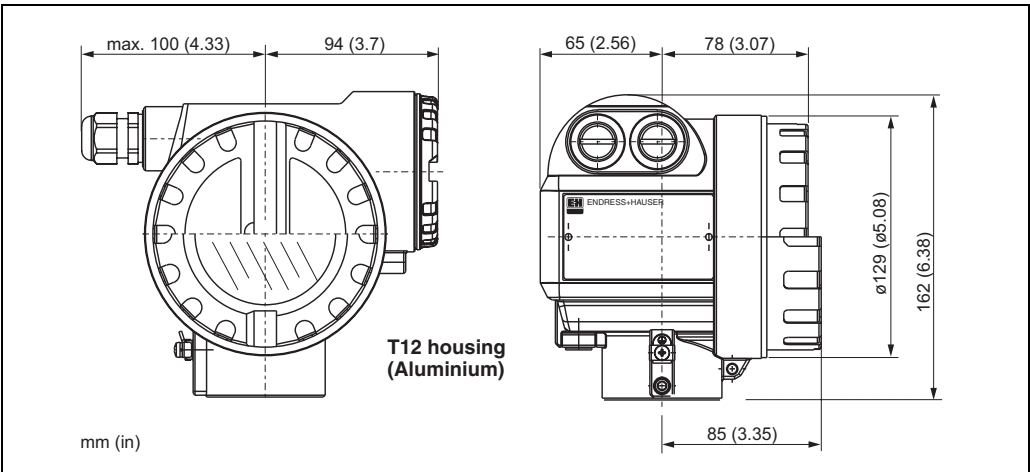The permissible storage temperature is –20 °C to +80 °C.
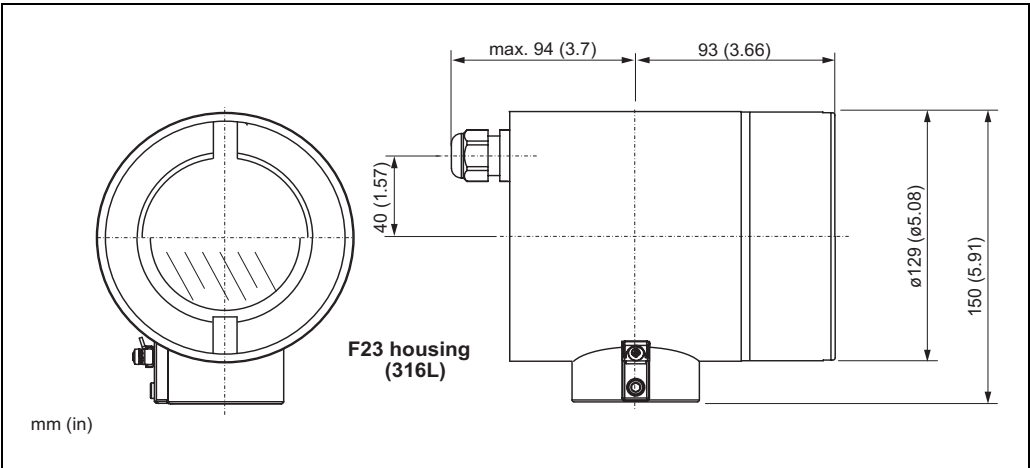
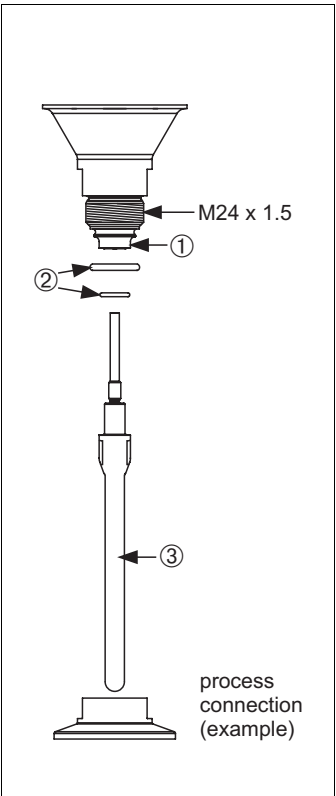# 3.2 Installation conditions

3.2.1 Dimensions

Housing dimensions

max. 110 (4.33)

65 (2.56)   78 (3.07)

ø129 (ø5.08)

150 (5.91)

**F12 housing
(Aluminium)**

85 (3.35)

mm (in)

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

max. 100 (4.33)   94 (3.7)

65 (2.56)   78 (3.07)

ø129 (ø5.08)

162 (6.38)

**T12 housing
(Aluminium)**

85 (3.35)

mm (in)

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

max. 94 (3.7)   93 (3.66)

40 (1.57)

ø129 (ø5.08)

150 (5.91)

**F23 housing
(316L)**

mm (in)
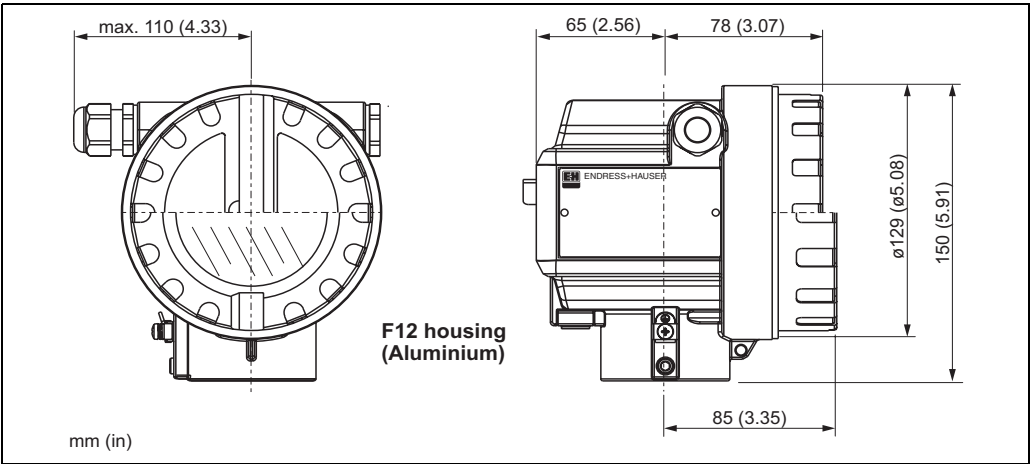
L00-F23xxxx-06-00-00-en-001

Probes – Dimensions and materials

F12 / T12 / F23 housing

Probe length LN

reference point of measurement

option "6/7": remote electronic

88

103

4 x Ø 8,5

88

Ø 5

R ≥ 50

option "1": compact

option "5": compact, detachable

55

17

69

17

17

99

Probe length LN

Probe length LN

Probe length LN

Ø 54

L00-FMP43xxx-06-00-00-en-001

M24 x 1.5

①
②
③

process connection (example)
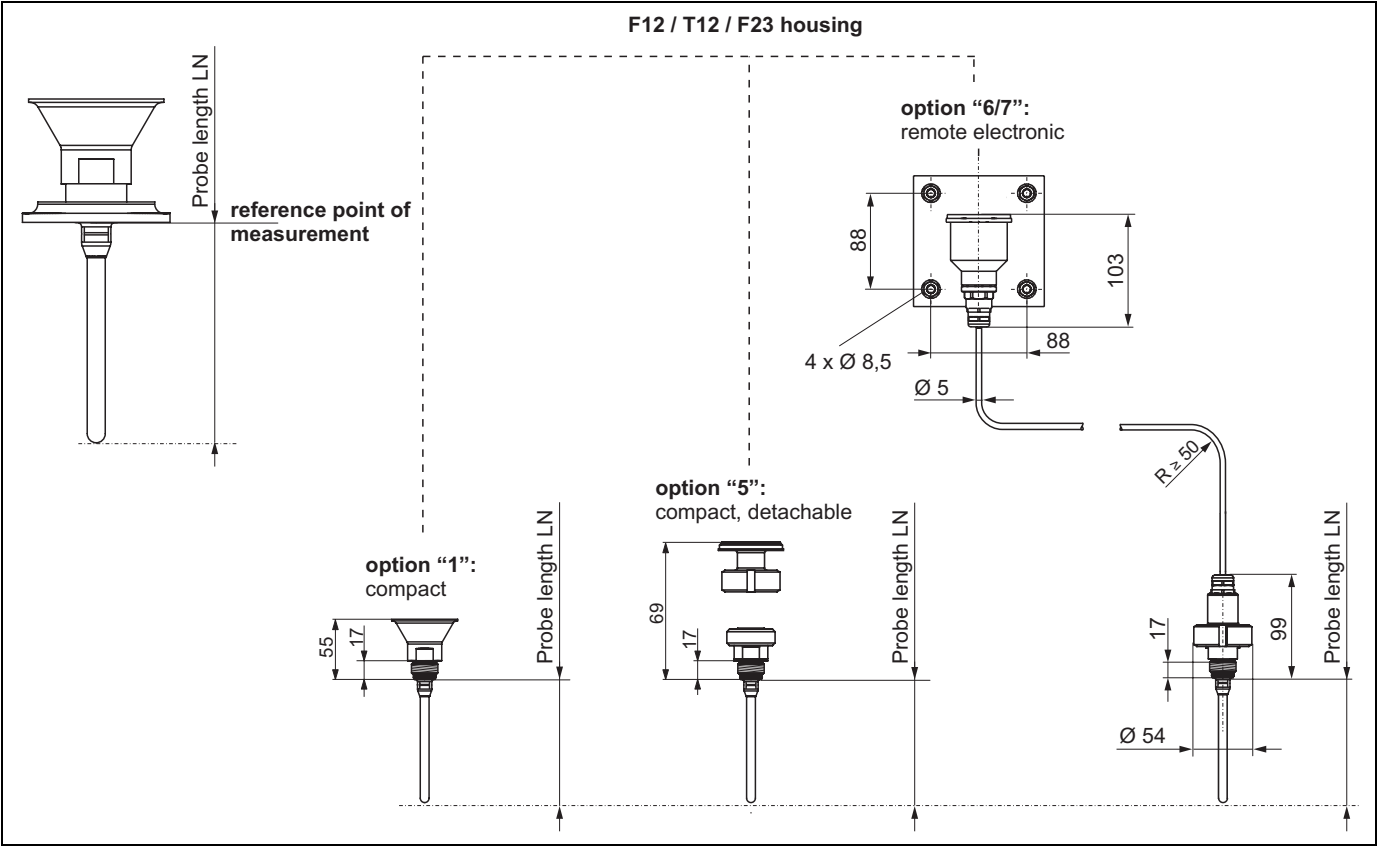
① **Insulator**

Material	Approval
Ketron PEEK LSG	FDA, 3A, USP Cl. VI

② **O-ring (see Feature 30 in "Ordering information"**
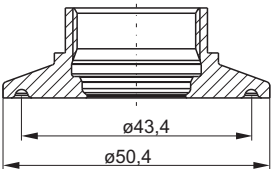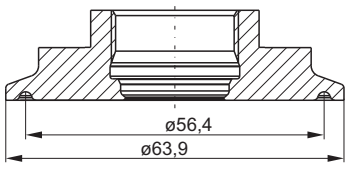
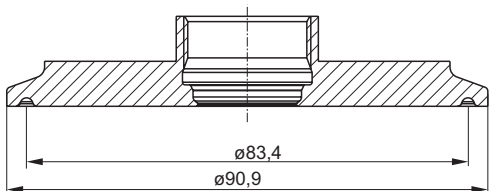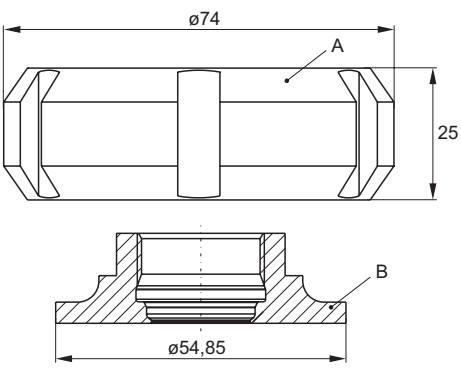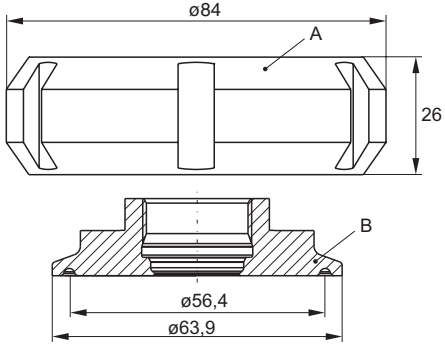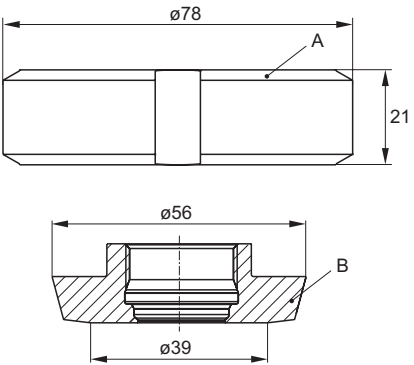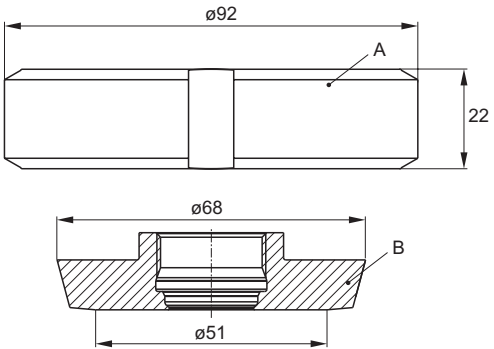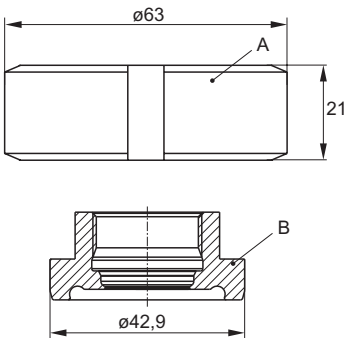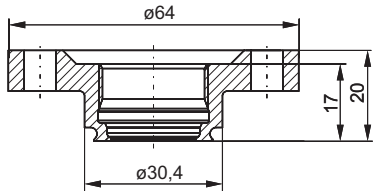| Material	Approval	Temperature range	Option
EPDM Freudenberg 70 EPDM 291	FDA, 3A, USP Cl. VI	– 20 °C to +130 °C (functional) – 20 °C to +121 °C (3A Class. II, USP Cl. VI)	5
FFKM DuPont Kalrez 6221		– 20 °C to +150 °C (functional) – 20 °C to +149 °C (3A Class. I, USP Cl. VI)	6
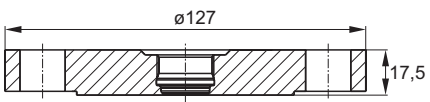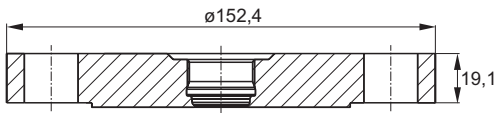
③ **Probe (see Feature 20 in "Ordering information)**
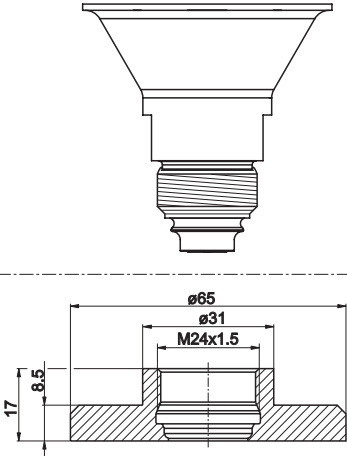
Material	Version	Option
316L (1.4435)	0.76 µm mechanically polished	K, M
	0.38 µm electropolished	S, T
Hastelloy C22	Special version available on request	Y

Process connections – Dimensions and materials

Endress+Hauser supplies DIN/EN flanges made of stainless steel according to AISI 316L (DIN/EN material number 1.4404 or 1.4435). With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1 Tab.18. The chemical composition of the two materials can be identical.

Process connection	Designation	Versions	Approvals	Option
ø43,4 / ø50,4	Tri-clamp ISO2852 DN25-38 (1 to 1-½")* P_{max} = 16 bar Material: 316L (1.4435)			TCJ
ø56,4 / ø63,9	Tri-clamp ISO2852 DN40-51 (2")* P_{max} = 16 bar Material: 316L (1.4435)	■ 0.76 µm ■ 0.38 µm electropolished	■ 🄰 ■ EHEDG ■ ASME-BPE compliant	TDJ
ø83,4 / ø90,9	Tri-clamp ISO2852 DN70-76.1 (3") P_{max} = 10 bar Material: 316L (1.4435)			TFJ
ø74, 25, A, B, ø54,85	SMS 1-½" PN25 with slotted nut* P_{max} = 16 bar Material: A= 1.4307 B= 316L (1.4435)			T7J
ø84, 26, A, B, ø56,4, ø63,9	SMS 2" PN25 with slotted nut* P_{max} = 16 bar Material: A= 1.4307 B= 316L (1.4435)	■ 0.76 µm	■ EHEDG	TXJ

Process connection	Designation	Versions	Approvals	Option
ø78 / A / 21 / ø56 / B / ø39	DIN11851 DN40 PN40 with slotted nut F40* P_{max} = 16 bar Material: A= 1.4307 B= 316L (1.4435)	▪ 0.76 µm		MQJ
ø92 / A / 22 / ø68 / B / ø51	DIN11851 DN50 PN40 with slotted nut F50* P_{max} = 16 bar Material: A= 1.4307 B= 316L (1.4435)		▪ EHEDG	MRJ
ø63 / A / 21 / B / ø42,9	DIN11864-1 A DN25 Pipe DIN11850 with slotted nut F25* P_{max} = 16 bar Material: A= 1.4307 B= 316L (1.4435)	▪ 0.76 µm ▪ 0.38 µm electropolished		MAJ
ø64 / 17 / 20 / ø30,4	NEUMO BioControl DN25 PN16* P_{max} = 16 bar Material: 316L (1.4435)			S1J
ø127 / 17,5	1-1/2" 150lbs RF Flange ANSI B16.5* P_{max} = 16 bar Material: 316L	▪ 0.76 µm		AEJ
ø152,4 / 19,1	2" 150lbs RF Flange ANSI B16.5* P_{max} = 16 bar Material: 316L			AFJ

Process connection	Designation	Versions	Approvals	Option
	Thread M24 x 1.5			U1J
	You need the following weld-in adapter:			
	Weld-in adapter order number: 71041381 P_{max} = 16 bar Material: 316L (1.4435)	Accessory: weld-in adapter ■ 0.76 µm		

3.3 Installation instructions

3.3.1 Mounting tools

A 4 mm Allen key is needed to turn the housing.

3.3.2 General instructions

Normally use rod probes. Rope probes are used for measuring ranges > 4 m and with restricted ceiling clearance which does not allow the installation of rigid probes.

Mounting location
- Do not mount the probe in the filling curtain (2).
- Mount the probe at such a distance away from the wall (B) that, in the event of buildup on the wall, there is still a minimum distance of 100 mm between the probe and the buildup.
- Mount the probe as far away as possible from internals.
- The minimum distance from the probe end to the tank floor is 10 mm.
- If installing outdoors, it is recommended that you use a weather protection cover (1). ("Accessories", → 📄 78).
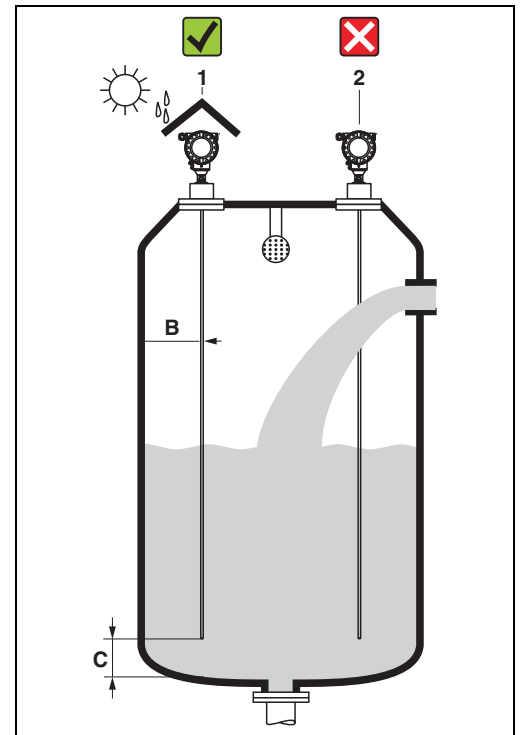
L00-FMP43xxx-17-00-00-xx-001

Tank internals
- If the distance to the internals is < 300 mm, "mapping" must be carried out, and the measurement capability may be restricted.
- During operation, the probe must not touch any internals within the measuring range.

Optimization options
Interference echo suppression: measurement can be optimized by electronically suppressing interference echoes.
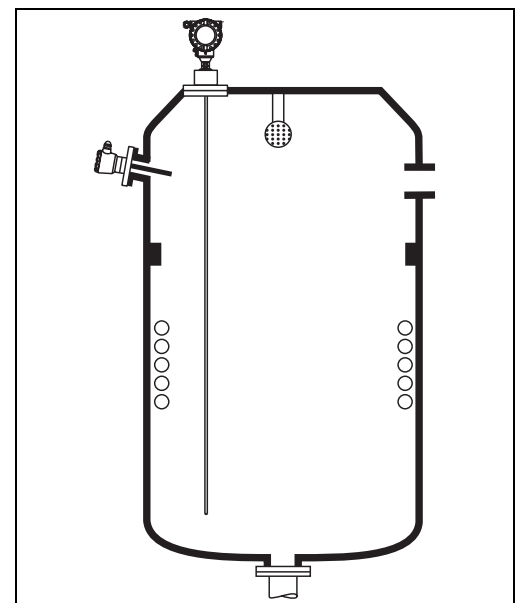
L00-FMP43xxx-17-00-00-xx-002

✎ Note!
You must ensure that the probe does not come into contact with the container wall, container bottom and tank internals.

3.3.3   Special instructions

When installing in tanks with agitator, observe the lateral loading capacity of rod probes:
- 10 Nm with 316L (1.4435)
- 16 Nm with Hasteloy C22 (on request).

The formula for calculating the bending torque M impacting on the probe:

$$M = c_w \cdot \frac{\rho}{2} \cdot v^2 \cdot d \cdot L \cdot (L_N - 0.5 \cdot L)$$

with
c_w : Friction factor
ρ [kg/m^3]: Density of the medium
v [m/s]: Velocity of the medium perpendicular to the probe rod
d [m]: Diameter of the probe rod (8 mm)
L [m]: Level
L_N [m]: Probe length

Calculation example

Friction factor [c_w]	0.9 (on the assumption of a turbulent current (high Reynolds number))
Density [ρ] in kg/m^3	1000 (e.g. water)
Probe diameter [d] in m	0.008
L = L_N (worst case)	

L00-FMP43xxx-16-00-00-xx-003

L00-FMP43xxx-16-00-00-de-004
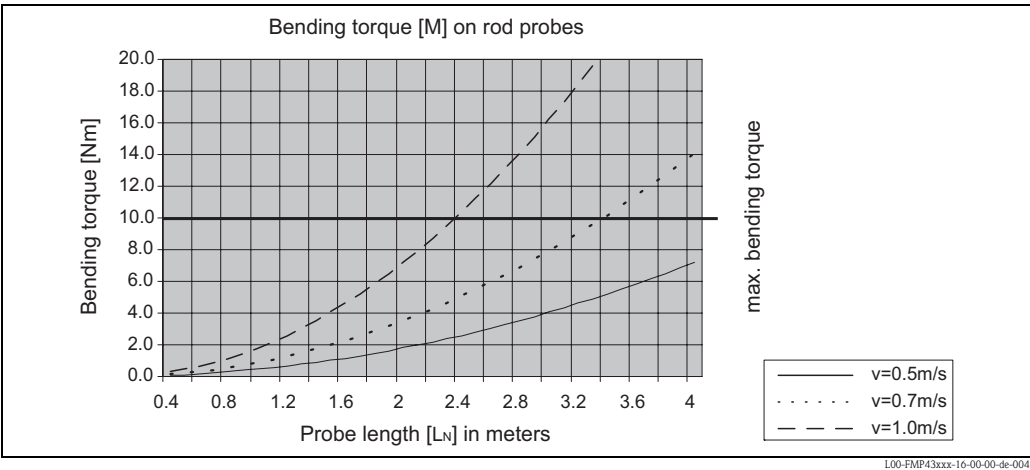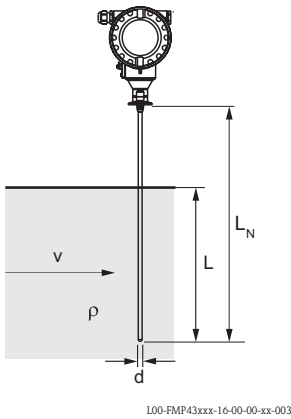
The probe must be mounted opposite the agitator.
If possible, check whether a non-contact process, ultrasonic or level–radar would be better suited, particularly if the agitator generates large mechanical loads on the probe.

L00-FMP43xxx-17-00-00-xx-005
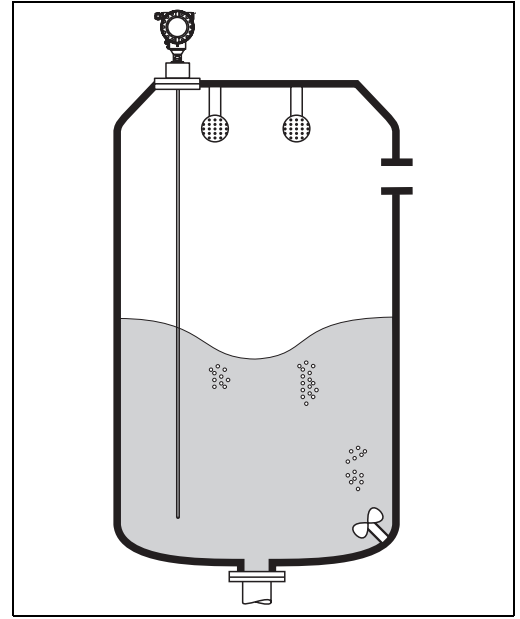
3.3.4 Notes on special installation situations

Installation at an angle
■ For mechanical reasons, the probe should be installed as vertically as possible.
■ With inclined installations the probe length has to be adjusted in dependence to the installation angle.
– up to 1 m = 30°
– up to 2 m = 10°
– up to 4 m = 5°.

L00-FMP4xIxx-17-00-00-en-048
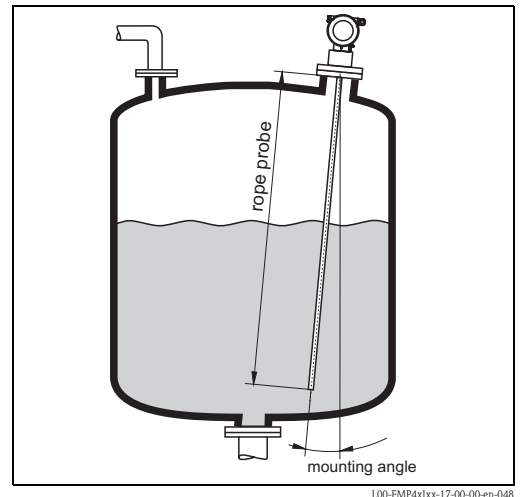
Installation in plastic containers

Please note that the "guided level radar" measuring principle requires a metallic surface at the process connection! When installing rod or robe probe in plastic silos, whose silo cover is also made of plastic or silos with wood cover, the probes must either be mounted in a ≥ DN50 (2") metallic flange, or a metal sheet with diameter of ≥ 200 mm must be mounted under the screw-in piece.
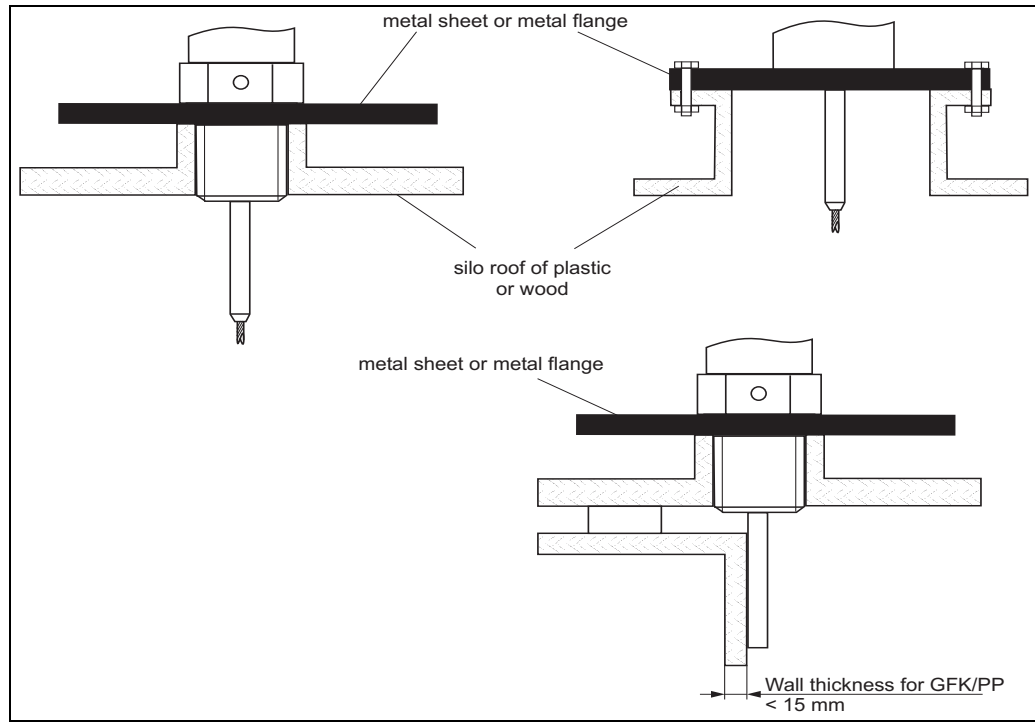
L00-FMP4xxxx-17-00-00-en-018

3.3.5   Installation with difficult-to-access process connections

Installation with remote electronics

- Wall and pipe bracket is contained in the scope of delivery and is already mounted.
- Mount the housing on the wall or pipe (vertically or horizontally, as required) as shown in the diagram.
- The wall retainer can also be used for mounting in display panels.
  Please observe the dimensions, → ▤ 10 for the cutout.
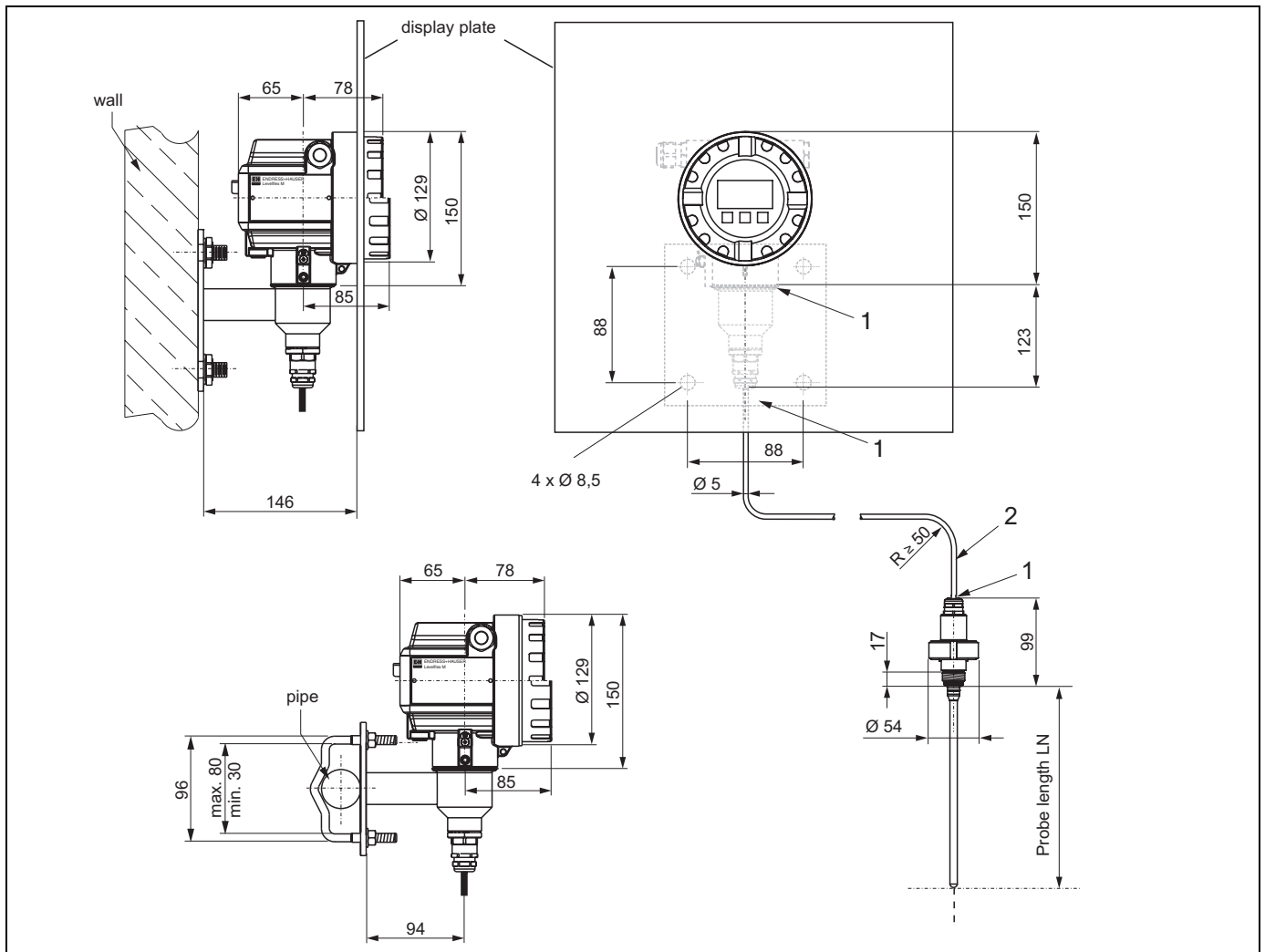
L00-FMP43xxx-17-00-00-en-002

✐ **Note!**
The cable cannot be disassembled at these points (1).
The cable should never be bent or buckled.

The ambient temperature for the connecting line (2) between the probe and electronics can be max. 105 °C. The version with remote electronics consists of the probe, a connecting cable and the housing. If they are ordered as a set, they are assembled on delivery.

3.3.6   Turning the housing

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

L00-FMP41Cxx-17-00-00-en-002
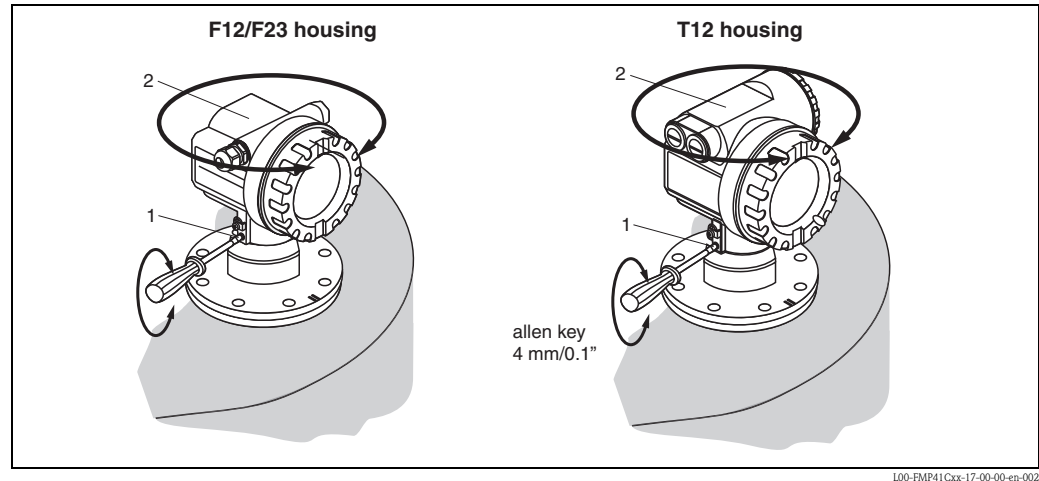
3.4   Post-installation check

After the measuring device has been installed, perform the following checks:
- Is the device damaged (visual inspection)?
- Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range, etc.?
- Are the measuring point number and labeling correct (visual inspection)?
- Is the device adequately protected against rain and direct sunlight (→ 🖺 78)?

3.5   Cleaning of the probe

3.5.1   Cleaning of the probe in the tank

Installation close to tank wall
By installing the probe close to the tank wall, the cleaning effect is improved in cases where a spray ball is used. The cleaning jet is deflected against the tank wall and onto the probe. This means that those parts of the probe are cleaned which would normally not be reached by the spray ball jet. If the probe is positioned in this way, only one spray ball is needed.
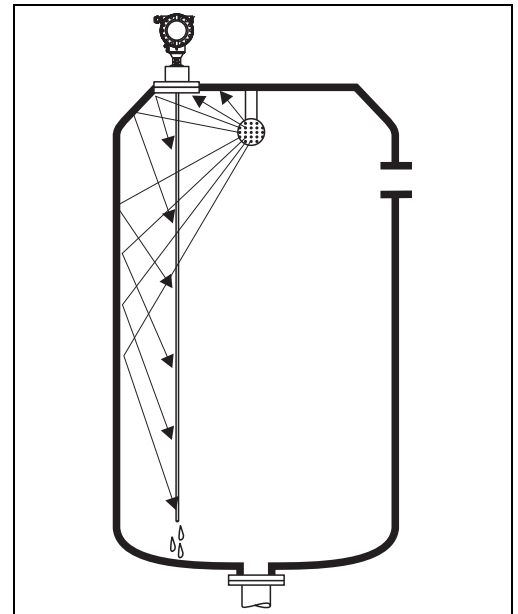
L00-FMP43xxx-17-00-00-xx-003

Installation in the center of the tank
If the probe is mounted in the center of the tank, it may be necessary to use a second spray ball. The spray balls should then be mounted to the left and right of the probe.
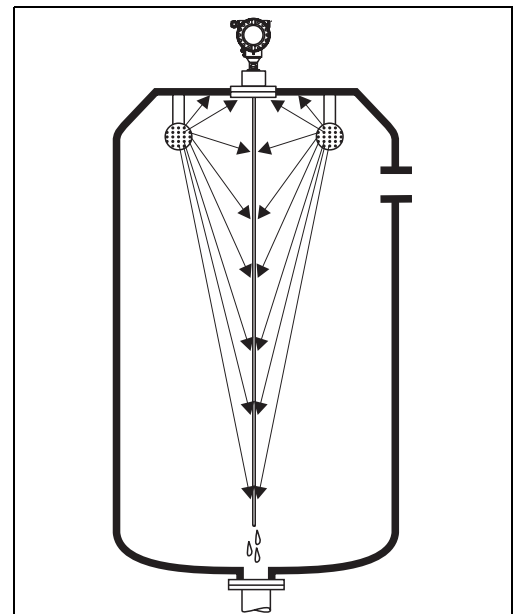
L00-FMP43xxx-17-00-00-xx-004

3.5.2   Cleaning of the probe outside of the tank

The probe can be disassembled so it can be cleaned better.

The disassembly requires the following tools:
- Note!
  vise with fiber braces (surface protection for the polished probe rod)
- hook wrench for sanitary process connections (diary or SMS)
- open–ended wrench AF27 ∕ AF32 with a torque adjustement up to 20 Nm

Before disassembly, it has to be make sure that the supply voltage for the device is switched off!
- Note!
  Disassembling the housing for calibration purposes:
  When releasing the slotted nut ① make sure to counterhold at the process connection ring ⑤ with an open–ended wrench as the adapter ③ could otherwise be released from the flange. In hazardous or contaminated areas, seal the adapter with a protective cover ⑦ ("Accessories", → 🖺 78) (20 Nm) and integrate into the local potential equalization where necessary.
- Unscrew the grooved nut ① with hook wrench.
- Remove the unscrewed housing ② together with the housing adapter from the adapter ③ of the process connection. The housing adapter is still connected with the housing. At the remote version: remove only the cable adapter.
- Replace O–ring ⑧ where necessary.
  Order number, → 🖺 86

Disassembly of rod probe:
- Unscrew adapter ③ from the process connection (as example: flange): unscrew adapter at the wrench flats with hook wrench (AF27) and pull it out of the tank together with the rod probe (length max. 4 m).
- Probe rod ④
  – without wrench flats (until 2009):
    clamp the probe rod in a vise.
  – with wrench flats (from 2009 onwards):
    clamp the probe rod at the wrench flats or use a fitting pliers.
  Caution:
  Protect the surface of the polished probe rod! Do not damage the surface by scratching or denting it.
- unscrew adapter ③ from the probe rod (approx. 12 rotations counter–clockwise and remove (plug connection). The probe rod is screwed in the insulating bush with 4.5 Nm.
- The O–rings ⑥ of the probe rod and adapter are now free accessible respectively changeable. The probe rod can be cleaned (autoclaved).
  O–ring order numbers, → 🖺 86.
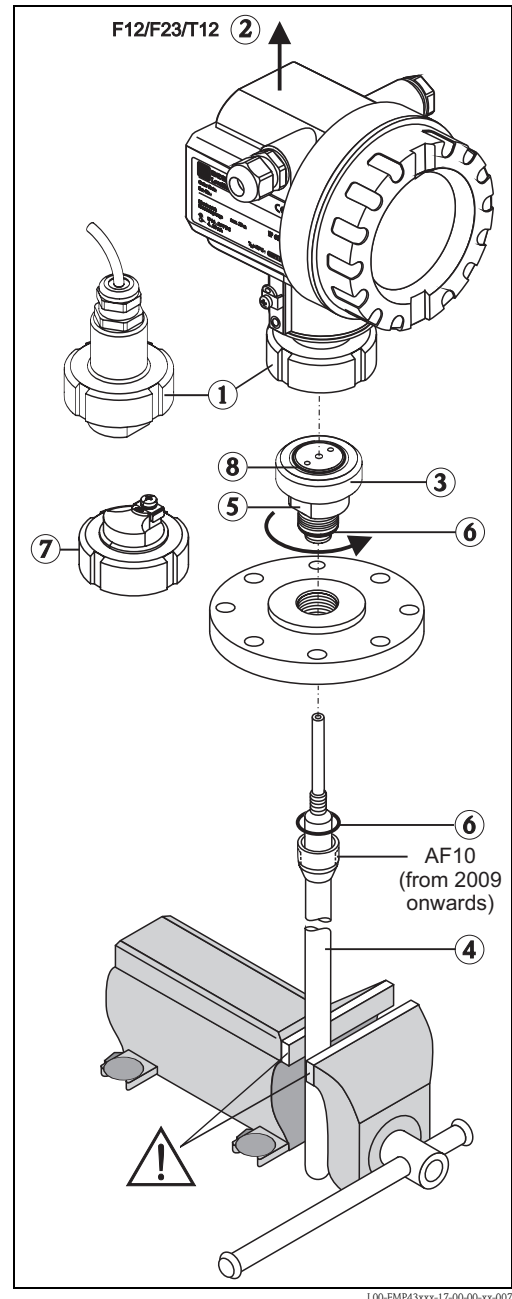
L00-FMP43xxx-17-00-00-xx-007

Assembly of the probe

The assembly is done in reversed order:
- screw adapter ③ with 4.5 Nm on the probe rod ④
- screw the adapter into the container process connection together with the probe rod and tighten with 20 Nm
- stick housing ② with housing adapter on the adapter and bolt it with the grooved nut ① - torque 20 Nm

4   Wiring

4.1   Quick wiring guide

Notes on PROFIBUS PA installation can be found in the operating manual BA034S/04/EN.

Wiring in F12/F23 housing

Caution!

Before connection please note the following:

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

- Connect potential matching line to transmitter ground terminal (7) before connecting up the device.

- Tighten the locking screw (8):
  It forms the connection between the antenna and the housing earth potential.
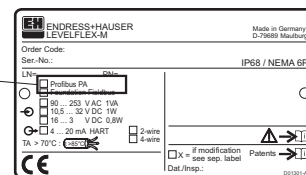
When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's).
Make sure you use the specific cable gland.

EX

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

- Housing F12 - Ex ia:
  Power supply must be intrinsically safe.

- The electronics and the current output are galvanically separated from the probe circuit.

Connect up the Levelflex M as follows:

- Unscrew housing cover (2).

- Remove any display (3) if fitted.

- Remove cover plate from terminal compartment (4).

- Pull out terminal module slightly using pulling loop.

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

EX

Only ground 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).
  (on dust-Ex torque » 40 Nm).

L00-FMP41Cxx-04-00-00-de-003
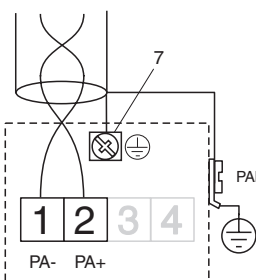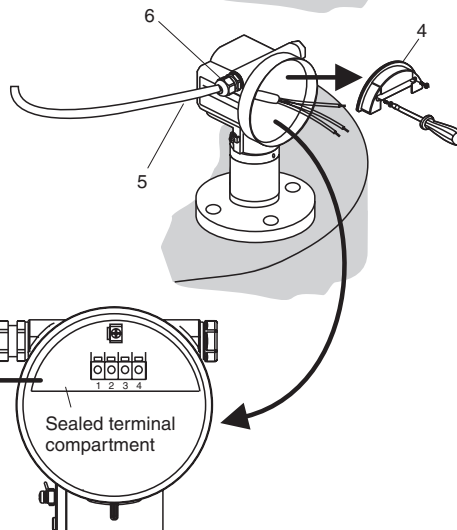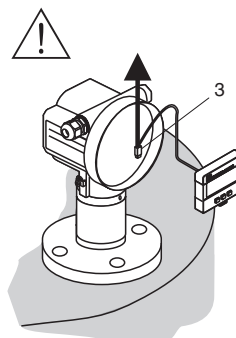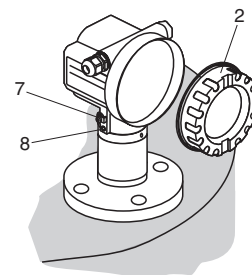
Wiring in T12 housing

Caution!

Before connection please note the following:

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

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

- Tighten the locking screw:
  It forms the connection between the probe 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

Connect up the Levelflex M as follows:

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

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

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.
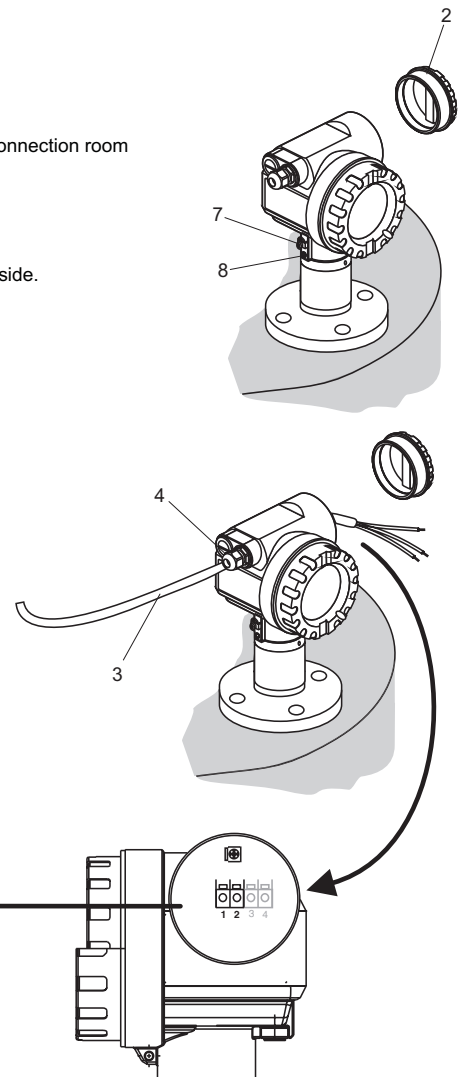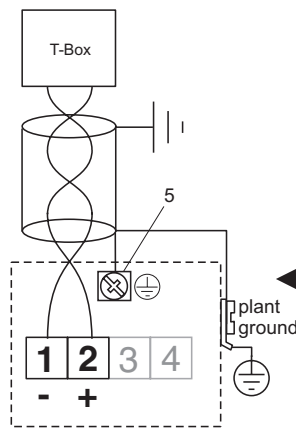
L00-FMP41Cxx-04-00-00-de-004
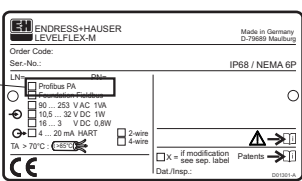
Wiring with M12 connector

Before connection please note the following:

Caution!

- PROFIBUS devices are marked on the nameplate (1). The voltage is determined by the PROFIBUS standard and the desired safety concept. (see chapter 4.3).
- Connect potential matching line to transmitter earth terminal before connecting up the device.
- Tighten the locking screw:
  It forms the connection between the probe 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 - Ex ia:
  Power supply must be intrinsically safe.
- The electronics and the current output are galvanically separated from the antenna circuit.
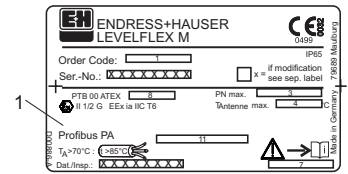
The Levelflex M is connected as follows:

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

L00-FMP40xxx-04-00-00-de-004

Cable specification PROFIBUS

Twisted, screened pairs must be used. The following specification must be met for explosion hazardous application (EN 50020, FISCO model):

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

The following cable types can be used, for example

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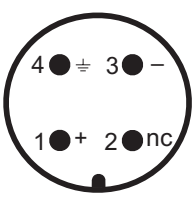
Ex-area:
- Siemens 6XV1 830–5AH10
- Belden 3076F
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Connector

For the versions with a connector, the housing does not have to be opened for connecting the signal line.

PIN assignment for M12 connector

PIN	Meaning
1	Signal +
2	Not assigned
3	Signal –
4	Earth

A0011175

4.2 Connecting the measuring unit

4.2.1 Terminal compartment

Three housings are available:
- Aluminum housing F12 with additionally sealed terminal compartment for:
  – standard
  – Ex ia
- Aluminum housing T12 with separate terminal compartment for:
  – standard
  – Ex e
  – Ex d
  – Ex ia (with overvoltage protection)
- Stainless steel 316L (1.4435) housing F23 for:
  – standard
  – Ex ia

After mounting, the housing can be turned 350° in order to ease access to the display and the terminal compartment.

L00-FMR2xxxx-04-00-00-en-019
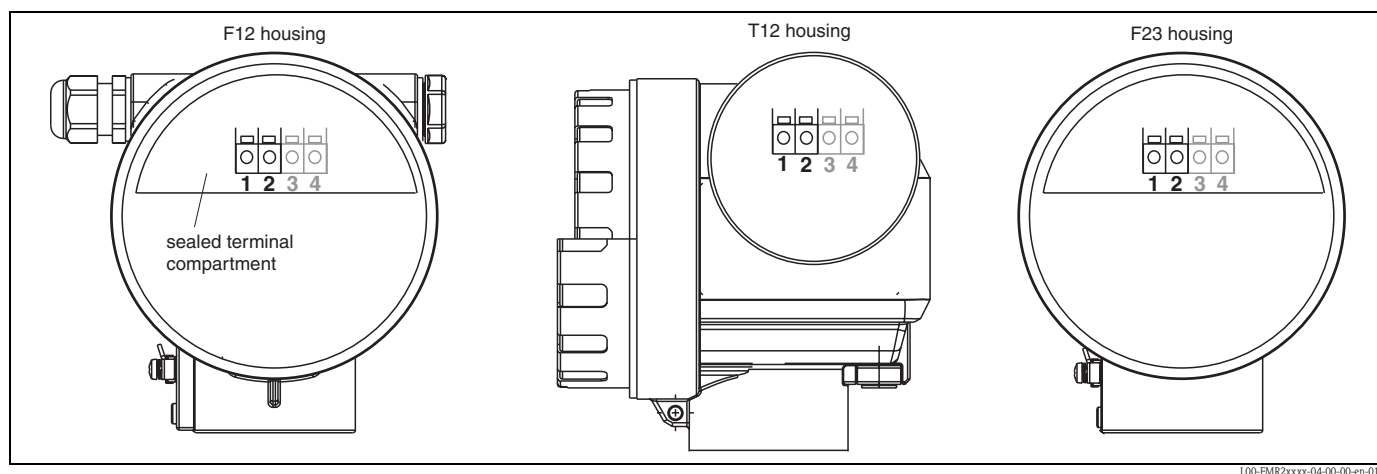
The device data are given on the nameplate together with important information regarding the analog output and power supply.
Housing orientation regarding the wiring see "Turning the housing", → 🗐 20.

4.2.2 Ground connection

It is necessary to make a good ground connection to the ground terminal on the outside of the housing, in order to achieve EMC security.

4.2.3 Cable gland

Type		Clamping area
Standard, Ex ia, IS	Plastic M20x1.5	5...10 mm
Ex em, Ex nA	Metal M20x1.5	7...10.5 mm

4.2.4 Terminals

For wire cross-sections of 0.5 to 2.5 mm^2

4.2.5   Cable entry

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

4.2.6   Supply voltage

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

Type	Terminal voltage
Standard	9 V to 32 V
Ex ia (FISCO model)	9 V to 17.5 V
Ex ia (Entity concept)	9 V to 24 V

Supply voltage	9 V to 32 V [1]
Lift-off voltage	9 V

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

4.2.7   Current consumption

Approx. 11 mA for the range of voltages given above.

4.2.8   Overvoltage protection

If the measuring device is used for the level measurement in flammable liquids which requires the
use of an overvoltage protection according to EN/IEC 60079-14 or EN/IEC 60060-1
(10 kA, Puls 8/20 µs) it has to be ensured that
- the measuring device with integrated overvoltage protection with gas discharge tubes within the
  T12-enclosure is used, refer to "Ordering structure", → 📄 6
  or
- this protection is achieved by the use of other appropriate measures (external protection devices
  e.g. HAW562Z).

4.2.9   Connection with M12 plug

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

4.3   Recommended connection

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

Caution!
Applications, which are subject to the explosion prevention, permit only under special conditions the repeated grounding of the protective screen , see to EN 60079-14.

4.4   Degree of protection

- with closed housing tested according to:
  - all housings:
    - IP68, NEMA6P (24 h at 1,83 m under water)
    - IP66, NEMA4X
  - F23 housing: additionally IP69K in connection with M20, G½ and NPT½ cable entries
- with open housing: IP20, NEMA1 also ingress protection of the display)

Caution!
Degree of protection IP68 NEMA6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in.

4.5   Post-connection check

After wiring the measuring device, perform the following checks:
- Is the terminal assignment correct (→ 🗎 24, 25)?
- Is the cable gland tight?
- Is the M12 connector screwed tight?
- Is the housing cover screwed tight?
- If power is supplied:
  Is the device ready for operation and is the LCD display lit?

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 f**unction** (e.g. "tank shape (002)") is selected.

   Note!
   The active selection is marked by a ✔ in front of the menu text.

3.) Activate Edit mode with + or −.

   Selection menus:
   a) Select the required **Parameter** in selected **function** (e.g. "tank shape (002)") with − or +.
   b) E confirms selection ➜ ✔ appears in front of the selected parameter
   c) E confirms the edited value ➜ system quits Edit mode
   d) + / − (= ⌐Esc⌐ −+) interrupts selection ➜ system quits Edit mode

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

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

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

   Press + / − (= ⌐Esc⌐ −+) twice ➜ return to **Group selection**

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

L00-FMP4xxxx-19-00-00-en-001

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 device are split up roughly into different function groups. The function groups that are available include: "**basic setup**", "**safety settings.**", "**output**", "**display**", etc.
- **Functions (001, 002, 003, ..., 0D8, 0D9):**
  Each function group consists of one or more functions. The actual operation or configuration of the device takes place in the functions. Numerical values can be entered here and parameters can be selected and saved. The available functions of the "**basic setup**" **(00)** function group include: "**tank properties**" **(002)**, "**medium property**" **(003)**, "**process propert.**" **(004)**, "**empty calibr.**" **(005)**, etc.

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

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

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

5.1.2   Identifying the functions

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


```
empty calibr.          005  ───►   005
     5.000 m
distance process
conn. to min. level          Function group        Function
```
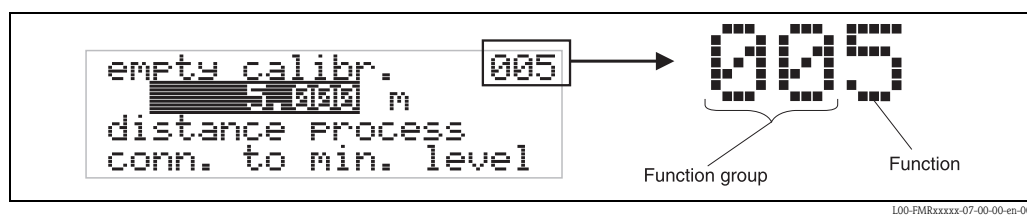
L00-FMRxxxxx-07-00-00-en-005

The first two digits identify the function group:
- **Basic setup**   00
- **safety settings**   01
- **Linearization**   04

...

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

• **Basic setup**	00	→	• **Tank properties**	002
			• **Medium property**	003
			• **Process propert.**	004
			...	

In the following section, the position is always given in brackets (e.g. "**tank properties**" **(002)**) after the function described.

5.2 Display and operating elements

5.2.1 Liquid crystal display (LCD)

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

L00-FMxxxxxx-07-00-00-en-001
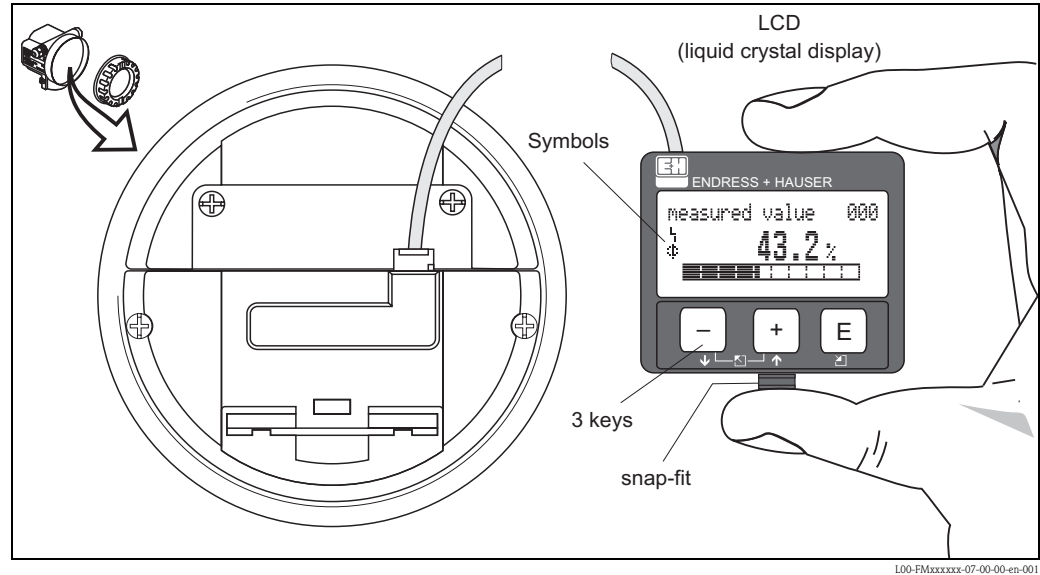
The VU331 LCD display can be removed to ease operation by simply pressing the snap–fit (see graphic above). It is connected to the device by means of a 500 mm cable.

5.2.2 Display

L00-FMRxxxxx-07-00-00-de-007
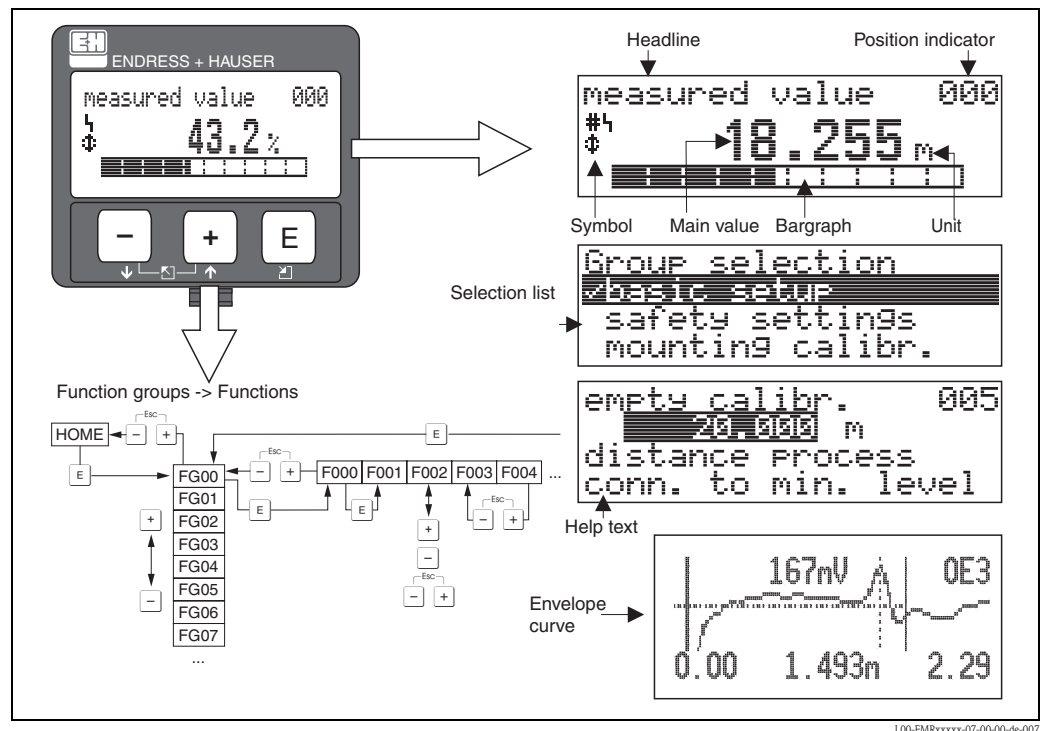
5.2.3   Display symbols

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

Symbol	Meaning
⌊ᵢ	**ALARM_SYMBOL** This alarm symbol appears when the device is in an alarm condition. If the symbol flashes, this indicates a warning.
🔒	**LOCK_SYMBOL** This lock symbol appears when the device is locked, i.e. if no entries are possible.
✛	**COM_SYMBOL** This communication symbol appears when data are being transmitted e.g. via HART, PROFIBUS PA or FOUNDATION Fieldbus.

5.2.4   Key assignment

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

Function of the keys

| Key(s)	Meaning
+ or ↑	Navigate upwards in the selection list. Edit numeric value within a function.
− or ↓	Navigate downwards in the selection list. Edit numeric value within a function.
− + or ⤺	Navigate to the left within a function group.
E	Navigate to the right within a function group, confirmation.
+ and E or − and E	Contrast settings of the LCD.
+ and − and E	Hardware locking/unlocking After a hardware lock, an operation of the device via display and communication is not possible! The hardware can only be unlocked via the display. A release code must be entered for this purpose.

5.3 Local operation

5.3.1 Locking the configuration mode

The Levelflex can be protected in two ways against unauthorized changing of device data, numerical values or factory settings:

Function "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 indicated on the display by the ⌁ symbol and can be released again either via the display or by communication.

Hardware locking:

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

Press ⊞, ⊟ and E simultaneously

The LOCK_SYMBOL appears on the LCD
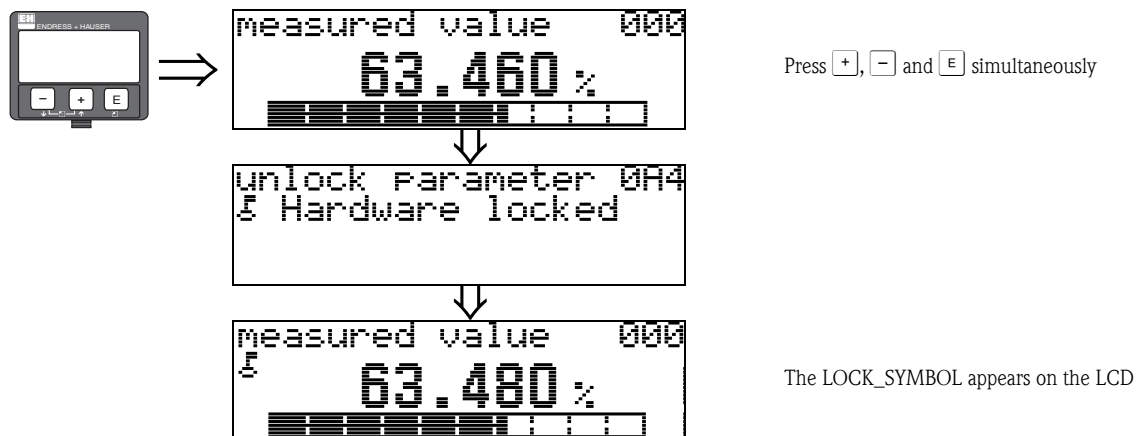
5.3.2   Unlocking the configuration mode

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

Function "unlock parameter" (0A4):

By entering the release code (on the display or via communication)

2457 = for PROFIBUS PA devices

the Levelflex is released for operation.

Hardware unlocking:

After pressing the $\boxed{+}$, $\boxed{-}$ and $\boxed{E}$ keys at the same time, the user is asked to enter the release code

2457 = for PROFIBUS PA devices

	measured value 000 63.480 %	Press $\boxed{+}$, $\boxed{-}$ and $\boxed{E}$ simultaneously
	unlock parameter 0A4 100	Please enter release code and confirm with $\boxed{E}$
	measured value 000 63.460 %	
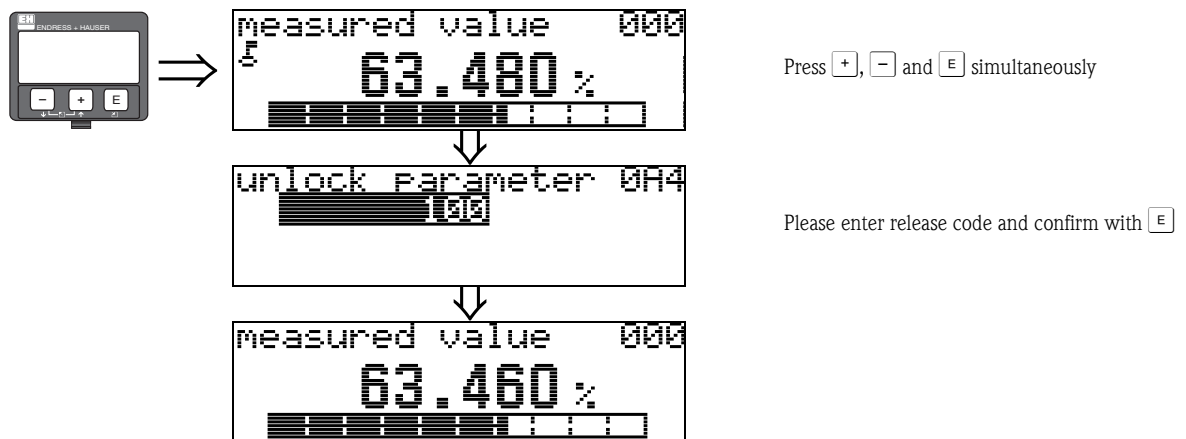
Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization.
Please contact Endress+Hauser if you have any questions.

5.3.3 Factory settings (reset)

Caution!
A reset sets the device 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 device...
- ...no longer works
- ...must be moved from one measuring point to another
- ...is being removed/put into storage/installed

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

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

- 33 333 = customer parameters

33 333 = reset customer parameters

This reset is recommended whenever a device with an unknown "history" is to be used in an application:
- The Levelflex is reset to the default values.
- **A customer-specific tank map is not deleted.**
- The mapping can be deleted in the "**cust. tank map**" **(055)** function of the "**extended calibr**" **(05)** function group.
- A linearization is switched to "**linear**" but the table values are retained. The table can be reactivated in the "**linearization**" **(04)** function group.

List of functions that are affected by a reset:

- Tank properties (002)
- Medium property (003)
- Process proper. (004)
- Empty calibr. (005)
- Full calibr. (006)
- Output on alarm (010)
- Outp. echo loss (012)
- Ramp %span/min (013)
- Delay time (014)
- Safety distance (015)
- In safety dist. (016)
- Overfill protection (018)
- End of probe (030)
- Level/ullage (040)
- Linearization (041)
- Customer unit (042)

- Max. scale (046)
- Diameter vessel (047)
- Check distance (051)
- Range of mapping (052)
- Start mapping (053)
- Offset (057)
- Output damping (058)
- Language (092)
- Back to home (093)
- Format display (094)
- No of decimals (095)
- Sep. character (096)
- Unlock parameter (0A4)
- application par (0A8)
- tag no (0C0)

A complete "**basic setup**" **(00)** must be activated.

5.4   Displaying and acknowledging error messages

5.4.1   Type of error

Errors that occur during commissioning or operation 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 the following types of error:
- **A (Alarm):**
  Device assumes a defined state (e.g. max 22 mA)
  Indicated by a constant ⌐ symbol.
  (For a description of the codes, → ▤ 82)
- **W (Warning):**
  Device continues to measure, error message is displayed.
  Indicated by a flashing ⌐ symbol.
  (For a description of the codes, → ▤ 82)
- **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, → ▤ 82)
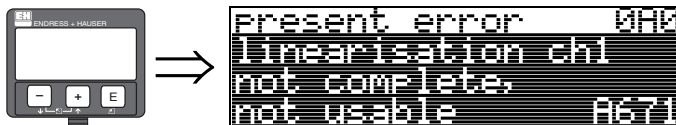
Error messages

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, → ▤ 82.
- The "**diagnostics**" **(0A)** function group can display the current error as well as the last error that occurred.
- If several errors are currently pending, use ⊞ or ⊟ to scroll through the error messages.
- The last error to occur can be deleted in the "**diagnostics**" **(0A)** function group
  with the function "**clear last error**" **(0A2)**.

5.5 PROFIBUS PA communication

5.5.1 Synopsis
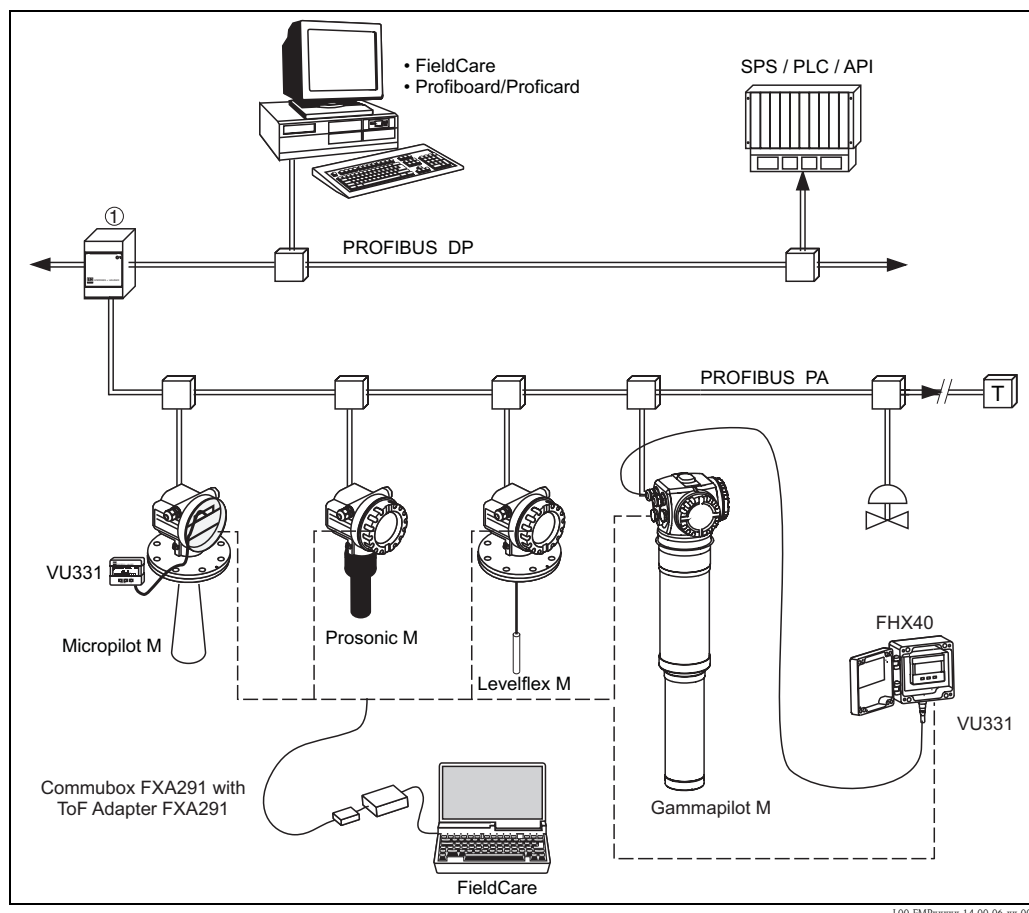
L00-FMPxxxxx-14-00-06-xx-007

A maximum of 32 transmitters can be connected to the bus (only 10 in explosion hazardous areas Ex ia IIC according to the FISCO model). The bus power is supplied by the segment coupler. On-site as well as remote operation are possible. For detailed information on the PROFIBUS PA standard refer to Operation Instructions BA034S/04/EN and the standards EN 50170/DIN 19245 (PROFIBUS PA) and EN 50020 (FISCO model).

5.5.2   Device address

Selecting the device address

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

Software addressing

Software addressing comes into operation, when DIP–switch 8 is in the position "ON".
BA034S/04/EN describes, how to set the address in this case.

Hardware addressing

L00-FMU4xxxx-19-00-00-en-014
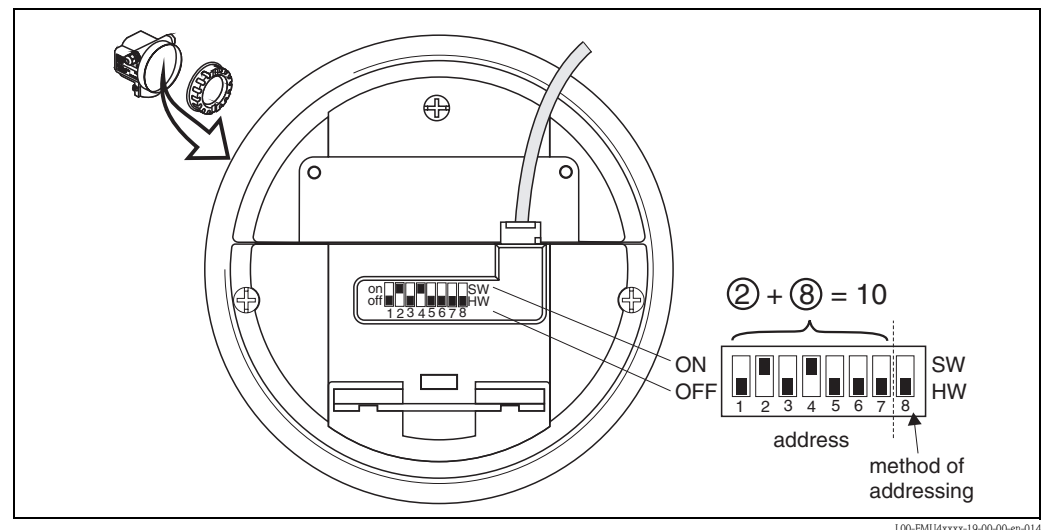
Hardware addressing comes into operation, when DIP switch 8 is in the position "HW (OFF)". In this case the address is determined by the position of DIP–switches 1 to 7 according to the following table:

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

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

5.5.3   Device database and type files (GSD)

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

Source of supply

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

Directory structure

The files are oranized in the folowing strucutre:

```
Levelflex_M/PA/Profile3/Revision1.0/
                               ├──BMP/
                               │      ├──Eh152D_d.bmp
                               │      ├──Eh152D_n.bmp
                               │      └──Eh152D_s.bmp
                               ├──DIB/
                               │      ├──Eh152D_d.dib
                               │      ├──Eh152D_n.dib
                               │      └──Eh152D_s.dib
                               ├──GSD/
                               │      ├──Extended/Eh3x152D.gsd
                               │      └──Standard/Eh3_152D.gsd
                               ├──Typdat5x/Eh3152Dx.200
                               └──Info/
                                      ├──Liesmich.pdf
                                      └──Readme.pdf
```

L00-FMP4XXXX-02-00-00-YY-001
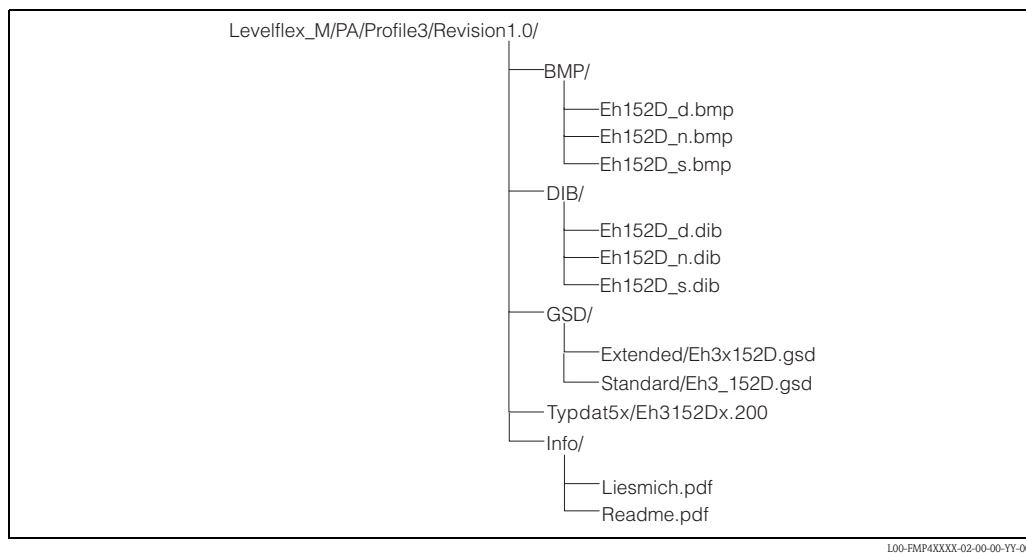
- The GSD files in the directory "Extended" are needed for the network design software STEP 7 of the S7-300/400 PLC family.
- The GSD files in the directory "Standard" are used for PLCs, which do not support an identifier format but only an identifier byte (e.g. PLC5 of Allen-Bradley)
- For the network design tool COM ET200 with Siemens S5 instead of an GSD file the Type file "EH_3152Dx.200" and instead of the BMP files the DIB files have to be used.

Universal Database File

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

5.5.4   Cyclic data exchange

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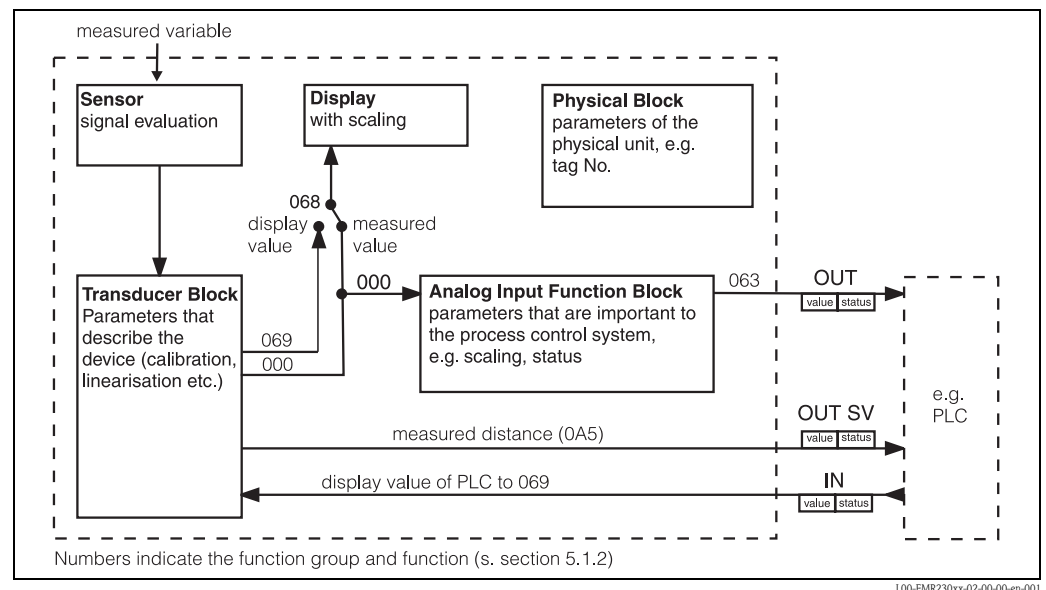
L00-FMR230xx-02-00-00-en-001

The block model shows, which data are exchanged continuously (i.e. by cyclic data transfer) between the Levelflex M and the PLC. The numbers refer to the function groups and functions:
- After linearization and integration in the transducer block the "**measured value**" **(000)** is transmitted to the Analog–Input Block. There, it may be scaled and checked for limit transgression, and is written out over "**OUT value**" **(063)** to the PLC.
- The function "**select V0H0**" (068) determines whether at the display of the device in the field for the main measured value the "**measured value**" **(000)** or the value from the PLC "**display value**" **(069)** are displayed.

Modules for the cyclic data telegram

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

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

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

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

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

Configuration of the cyclic data telegram

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

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

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

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

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

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

Structure of the input data (Levelflex M → PLC)

The input data are transmitted according to the following structure:

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

Structure of the output data (PLC → Levelflex M)

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

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

IEEE–745 Floating Point Number

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

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

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

Example:

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

Status codes

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

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

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

5.5.5   Acyclic data exchange

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

Acyclic data exchange is used
- to transmit device parameters during commissioning and maintenance;
- to display measured values that are not acquired in cyclic traffic.

There are two types of acyclic data exchange:

Acyclic communication with a Class 2 master (MS2AC)

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

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

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

Acyclic communication with a Class 1 master (MS1AC)

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

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

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

The Levelflex M supports MS2AC communication with two SAP´s.
The Levelflex M does not support MS1AC communication.

5.5.6   Slot/index tables

Device Management

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

Analog–Input–Block

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		1	16	20	DS–32*	X		constant
Static revision		1	17	2	UNSIGNED16	X		non–vol.
Instrument tag		1	18	32	OSTRING	X	X	static
Strategy		1	19	2	UNSIGNED16	X	X	static
Alert key		1	20	1	UNSIGNED8	X	X	static
Target Mode		1	21	1	UNSIGNED8	X	X	static
Mode		1	22	3	DS–37*	X		dynamic non–vol. constant
Alarm summary		1	23	8	DS–42*	X		dynamic
Batch		1	24	10	DS–67*	X	X	static
Gap		1	25					
Block parameters								
Out	V6H2 (Wert) V6H3 (Status)	1	26	5	DS–33*	X		dynamic
PV Scale		1	27	8	Array of FLOAT	X	X	static
Out Scale		1	28	11	DS–36*	X	X	static
Linearisation type		1	29	1	UNSIGNED8	X	X	static
Channel		1	30	2	UNSIGNED16	X	X	static
Gap		1	31					
PV fail safe time		1	32	4	FLOAT	X	X	non–vol.
Fail safe type		1	33	1	UNSIGNED8	X	X	static
Fail safe value		1	34	4	FLOAT	X	X	static
Alarm Hysteresis		1	35	4	FLOAT	X	X	static
Gap		1	36					
HI HI Limit		1	37	4	FLOAT	X	X	static
Gap		1	38					
HI Limit		1	39	4	FLOAT	X	X	static
Gap		1	40					
LO Limit		1	41	4	FLOAT	X	X	static
Gap		1	42					

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
LO LO Limit		1	43	4	FLOAT	X	X	static
Gap		1	44–45					
HI HI Alarm		1	46	16	DS–39*	X		dynamic
HI Alarm		1	47	16	DS–39*	X		dynamic
LO Alarm		1	48	16	DS–39*	X		dynamic
LO LO Alarm		1	49	16	DS–39*	X		dynamic
Simulate		1	50	6	DS–51*	X	X	non–vol.
Out unit text		1	51	16	OSTRING	X	X	static

Physical Block

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		0	16	20	DS–32*	X		constant
Static revision		0	17	2	UNSIGNED16	X		non–vol.
Instrument tag		0	18	32	OSTRING	X	X	static
Strategy		0	19	2	UNSIGNED16	X	X	static
Alert key		0	20	1	UNSIGNED8	X	X	static
Target mode		0	21	1	UNSIGNED8	X	X	static
Mode		0	22	3	DS–37*	X		dynamic non–vol. constant
Alarm summary		0	23	8	DS–42*	X		dynamic
Block parameters								
Software revision		0	24	16	OSTRING	X		constant
Hardware revision		0	25	16	OSTRING	X		constant
Instrument manufacturer ID		0	26	2	UNSIGNED16	X		constant
Instrument ID		0	27	16	OSTRING	X		constant
Instrument serial number		0	28	16	OSTRING	X		constant
Diagnosis		0	29	4	OSTRING	X		dynamic
Diagnosis extension		0	30	6	OSTRING	X		dynamic
Diagnosis mask		0	31	4	OSTRING	X		constant
Diagnosis mask ext.		0	32	6	OSTRING	X		constant
Instrument certification		0	33	32	OSTRING	X	X	constant
Security locking	V9H9	0	34	2	UNSIGNED16	X	X	non–vol.
Factory reset	V9H5	0	35	2	UNSIGNED16		X	non–vol.
Descriptor		0	36	32	OSTRING	X	X	static
Instrument message		0	37	32	OSTRING	X	X	static
Instrument instal. date		0	38	8	OSTRING	X	X	static
Gap reserved		0	39					
Ident number select	V6H0	0	40	1	UNSIGNED8	X	X	static
HW write protection		0	41	1	UNSIGNED8	X	X	dynamic

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Gap reserved		0	42-53					
Endress+Hauser-Parameters								
error code		0	54	2	UNSIGNED16	X		dynamic
last error code		0	55	2	UNSIGNED16	X	X	dynamic
Up Down features		0	56	1	OSTRING	X		constant
Up Down control		0	57	1	UNSIGNED8		X	dynamic
Up Down param		0	58	20	OSTRING	X	X	dynamic
Bus address		0	59	1	UNSIGNED8	X		dynamic
Instrument SW No.		0	60	2	UNSIGNED16	X		dynamic
set unit to bus		0	61	1	UNSIGNED8	X	X	static
input value		0	62	6	FLOAT+U8+U8	X		dynamic
Select Main value		0	63	1	UNSIGNED8	X	X	dynamic
PA profile revision		0	64	16	OSTRING	X		constant

Endress+Hauser specific level transducer block

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameter								
Block data		1	130	20	DS-32*	x		constant
Static revision		1	131	2	UNSIGNED16	x		non-vol.
Instrument tag		1	132	32	OSTRING	x	x	static
Strategy		1	133	2	UNSIGNED16	x	x	static
Alert key		1	134	1	UNSIGNED8	x	x	static
Target mode		1	135	1	UNSIGNED8	x	x	static
Mode		1	136	3	DS-37*	x		dynamic / non-vol./ static
Alarm summary		1	137	8	DS-42*	x		dynamic
Endress+Hauser parameters								
Measured value	V0H0	1	138	4	FLOAT	x		dynamic
Gap			139					
Tank properties	V0H2	1	140	1	UNSIGNED8	x	x	static
Application parameter	V0H3	1	141	1	UNSIGNED8	x	x	static
Process properties	V0H4	1	142	1	UNSIGNED8	x	x	static
Empty calibration	V0H5	1	143	4	FLOAT	x	x	static
Full calibration	V0H6	1	144	4	FLOAT	x	x	static
Tube diameter	V0H7	1	145	4	FLOAT	x	x	static
Gap			146 – 147					
Output on alarm	V1H0	1	148	1	UNSIGNED8	x	x	static
Gap			149					
Outp. echo loss	V1H2	1	150	1	UNSIGNED8	x	x	static
Ramp %span/min	V1H3	1	151	4	FLOAT	x	x	static

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Delay time	V1H4	1	152	2	UNSIGNED16	x	x	static
Safety distance	V1H5	1	153	4	FLOAT	x	x	static
In safety dist.	V1H6	1	154	1	UNSIGNED8	x	x	static
Reset self holding	V1H7	1	155	1	UNSIGNED8	x	x	static
Operating mode	V1H8	1	156	1	UNSIGNED8	x	x	static
Brocken probe det.	V1H9	1	157	1	UNSIGNED8	x	x	static
End of probe	V2H0	1	158	1	UNSIGNED8	x	x	static
Probe shortened	V2H1	1	159	1	UNSIGNED8	x	x	static
Probe free	V2H2	1	160	1	UNSIGNED8	x	x	static
Probe length	V2H3	1	161	4	FLOAT	x	x	static
Probe length setup	V2H4	1	162	1	UNSIGNED8	x	x	static
Gap		1	163-167					
Level/ullage	V3H0	1	168	1	UNSIGNED8	x	x	static
Linearisation mode	V3H1	1	169	1	UNSIGNED8	x	x	static
Customer unit	V3H2	1	170	1	UNSIGNED16	x	x	static
Table no.	V3H3	1	171	1	UNSIGNED8	x	x	static
Input level	V3H4	1	172	4	FLOAT	x	x	static
Input volume	V3H5	1	173	4	FLOAT	x	x	static
Max. volume	V3H6	1	174	4	FLOAT	x	x	static
Cylinder vessel	V3H7	1	175	4	FLOAT	x	x	static
Gap		1	176-177					
Selection	V4H0	1	178	1	UNSIGNED8	x	x	static
check distance	V4H1	1	179	1	UNSIGNED8	x	x	static
Range of mapping	V4H2	1	180	4	FLOAT	x	x	static
Mapping rec start	V4H3	1	181	1	UNSIGNED8	x	x	static
Pres. map. dist.	V4H4	1	182	4	FLOAT	x		dynamic
Delete mapping	V4H5	1	183	1	UNSIGNED8	x	x	static
Echo quality	V4H6	1	184	1	UNSIGNED8	x		dynamic
Offset meas dist	V4H7	1	185	4	FLOAT	x	x	static
Output damping	V4H8	1	186	4	FLOAT	x	x	static
High blocking dist.	V4H9	1	187	4	FLOAT	x	x	static
Bus address	V5H0	1	188	1	UNSIGNED8	x		dynamic
Ident nr sel	V5H1	1	189	1	UNSIGNED8	x	x	static
Set unit to bus	V5H2	1	190	1	UNSIGNED8	x	x	static
AI out value	V5H3	1	191	4	FLOAT	x		dynamic
AI out status	V5H4	1	192	1	UNSIGNED8	x		dynamic
Simulation type	V5H5	1	193	1	UNSIGNED8	x	x	static
Simulation value	V5H6	1	194	4	FLOAT	x	x	static
2nd cyclic value	V5H7	1	195	1	UNSIGNED8	x	x	static
Select Main Value	V5H8	1	196	1	UNSIGNED8	x	x	static
Input value	V5H9	1	197	4	FLOAT	x		dynamic
Gap		1	198					
Display contrast	V6H1	1	199	1	UNSIGNED8	x	x	static

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Language	V6H2	1	200	1	UNSIGNED8	x	x	static
Back to home	V6H3	1	201	2	INT16	x	x	static
Format display	V6H4	1	202	1	UNSIGNED8	x	x	static
No. decimals	V6H5	1	203	1	UNSIGNED8	x	x	static
Sep. character	V6H6	1	204	1	UNSIGNED8	x	x	static
Display test	V6H7	1	205	1	UNSIGNED8	x	x	static
Gap		1	206 – 207					
Gap		1	218–227					
Actual alarm	V9H0	1	228		STRUCT	x		dynamic
Last alarm	V9H1	1	229		STRUCT	x		dynamic
Clear last alarm	V9H2	1	230	1	UNSIGNED8	x	x	static
Reset	V9H3	1	231	2	UNSIGNED16	x	x	static
Operating code	V9H4	1	232	2	UNSIGNED16	x	x	static
Measured distance	V9H5	1	233	4	FLOAT	x		dynamic
Measured level	V9H6	1	234	4	FLOAT	x		dynamic
Gap		1	235					
Application parameter	V9H8	1	236	1	UNSIGNED8	x		dynamic
Gap		1	237					
Tag no.	VAH0	1	238		STRING	x		const
Profile revision	VAH1	1	239		STRING	x	x	static
Version string	VAH2	1	240		STRING	x		const
Gap		1	241					
Serial no.	VAH4	1	242		STRING	x	x	static
Distance unit	VAH5	1	243	2	UNSIGNED16	x	x	static
Gap		1	244 – 245					
Download mode	VAH8	1	246	1	UNSIGNED8	x	x	static

Data strings

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

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

5.5.7   Scaling of the output data

The on-site display and the digital output are working independently of each other.

On-site display

The on-site display always displayes the main value V0H0 directly from the Transducer Block.

Digital output

For the digital output this value is rescaled in two steps:

L00-FMUx3xxx-05-00-00-en-001
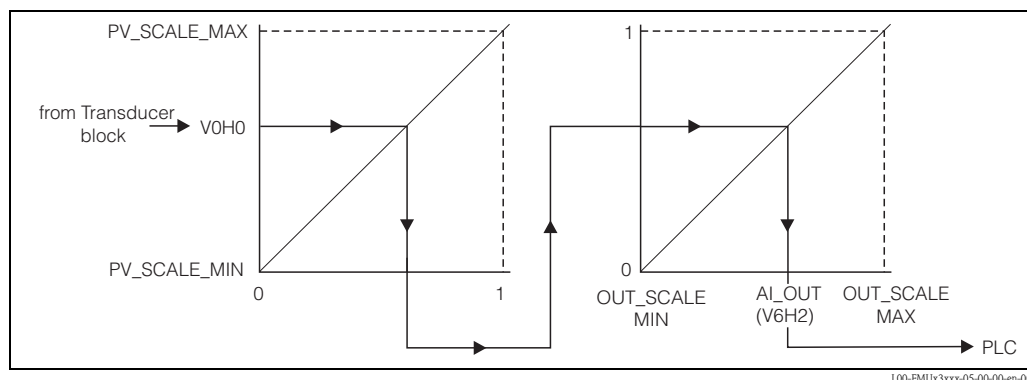
1. In a first step, the main value is mapped to the interval [0;1]. PV_SCALE_MIN and PV_SCALE_MAX determine the limits of this mapping.

2. In a second step, the interval [0,1] is mapped to the interval [OUT_SCALE_MIN, OUT_SCALE_MAX]. The value resulting from this mapping is transfered via V6H2 to the PLC.

✎ Note!
The scaling of the ouptut value is required by the Profibus profiles. It prevents uncontrolled jumps of the output value when one changes the unit of the measuring value in the Transducer Block. If units are changed, PV_SCALE_MIN and PV_SCALE_MAX automatically adapt themselves in such a way that the output value remains unchanged. Only after confirming the change by the "**Set unit to bus**" **(062)** function,
OUT_SCALE_MIN is set equal to PV_SCALE_MIN and
OUT_SCALE_MAX equal to PV_SCALE_MAX.
Thereby the new unit also becomes effective at the output.

☞ Caution!
If a linearisation has been carried out, it must be confirmed by the "**Set unit to bus**" **(062)** function in order to become effective at the digital output.

5.5.8   Endress+Hauser operating program

The operating program FieldCare is an Endress+Hauser Plant Asset Management Tool based on
FDT technology. You can use FieldCare to configure all your Endress+Hauser devices, as well as
devices from other manufacturers that support the FDT standard. Hardware and software
requirements you can find on the internet:
www.endress.com → select your country → search: FieldCare → FieldCare → Technical Data.

FieldCare supports the following functions:
- Online configuration of transmitters
- Signal analysis via envelope curve
- Tank linearization
- Loading and saving of device data (upload/download)
- Documentation of the measuring point

Connection options:
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Commubox FXA291 with ToF Adapter FXA291 via service interface

Menu-guided commissioning

L00-FMP4xxxx-20-00-00-en-001

Signal analysis via envelope curve

L00-FMP4xxxx-20-00-00-en-007

Tank linearization

L00-fmp-Ixxx-20-00-00-en-041
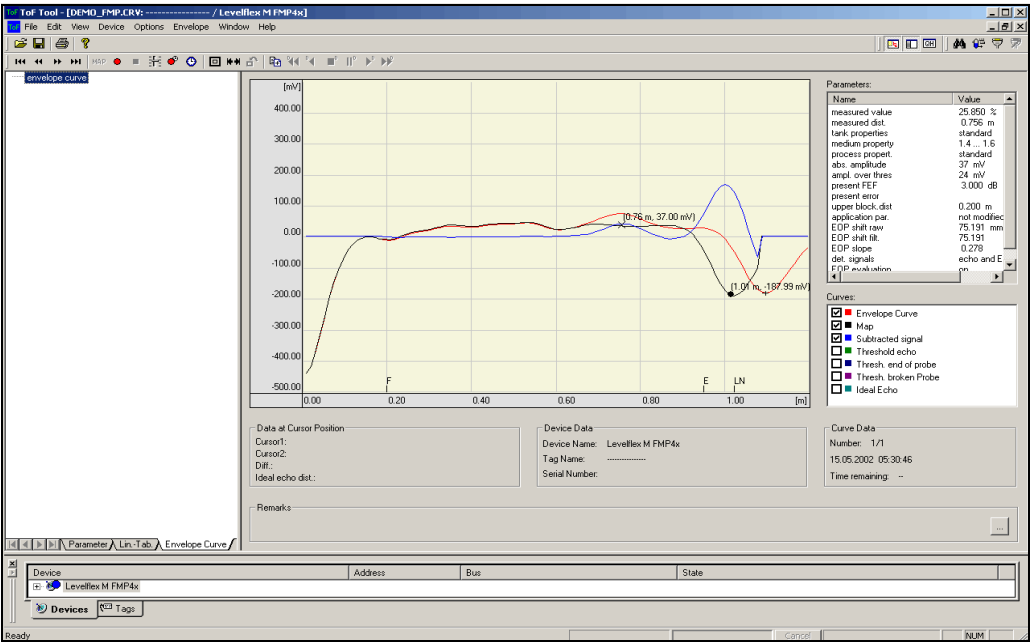
6   Commissioning

6.1   Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist "Post-installation check", → 20.
- Checklist "Post-connection check", → 29.

6.2   Switching on the measuring device

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

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

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

The current measured value is displayed

After pressing E, you are taken to the group selection

This selection enables you to perform the basic setup

6.3   Basic setup

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

LN = probe length
    setting in 033
UB = upper blocking distance
    setting in 059
SD = safety distance
    setting in 015
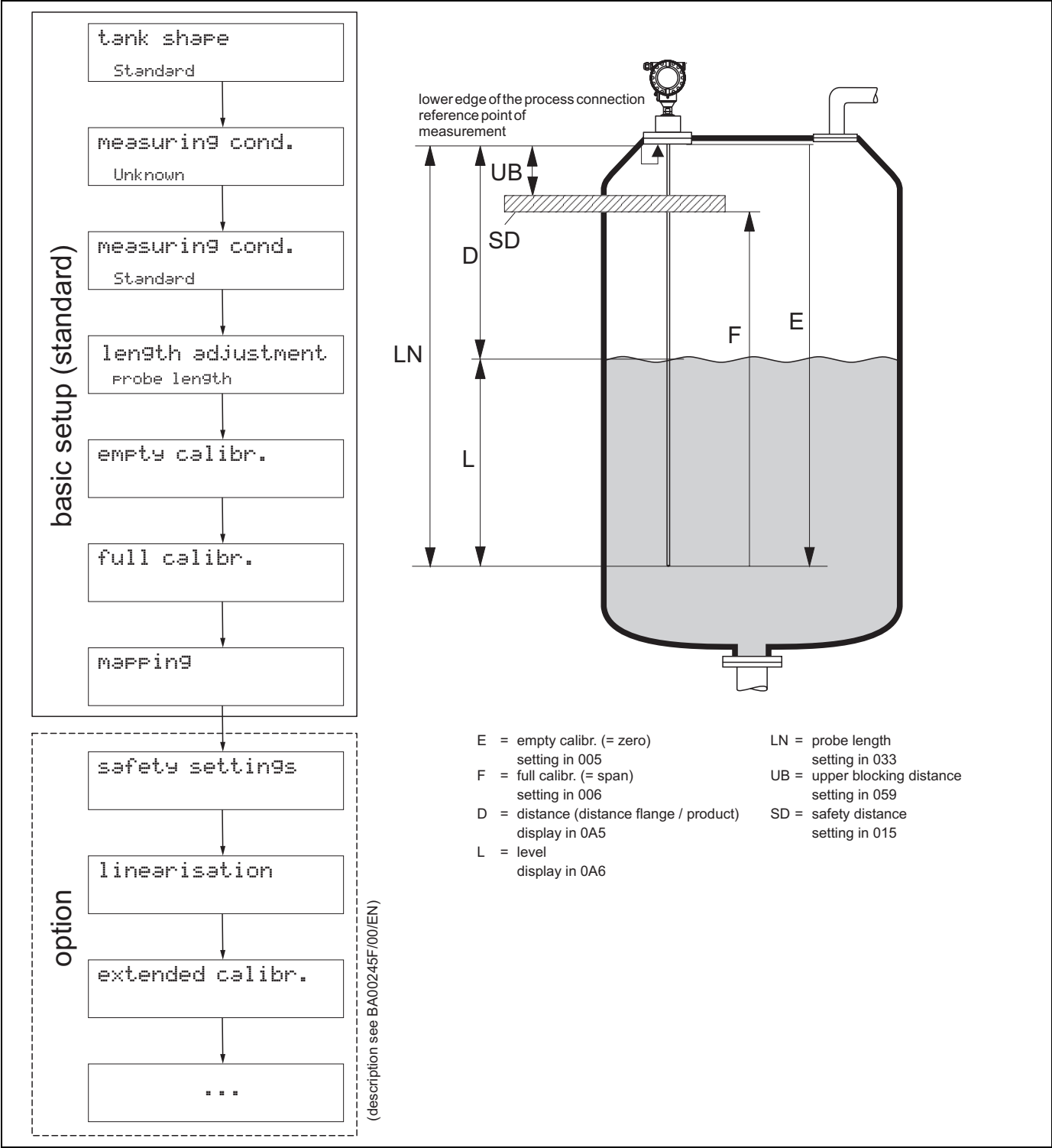
L00-FMP43xxx-19-00-00-en-001

Caution!
The basic setup is sufficient for successful commissioning in most applications.
The Levelflex is precalibrated at the factory to the probe length ordered so that in most cases only the application parameters, which automatically adapt the device to the measuring conditions, need to be entered. For digital outputs and the display module, the factory adjustment for zero point "E" and span "F" is 0 % and 100 %.
A linearization function with max. 32 points, which is based on a table input manually or semi-automatically, can be activated onsite or via remote operation. This function allows the conversion of the level into units of volume or weight, for example.

Note!
The Levelflex M also makes it possible to monitor the probe for breakage. On delivery, this function is switched since any probe shortening would be mistaken for a broken probe. To activate this function, perform the following:

1. With the probe uncovered, perform a mapping ("**range of mapping**" **(052)** and "**start mapping.**" **(053)**).

2. Activate the "**broken probe det**" **(019)** function in the "**safety settings**" **(01)** function group.

Complex measuring operations necessitate additional functions that the user can use to customize the Levelflex as necessary to suit his specific requirements. The functions available to do this are described in detail in BA00245F/00/EN.
Comply with the following instructions when configuring the functions in the "**basic setup**" **(00)**:
- Select the functions as described, → 🖹 30.
- Certain functions (e.g. starting interference echo suppression (053)) prompt you to confirm this function after entering the data. Press ⊞ or ⊟ to select "**YES**" and press ⒠ to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group "**display (09)**"), the system returns automatically to the measured value display position.

Note!
- The device 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 optimized.
- If the power supply fails, all preset and configured values remain safely stored in the EEPROM.
- All functions are described in detail, as is the overview of the operating menu itself, in **"BA00245F – Description of Instrument Functions"** on the enclosed CD-ROM.

6.4   Basic setup with display VU331

Function "measured value" (000)

```
measured value    000
    63.460 %
▓▓▓▓▓▓▓▓▓▓▓▓░░░░░░
```
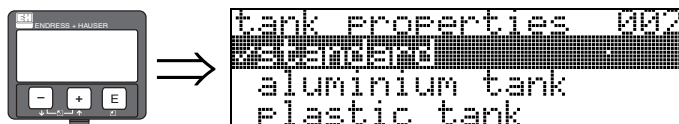
This function displays the current measured value in the selected unit (see "**customer unit**" **(042)**) function). The number of digits after the decimal point can be selected in the "**no.of decimals**" **(095)** function.

6.4.1   Function group "basic setup" (00)

```
Group selection   00→
▓basic setup▓▓▓▓▓▓▓▓
  safety settings
  linearisation
```
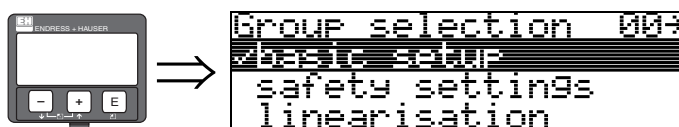
Function "tank properties" (002)

```
tank properties   002
▓standard▓▓▓▓▓▓▓▓▓▓▓
  aluminium tank
  plastic tank
```

This function is used to select the tank properties.

Options:
- **Standard**
- Aluminum tank
- Plastic tank
- Bypass / pipe
- Coax probe
- Concrete wall

Standard

The "**standard**" option is recommended for normal containers for rod and rope probes.

Aluminum tank

The "**aluminium tank**" option is designed especially for high aluminium silos that cause an increased level of noise when empty. This option is only useful for probes longer than > 4 m. For short probes (< 4 m) select the "**standard**" option!

✎ Note!
If "**aluminum tank**" is selected, the device calibrates of its own accord when first filled, depending on the medium's properties. Slope errors can, therefore, occur when beginning the first filling procedure.

Plastic tank

Select the "**plastic tank**" option when installing probes in wood or plastic containers **without** metallic surfaces at the process connection (see installation in plastic containers). When using a metallic surface at the process connection, the "**standard**" option is sufficient!

✎ Note!
In principle, it is preferable to use a metallic surface at the process connection!

Bypass / pipe

The "**bypass / pipe**" option is designed especially for the installation of probes in a bypass or a stilling well. If this option is selected, the upper blocking distance is preset to 100 mm.

Coax probe (not relevant for FMP43)

Select the "**coax probe**" option when using a coaxial probe. When this setting is made, the evaluation is adapted to the high sensitivity of the coax probe. This option should, therefore, **not** be selected when using rope or rod probes.

Concrete wall

The "**concrete wall**" option takes into account the signal–damping property of concrete walls when mounting with < 1 m distance to the wall.

Function "medium property" (003)
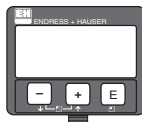
```
medium property   003
unknown
  1.4 ... 1.6
  1.6 ... 1.9
```

This function is used to select the dielectric constant.

Options:
- **unknown**
- 1.4 to 1.6 (use coax or Rod probe with installation in metallic pipes ≤ DN150)
- 1.6 to 1.9
- 1.9 to 2.5
- 2.5 to 4.0
- 4.0 to 7.0
- > 7.0

Media group	DC (εr)	Typical liquids	Typ. measuring range
1	1.4 to 1.6	– Condensed gases, e.g. N_2, CO_2	—
2	1.6 to 1.9	– Liquefied gas, e.g. propane – Solvent – Frigen / Freon – Palm oil	
3	1.9 to 2.5	– Mineral oils, fuels	
4	2.5 to 4	– Benzene, styrene, toluene – Furan – Naphthalene	4 m (354")
5	4 to 7	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline	
6	> 7	– Aqueous solutions – Alcohols – Acids, alkalis	

Function "process propert." (004)

```
Process propert. 004
standard
fast change
slow change
```
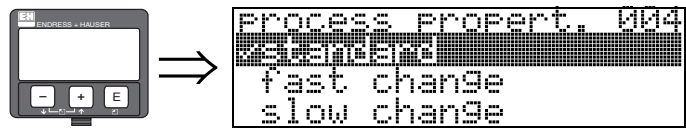
Use this function to adapt the device reaction to the filling speed in the tank. The setting impacts on an intelligent filter.

Options:
- **Standard**
- Fast change
- Slow change
- Test:no filter

| Selection:	Standard	Fast change	Slow change	Test:no filter
Application:	For all normal applications, bulk solids and liquids at low to medium filling speed and sufficiently large tanks.	Small tanks, primarily with liquids, at high filling speeds.	Applications with strong surface movement, e.g. caused by agitator, primarily large tanks with slow to medium filling speed.	Shortest reaction time: ■ For test purposes ■ Measurement in small tanks at high filling speeds, if "fast change" setting is too slow.
2-wire electronics:	Dead time: 4 s Rise time: 18 s	Dead time: 2 s Rise time: 5 s	Dead time: 6 s Rise time: 40 s	Dead time: 1 s Rise time: 0 s
4-wire electronics:	Dead time: 2 s Rise time: 11 s	Dead time: 1 s Rise time: 3 s	Dead time: 3 s Rise time: 25 s	Dead time: 0.7 s Rise time: 0 s

Function "end of probe" (030)

```
end of probe      030
free
tie down isol.
tie down gnd.
```
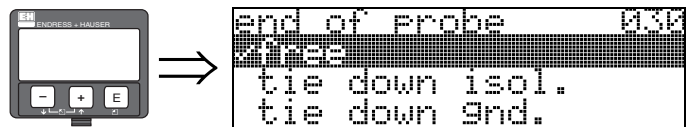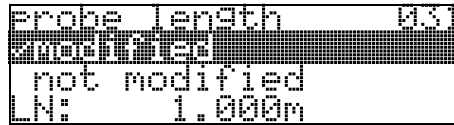
Use this function to select the polarity of the probe end signal. If the probe end is uncovered or in an insulated attachment, there is a negative probe end signal. The signal from the probe end is positive if the attachment is grounded and a metallic centering of probe end is used.

Options:
- **Free**
- Tie down isol.
- Tie down gnd.

Function "probe length" (031)

```
probe length      031
┃modified┃
 not modified
LN:      1.000m
```
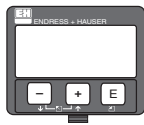
Use this function to select whether the probe length was changed after factory calibration. Only then is it necessary to enter or correct the probe length.

Options:
- **not modified**
- Modified

✎ Note!
If "modified" was selected in the "**probe length**" **(031)** function, the probe length is defined in the next step.

Function "probe" (032)

```
probe             032
┃free┃
 covered
```
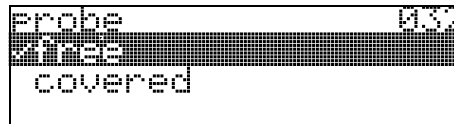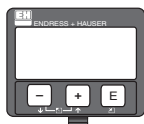
Use this function to select whether the probe is uncovered or covered at the time of probe length adjustment. If the probe is uncovered, the Levelflex can determine the probe length automatically by the "**determine length**" **(034)** function. If the probe is covered, a correct entry is required in the "**probe length**" **(033)** function.

Options:
- **Free**
- Covered

Function "probe length" (033)

```
probe length      033
     ┃0.000┃ m
```
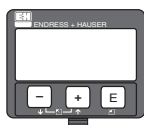
Use this function to enter the probe length manually.

Function "determine length" (034)
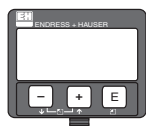
```
determine length 034
length ok
  too short
LN:      0.399m
```

Use this function to determine the probe length automatically.

Depending on the installation conditions, the automatically determined probe length may be larger than the actual probe length (typically 20 to 30 mm longer). This does not affect the measuring accuracy. When entering a linearization, please use the "empty calibration" value for the empty value instead of the automatically determined probe length.

Options:
- **Length ok**
- Too short
- Too long

After selecting "length too short" or "length too long", the calculation of the new value takes approx. 10 s.

Function "empty calibr." (005)

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

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

E = empty calibration (= zero)
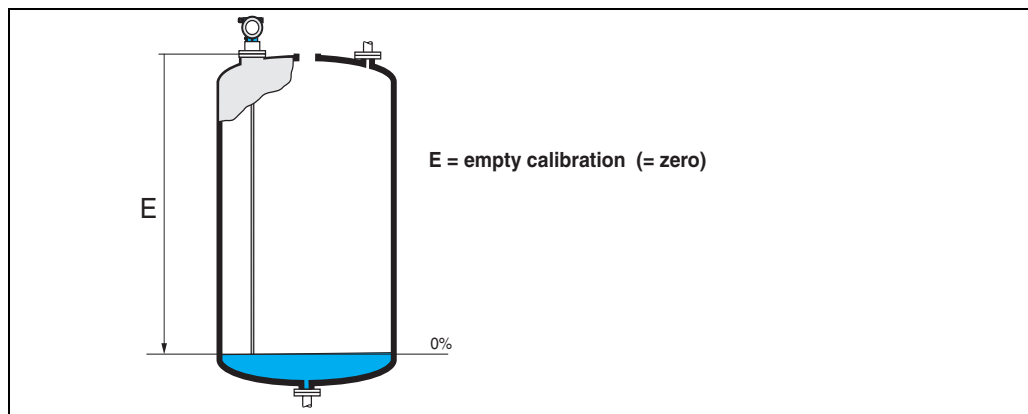
L00-FMP4xxxx-14-00-06-en-008

Function "full calibr." (006)

```
full calibr.      006
      3.800 m
span
```

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

F = full calibration (= span)

F_{max} = E – upper blocking distance

$F_{max} = E - \text{upper blocking distance}$
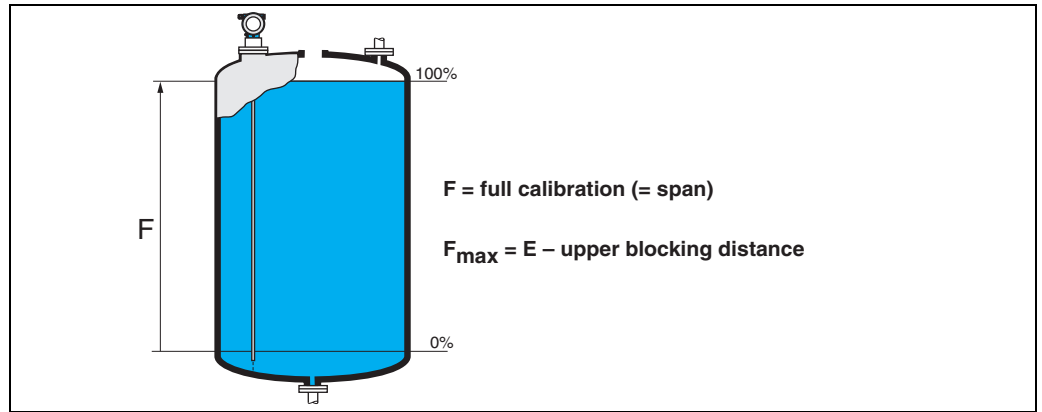
L00-FMP4xxxx-14-00-06-en-009

✎ Note!
The usable measuring range lies between the upper blocking distance and the probe end.
The values for empty distance "E" and span "F" can be set independently of this.

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

```
dist./meas.value 008
dist.    0.180 m
m.val  102.46 %
```
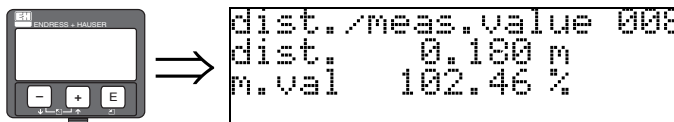
The **distance** measured from the reference point to the product surface and the **meas. value** calculated with the aid of empty calibration are displayed. Check whether the values correspond to the actual measured value or the actual distance. The following cases can occur:

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

Function "check distance" (051)


```
check distance      051
dist. unknown
manual
probe free
```
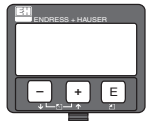
This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface. The following options are available:

Options:
- Distance = ok
- Dist. too small
- Dist. too big
- Dist. unknown
- **Manual**
- Probe free
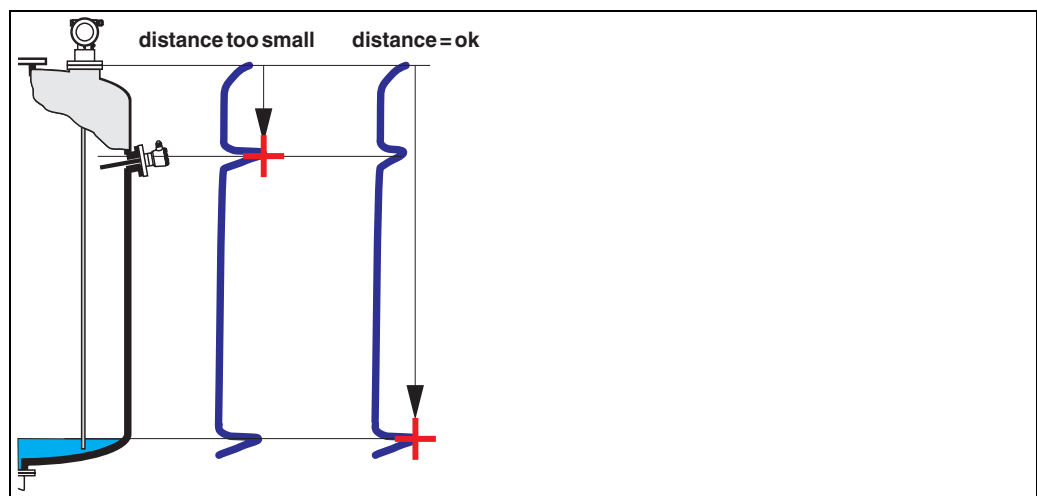
L00-FMP4xxxx-14-00-06-en-010

Distance = ok

Use this function for partially covered probes. Choose "**manual**" or "**probe free**" if the probe is free.
- Mapping is carried out up to the currently measured echo
- The range to be suppressed is suggested in the "**range of mapping**" **(052)** function

It is wise to carry out a mapping even in this instance.

✎ Note!
If the probe is free, the mapping should be confirmed with "**probe free**".

Dist. too small
- At the moment, an interference echo is being evaluated
- Therefore, a mapping is carried out including the echoes currently measured
- 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 suppression
- Check 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
Mapping is also possible by manually entering the range to be suppressed. This entry is made in the "**range of mapping**" **(052)** function.

Caution!
The range of mapping must end 0.3 m (20") before the echo of the actual level.

Probe free
If the probe is uncovered, mapping is carried out along the whole probe length.

Caution!
Only begin mapping in this function if the probe is definitely uncovered. Otherwise, the device will not measure correctly!

Function "range of mapping" (052)
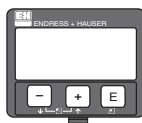
```
range of mapping 052
        0.000  m
input of
mapping range
```

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement ($\rightarrow$ 📄 54). This value can be edited by the operator.
For manual mapping, the default value is 0.3 m.

Function "start mapping"(053)

```
start mapping    053
 off
 on
```

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

Options:
- **off**: no mapping is carried out
- on: mapping is started

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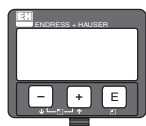
```
dist./meas.value 008
dist.      2.463 m
meas.v.   63.422 %
```

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

- Distance correct – meas. value correct → basic setup completed
- Distance incorrect – meas. value incorrect → another interference echo suppression must be carried out "**check distance**" **(051)**
- Distance correct – meas. value incorrect → check "**empty calibr**" **(005)**
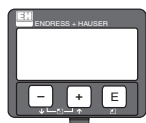
```
    Return to
 Group Selection
```

⇩

```
Group selection  00→
 basic setup
 safety settings
 length adjustment
```

After 3 s, the following message appears

✎ Note!
After the basic setup, it is recommended to evaluate the measurement with the aid of the envelope curve ("**envelope curve**" **(0E)** function group, → 🖺 67).

6.5   Blocking distance

Function "upper block. dist" (059)
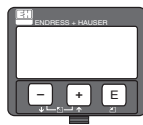
```
upper block.dist 059
        0.100  m
```

For rod probes and for rope probes with lengths of up to 8 m, the upper blocking distance is set to 0.2 m at the factory.

The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (lower edge of the process connection) to the maximum level. At the lowest part of the probe an exact measurement is not possible, see "Performance characteristics", → 🖹 88.
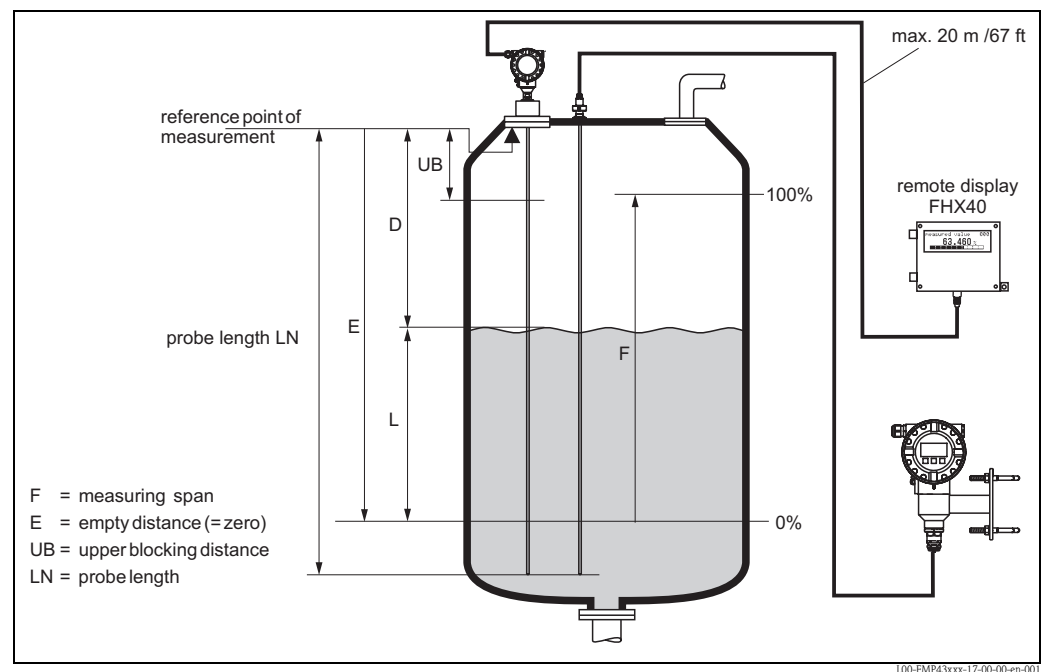
Reference point of measurement, details → 🖹 *54*

The blocking distance can be reduced if the probe is mounted flush with the wall or in a nozzle, max. 50 mm in height.

When using a spray ball the blocking distance may not be smaller than 50 mm.

Maximum measured error

Typical values under reference operating conditions:
DIN EN 61298-2, percentage values with reference to the span.

Output:	Digital
Sum of non-linearity, non-repeatability and hysteresis	±3 mm
Offset / zero point	±4 mm

If the reference conditions are not met, the offset/zero point resulting from the installation setup may be up to ±12 mm. This additional offset/zero point can be compensated for by entering a correction (function **"offset" (057)**) during commissioning.

Differing from this, the following measuring error is present in the vicinity of the upper and lower probe end:
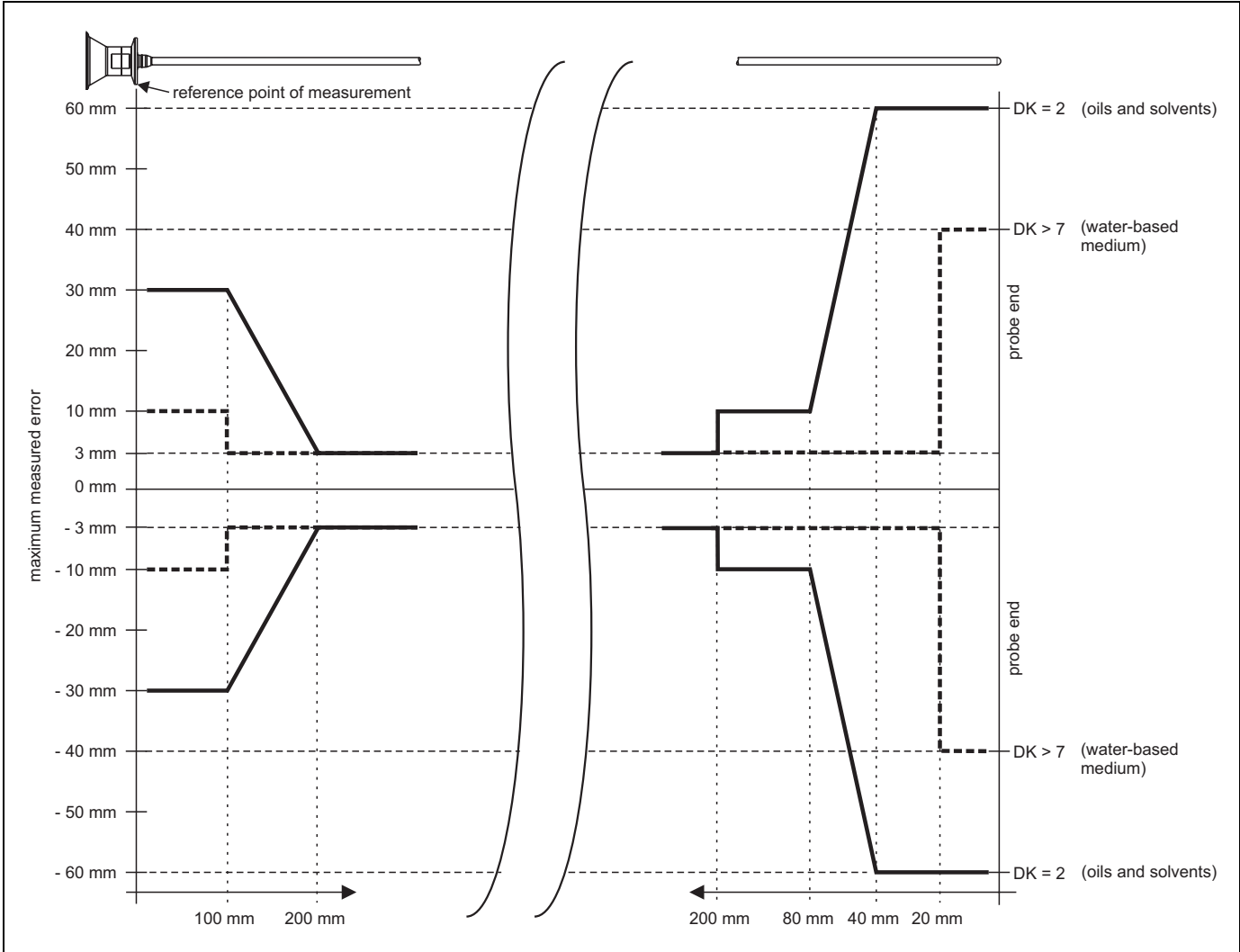
L00-FMP43xxx-05-00-00-en-001

6.6   Envelope curve with VU331

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

6.6.1   Function "plot settings" (0E1)

Here you can select which information is shown on the display:
- **Envelope curve**
- Substracted signal
- Mapping


```
Plot settings    0E1
envelope curve
 subtracted signal
 mapping
```
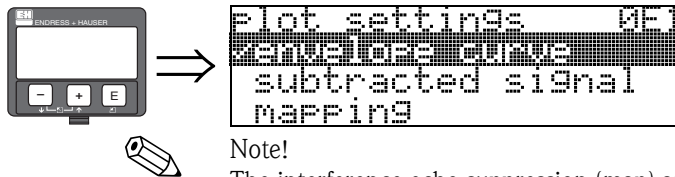
Note!
The interference echo suppression (map) are explained in BA00245F/00/EN "Description of Instrument Functions".

6.6.2   Function "recording curve" (0E2)

This function determines whether the envelope curve is read as
- **Single curve** or
- Cyclic


```
recording curve  0E2
single curve
 cyclic
```
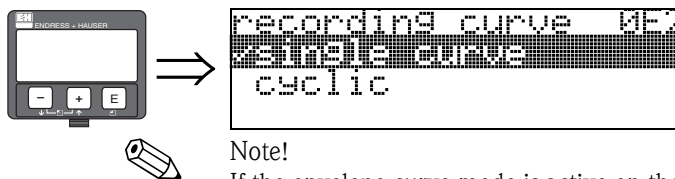
Note!
If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimized.

6.7 Function "envelope curve display" (0E3)

You can obtain the following information from the envelope curve display in this function:
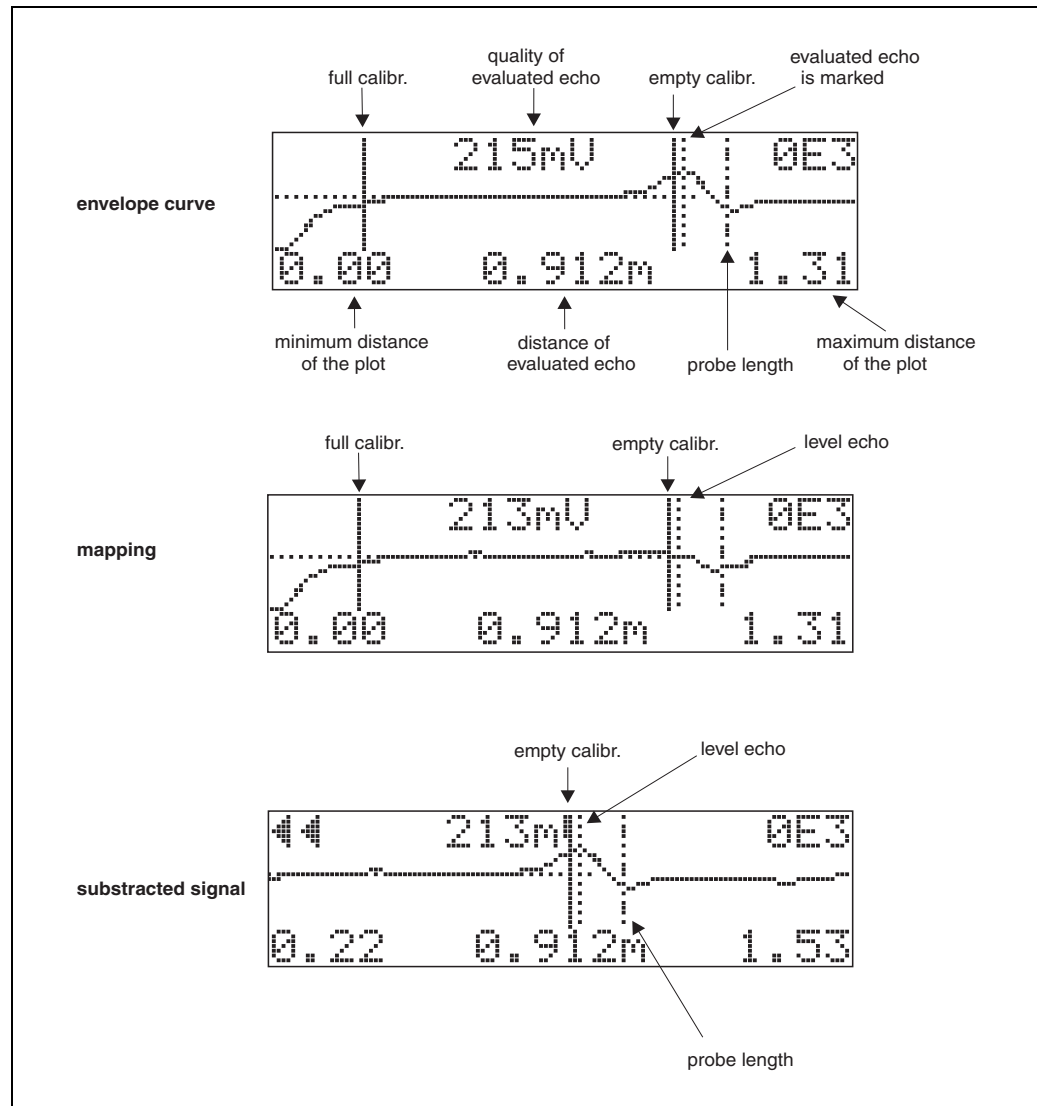
L00-FMPxxxxx-07-00-00-en-003

6.7.1 Envelope curve

The Levelflex emits individual pulses in quick succession and scans their reflection with a slightly variable delay. The energy values received are ordered by their time-of-flight. The graphic representation of this sequence is known as an "envelope curve".

6.7.2 Mapping (empty curve) and difference curve

To suppress interference signals, the envelope curve is not directly evaluated in the Levelflex.
The mapping (empty curve) is first subtracted from the envelope curve.
The system looks for level echoes in the resulting difference curve.
Difference curve = envelope curve – mapping (empty curve)
The mapping (empty curve) should be a good representation of the probe and the empty tank or silo. Ideally, only the signals from the medium being measured remain in the difference curve.

6.7.3   Mapping

- Factory mapping
  Mapping (empty curve) is already available in the device when the device is delivered.
- Customer mapping
  In a partially filled state, the distance up to 10 cm before the actual total level can be mapped
  (range of mapping = actual distance from total level – 10 cm), or values > LN can be mapped in
  the case of empty tanks.
- Dynamic mapping
  It is not static like factory and customer-specific interference echo suppression. Instead, it follows
  directly from static mapping and constantly adapts to the changing features of the probe
  environment during ongoing operation. Thus, dynamic mapping does not have to be recorded
  explicitly.

6.7.4   Echo threshold

Maximum points in the difference curve are only accepted as reflection signals if they are above a
specified threshold. This threshold depends on the location and is automatically calculated from the
ideal echo curve of the probe used. The calculation of the threshold in question depends on the
"Installation" customer parameter in the extended calibration function.

6.7.5   Navigation in the envelope curve display

Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left
or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the
display.
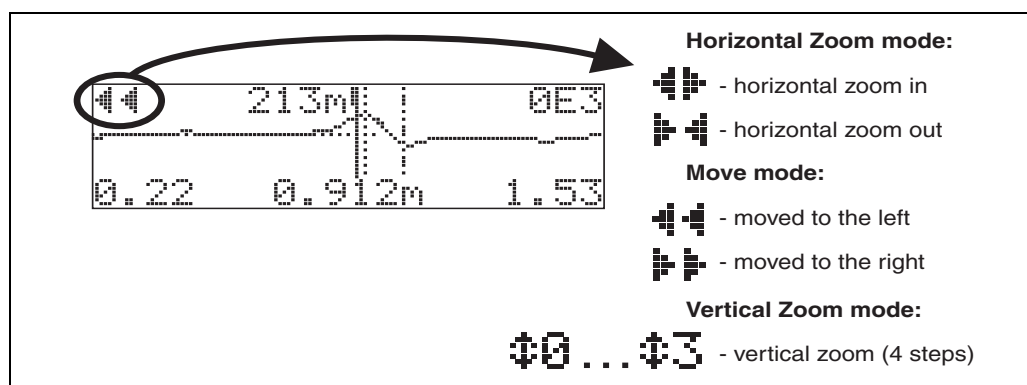
L00-FMPxxxxx-07-00-00-en-004

Horizontal zoom mode

Press ⊞ or ⊟, to switch to the envelope curve navigation. You are now in the horizontal zoom
mode. Either or is displayed.

You now have the following options:
- ⊞ increases the horizontal scale.
- ⊟ decreases the horizontal scale.
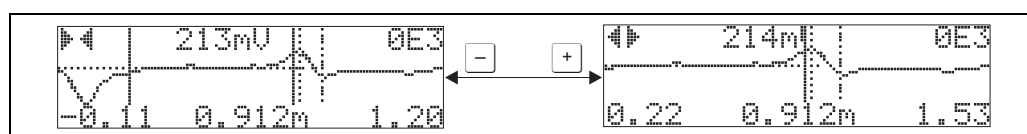
L00-FMPxxxxx-07-00-00-xx-001

Move mode

Then press $\boxed{\text{E}}$ to switch to the move mode. Either $\blacktriangleright\!\blacktriangleright$ or $\blacktriangleleft\!\blacktriangleleft$ is displayed.

You now have the following options:
- $\boxed{+}$ shifts the curve to the right.
- $\boxed{-}$ shifts the curve to the left.

L00-FMPxxxxx-07-00-00-xx-002
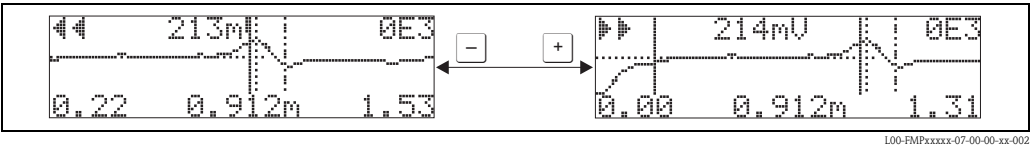
Vertical zoom mode

Press $\boxed{\text{E}}$ once more to switch to the vertical zoom mode. $\updownarrow\!1$ is displayed.

You now have the following options:
- $\boxed{+}$ increases the vertical scale.
- $\boxed{-}$ decreases the vertical scale.

The display icon shows the current zoom factor ($\updownarrow\!0$ to $\updownarrow\!3$).

L00-FMPxxxxx-07-00-00-xx-003
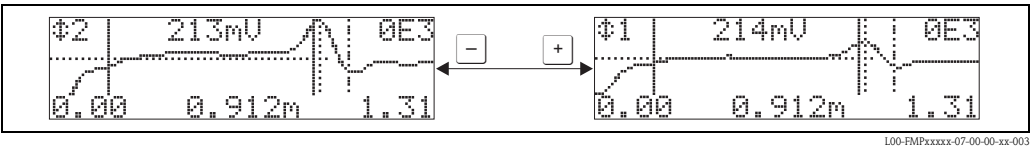
Exiting the navigation

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


```
        Return to
     Group Selection
```

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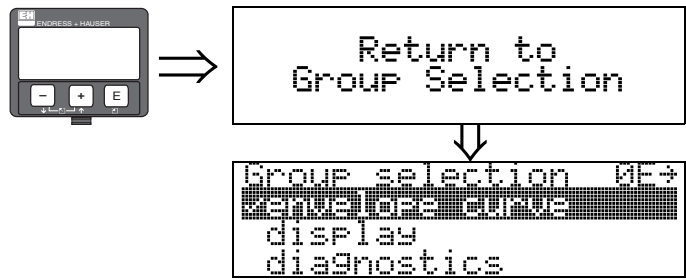
```
Group selection   0E→
envelope curve
 display
 diagnostics
```

6.8   Basic setup with the Endress+Hauser operating program

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

The following display appears on the screen:

Basic setup step 1/6:
- Status image
- The TAG number can be entered.

L00-FMP4xxxxx-20-00-00-en-001
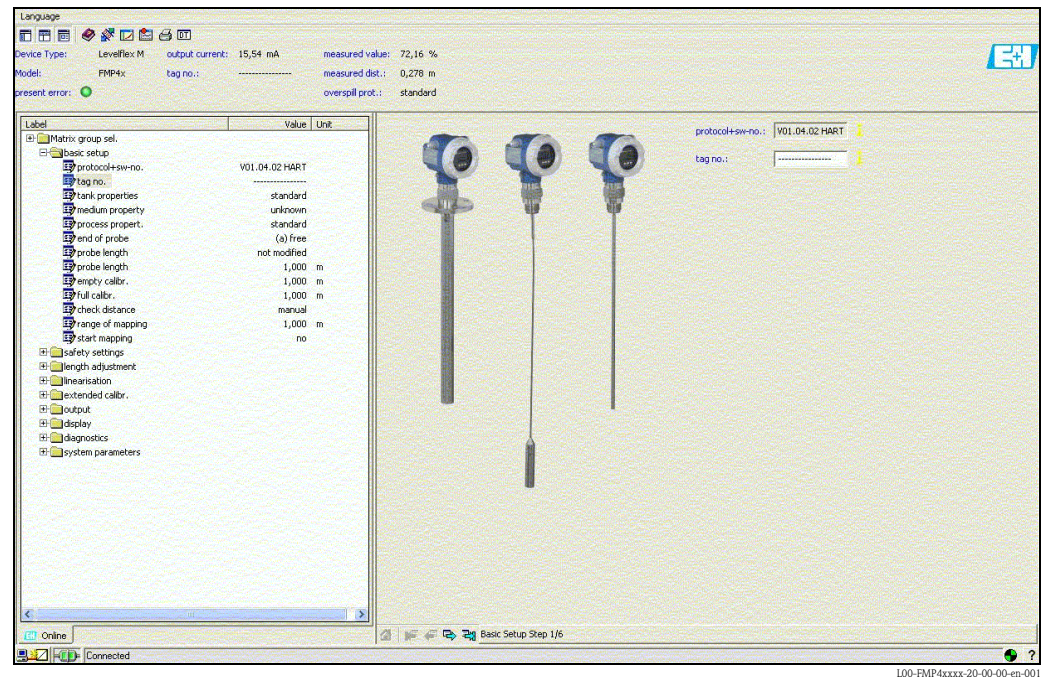
✎   Note!
- Each parameter that is changed must be confirmed with the **RETURN** key!
- The "**Next**" button takes you to the next screen:

Basic setup step 2/6:
■ Enter the application parameters (see chapter basic setup with "VU331"):
  – Tank properties
  – Medium properties
  – Process properties

I00-fmp4xxxx-20-00-00-en-002
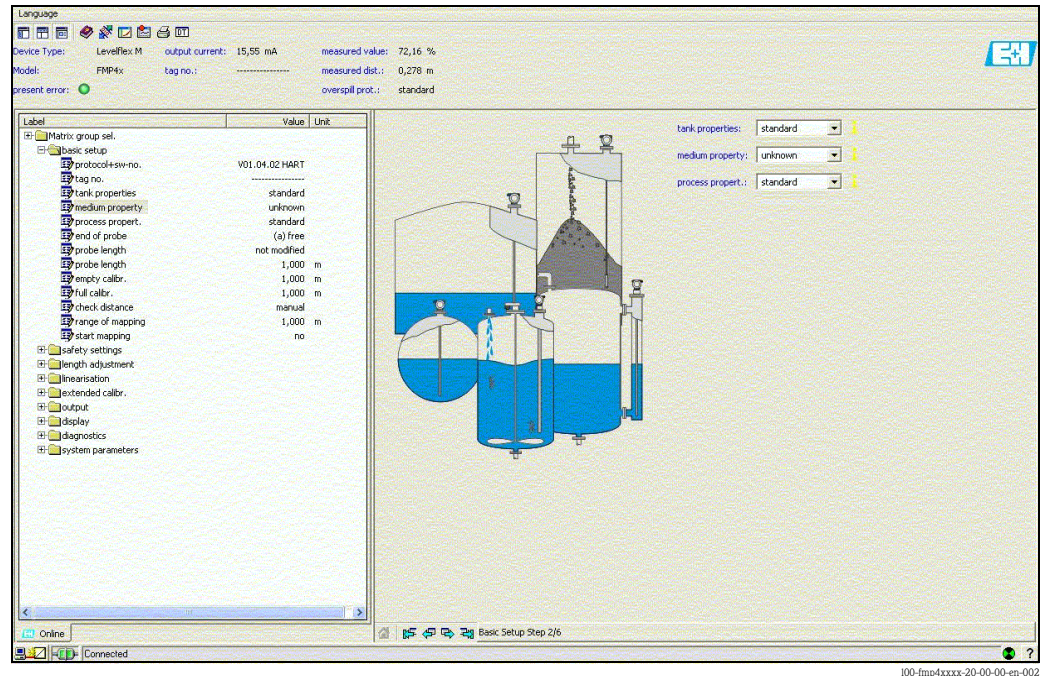
Basic setup step 3/6:
■ Enter the application parameters (see chapter basic setup with "VU331"):
  – End of probe

I00-fmp4xxxx-20-00-00-en-003
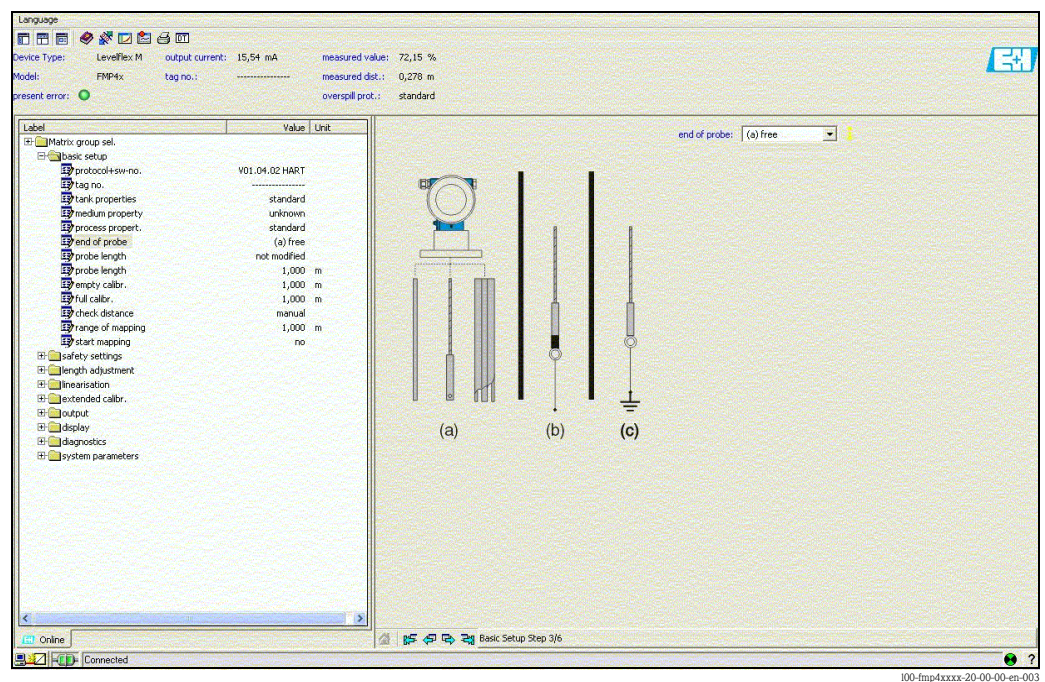
Basic setup step 4/6:
- Enter the application parameters (see chapter basic setup with "VU331"):
  – Probe length
  – Probe
  – Probe length
  – Determine length

I00-fmp4xxxx-20-00-00-en-004
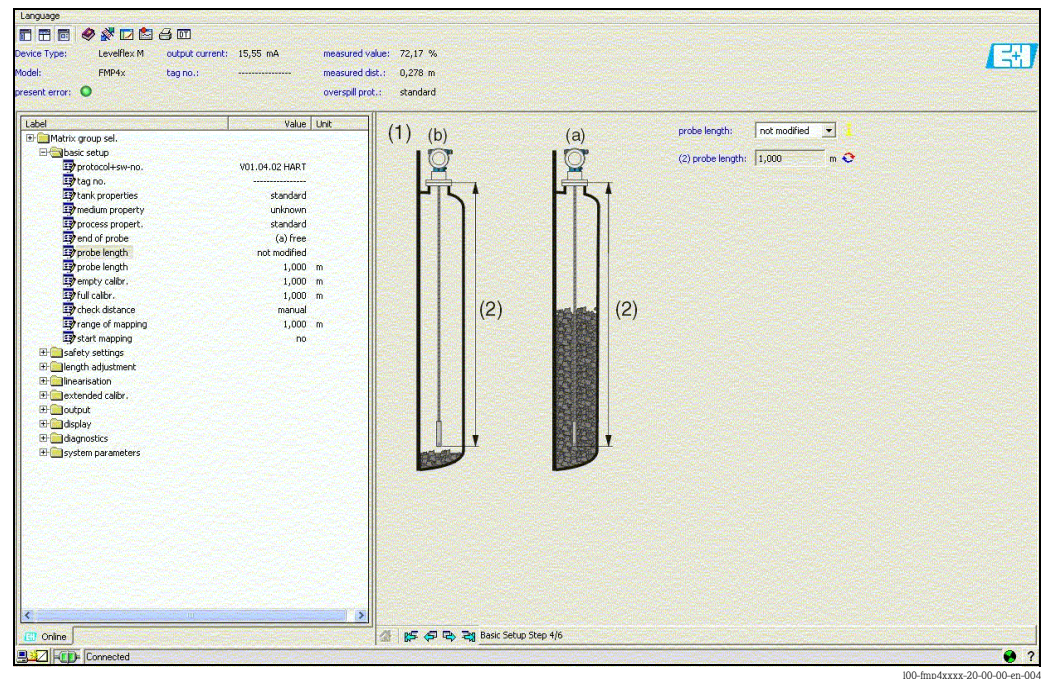
Basic setup step 5/6:
- Enter the application parameters (see chapter basic setup with "VU331"):
  – Empty calibration
  – Full calibration

I00-fmp4xxxx-20-00-00-en-005
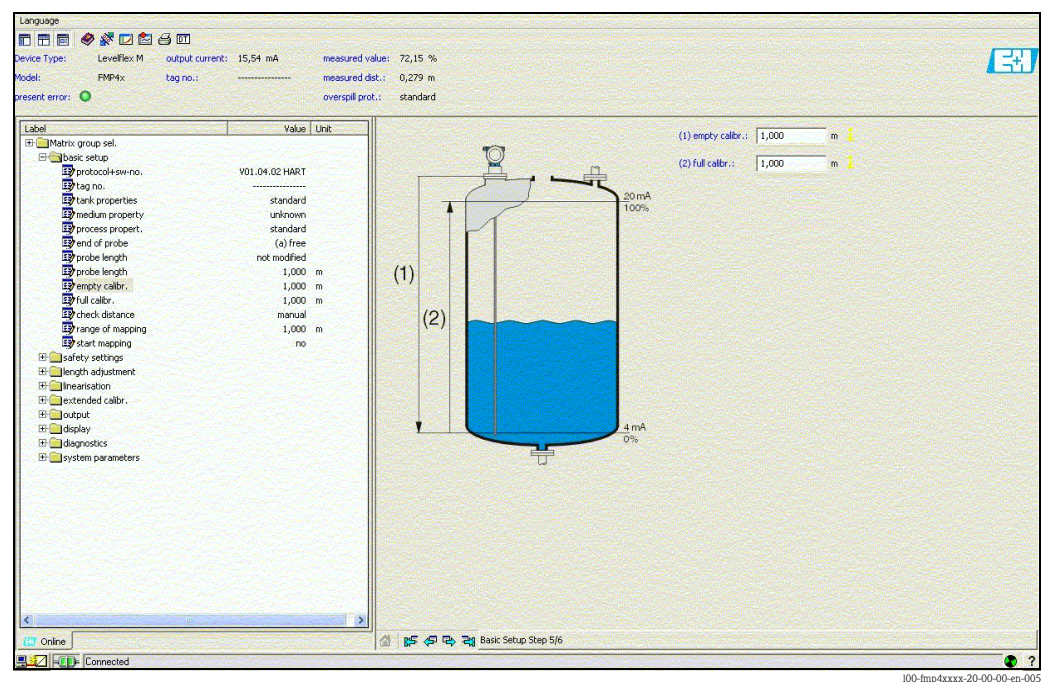
Basic setup step 6/6:
- Interference echo suppression takes place in this step
- The measured distance and the current measured value are always displayed in the header

l00-fmp4xxxx-20-00-00-en-006.gif
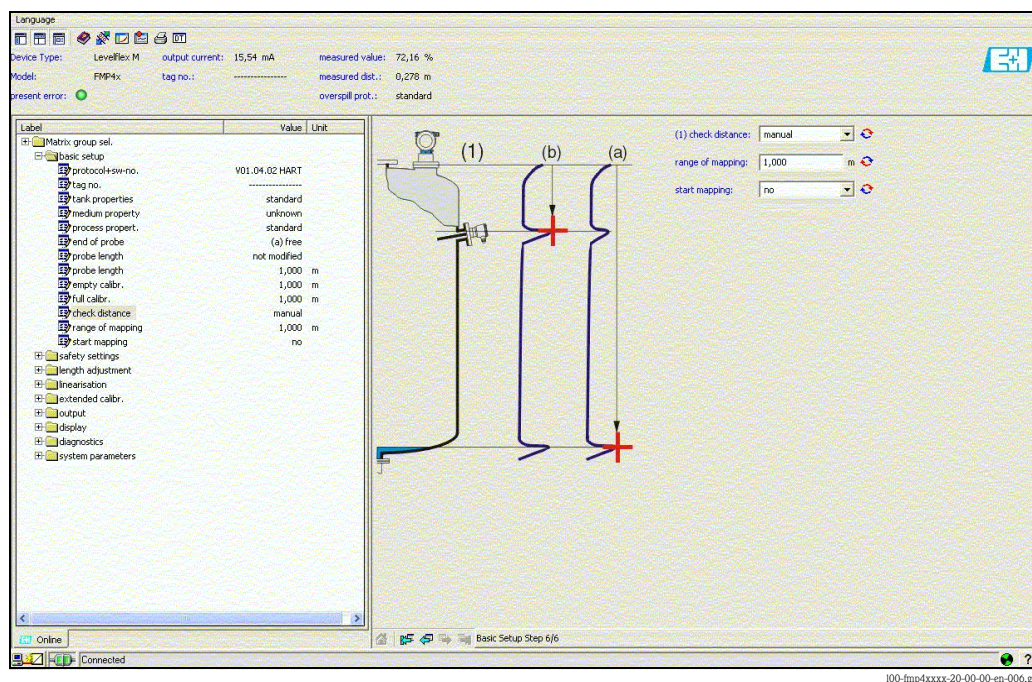
6.8.1 Signal analysis via envelope curve

After the basic setup, it is recommended to evaluate the measurement with the aid of the envelope curve.

L00-FMP4xxxx-20-00-00-en-007
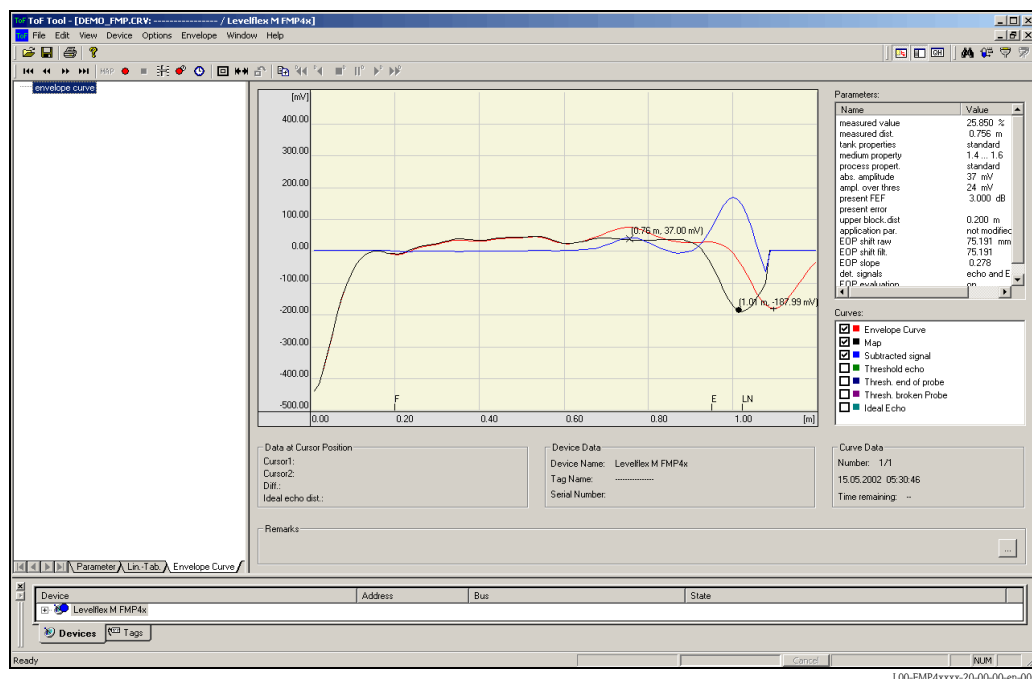
✎ Note!
In the event of severe interference echoes, installing the Levelflex at another point can optimize the measurement routine.

Evaluating the measurement with the aid of the envelope curve

Typical curve shapes:

The following examples display typical curve shapes for a rope or rod probe in an empty tank. For all probe types, a negative probe end signal is shown. For rope probes, the end weight causes an additional preliminary positive echo (see rope probe diagram).
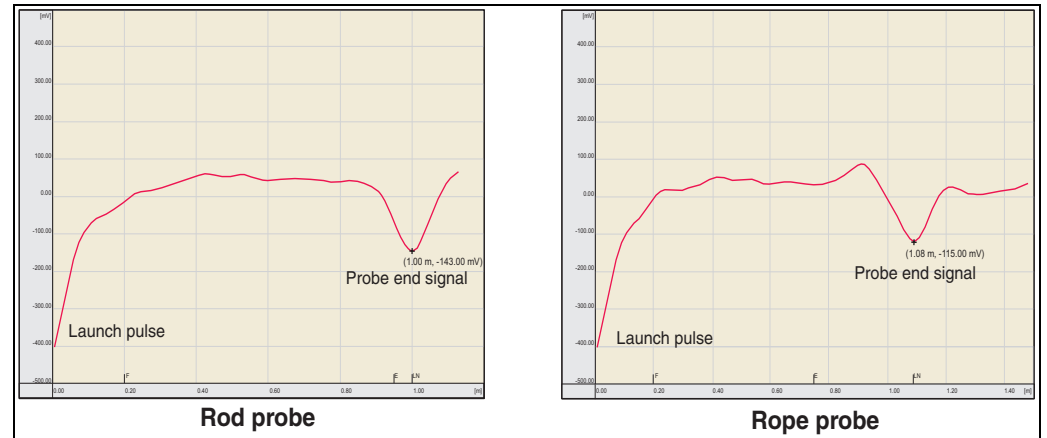
L00-FMP40xxx-05-00-00-en-024

Level echoes are indicated as positive signals in the envelope curve. Interference echoes can be both positive (e.g. reflections from internals) and negative (e.g. nozzles). The envelope curve, the map and the differential curve are used for the evaluation. Level echoes are searched for in the differential curve.

Evaluating the measurement:

- The map must correspond to the course of the envelope curve (for rod probes up to approx. 5 cm and for rope probes up to approx. 25 cm before the end of the probe) when the tank is empty.
- Amplitudes in the differential curve should be at a level of 0 mV when the tank is empty and lie within the span that is specified by the probe-specific blocking distances. In order to not detect any interference echoes, there must be no signals that exceed the echo threshold when the tank is empty.
- For partially-filled tanks, the map may only differ from the envelope curve at the position of the level echo. The level signal is then detected unequivocally as a positive signal in the differential curve. For detecting the level echo, the amplitude must lie above the echo threshold.

Envelope curve   **Mapping**

Differential curve = Envelope curve Mapping
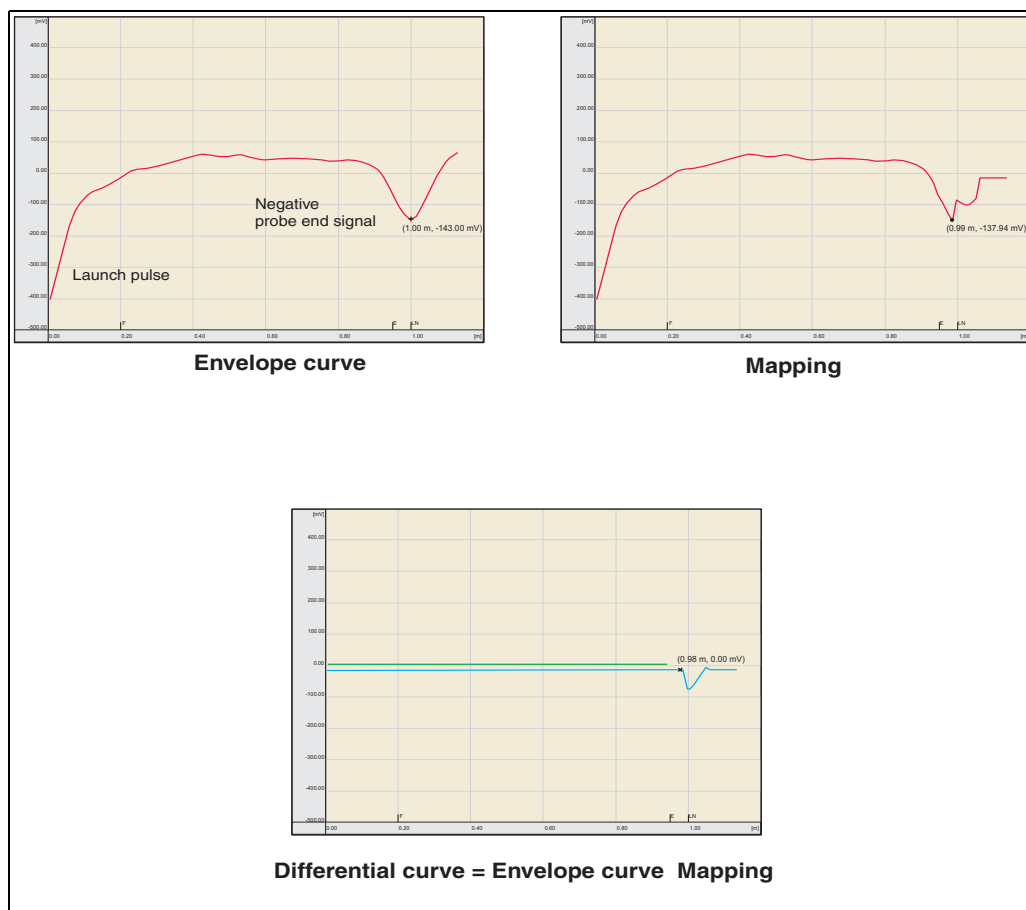
L00-FMP40xxx-05-00-00-en-025

6.8.2   User-specific applications (operation)

For details of setting the parameters of user-specific applications, see separate documentation BA00245F/00/EN "Description of Instrument Functions" on the enclosed CD-ROM.

7 Maintenance

The Levelflex M measuring device requires no special maintenance.

7.1 Exterior cleaning

When cleaning the Levelflex M, always use cleaning agents that do not attack the surface of the housing and the seals.

7.2 Repair

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", → 📄 86). Please contact Endress+Hauser Service for further information on service and spare parts.

7.3 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 genuine spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified individual test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified version.
- Document all repair work and conversions.

7.4 Replacement

After a complete Levelflex M or electronic module has been replaced, the parameters can be downloaded into the device again via the communication interface. To do so, the data have to have been uploaded to the PC beforehand using the FieldCare.Measurement can continue without having to carry out a new calibration.

- You may have to activate linearization (see BA00245F/00/EN on the enclosed CD-ROM.)
- New interference echo suppression (see Basic setup)

After a probe or the electronics have been replaced, a new calibration must be carried out. This is described in the repair instructions.

8   Accessories

8.1   Weather protection cover

A weather protection cover made of stainless steel is recommended for outdoor mounting (order No: 543199-0001). The shipment includes the protective cover and tension clamp.
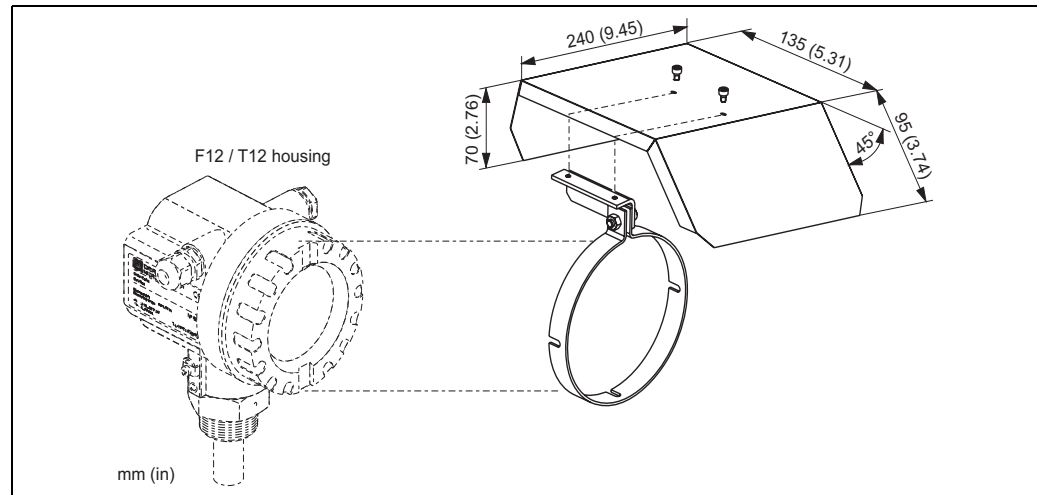
L00-FMR2xxxx-00-00-06-en-001

8.2   Weld-in adapter

Welding adapter with M24xof 1.5 – threads for the front-concise assembly of the sensor.
Material:
corrosion-resistant steel AISI 316L (1.4435)
Weight: 0.22 kg
For details refer to BA00361F/00/A6.
- Standard:
  Order No.: 71041381
- With 3.1 inspection certificate:
  Order No.: 71041383
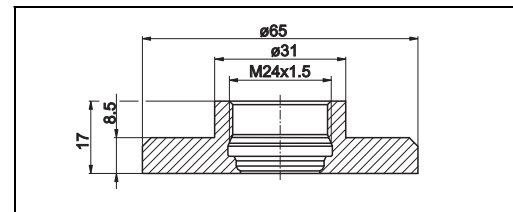
L00-FMP43xxx-06-00-00-xx-016

8.3 Remote display and operation FHX40

L00-FMxxxxxx-00-00-06-de-005
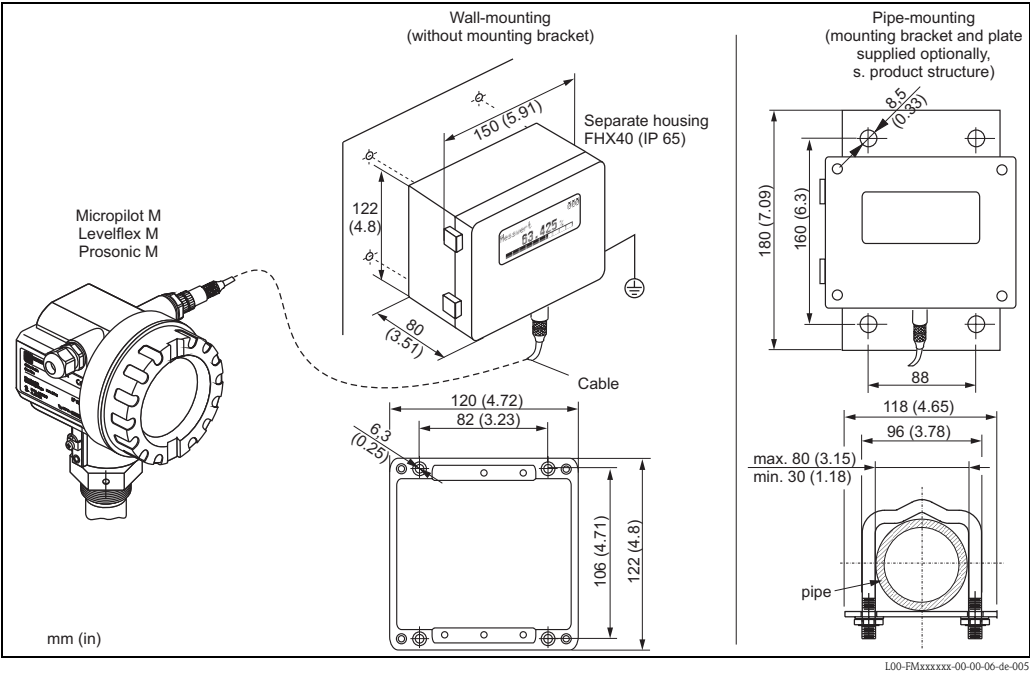
Technical data (cable and housing) and product structure:

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

010			Approval:	
	A		Non-hazardous area	
	2		ATEX II 2G Ex ia IIC T6	
	3		ATEX II 2D Ex ia IIIC T80°C	
	G		IECEx Zone1 Ex ia IIC T6/T5	
	S		FM IS Cl. I Div.1 Gr. A-D, zone 0	
	U		CSA IS Cl. I Div.1 Gr. A-D, zone 0	
	N		CSA General Purpose	
	K		TIIS Ex ia IIC T6	
	C		NEPSI Ex ia IIC T6/T5	
	Y		Special version, TSP-No. to be spec.	
020			**Cable:**	
		1	20m / 65ft (> for HART)	
		5	20m / 65ft (> for PROFIBUS PA/FOUNDATION Fieldbus)	
		9	Special version, TSP-No. to be spec.	
030				**Additional option:**
			A	Basic version
			B	Mounting bracket, pipe 1"/ 2"
			Y	Special version, TSP-No. to be spec.
FHX40 –				Complete product designation

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

8.4   Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with CDI interface
(= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a
notebook. For details refer to TI00405C/07/EN.

✎ Note!
For the device you need the "ToF Adapter FXA291" as an additional accessory.

8.5   ToF Adapter FXA291

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

8.6   Proficard

For the connection of a Laptop to PROFIBUS.

8.7   Profiboard

For the connection of a Personal Computer to PROFIBUS.

8.8   Protective cover

With the protective cover the probe can be
locked with dismantled electronics.
For details refer to BA00362F/00/A6.
Order No.: 71041379
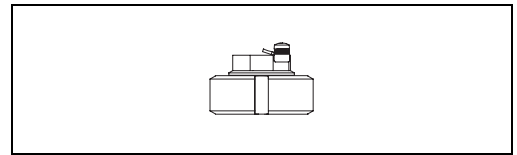
L00-FMP43xxx-06-00-00-xx-016

8.9   Calibration kit

The calibration kit is used to regularly test the accuracy and reproducibility of the Levelflex M
FMP43 level measurement device. For details refer to BA00360F/00/EN.
Order No.: 71041382

9   Troubleshooting

9.1   Troubleshooting instructions

Levelflex M -Trouble Shooting

Instrument does not respond → Check voltage and compare it with the specifications on the nameplate. — Not ok → Connect the correct voltage → Instrument works? — Yes → Ready / No

ok

Check the polarity of the voltage. — Not ok → Correct the polarity → Instrument works? — Yes → Ready / nein

ok

Check power connection to electronic board — Not ok → Connect plug → Instrument works? — Yes → Ready / No

ok

Values on display invissible — Yes → Contrast: E + + — ok → Ready

No / Not ok

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

ok

Communication PA does not function — Yes → Check cabling + terminator — Not ok → Correct cabling + terminator → Communication ok? — Yes → Ready / No

ok.

EMC interference? — Yes → Check screening (see BA Section 'Connection') → Communication ok? — Yes → Ready / No → Contact Endress+Hauser Service

No

Communication via Service adapter does not function — Yes → Check configuration of COM port on PC — Not ok → Correct configuration → Communication ok? — Yes → Ready / No → Contact Endress+Hauser Service

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

ok.

Proceed according to section 'Trouble shooting' in OM

L00-FMP4xxxx-19-00-00-de-100

9.2   System error messages

Code	Description	Possible cause	Remedy
A102	checksum error total reset & new calibr. required.	device was switched off before data were stored; EMC problem; EEPROM defective	reset avoid EMC problems; if alarm prevails after reset, exchange electronics
W103	initializing – please wait	EEPROM storage not yet finished	wait a few seconds; if warning prevails, exchange electronics
A106	downloading – please wait	downloading data	wait, message disappears after downloading operation
A110	checksum error total reset & new calibr. required.	device was switched off before data were stored; EMC problem; EEPROM defective	reset avoid EMC problems; if alarm prevails after reset, exchange electronics
A111	electronics defective	RAM defective	reset if alarm prevails after reset, exchange electronics
A113	electronics defective	ROM defective	reset if alarm prevails after reset, exchange electronics
A114	electronics defective	EEPROM defective	reset if alarm prevails after reset, exchange electronics
A115	electronics defective	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 defective	no factory calibration available; EEPROM cleared	contact service
W153	initializing – please wait	initialization of electronics	wait a few seconds; if warning prevails, switch power off and on again
A160	checksum error total reset & new calibr. required.	device was switched off before data were stored; EMC problem; EEPROM defective	reset avoid EMC problems; if alarm prevails after reset, exchange electronics
A164	electronics defective	hardware problem	reset if alarm prevails after reset, exchange electronics
A171	electronics defective	hardware problem	reset if alarm prevails after reset, exchange electronics
A221	probe pulse deviates from normal values	HF module or cable between HF module and electronics defective	check contacts on HF module if fault cannot be eliminated: replace HF module
A241	Broken probe	rod probe broken, rope probe broken/torn or value entered for probe length is too long	check the probe length in 033, check the probe mechanically, if the probe is broken, change the probe or change to a non contact system
		probe break monitoring enabled without mapping beforehand	disable probe break monitoring, perform mapping and then reactivate probe break monitoring

Code	Description	Possible cause	Remedy
A251	feedthrough	lost contact in the process feedthrough	replace process feedthrough
A261	HF cable defective	HF cable defective or HF connector loose	check HF connector, replace cable if defective
W275	offset too high	temperature at the electronics too high or HF module defective	check temperature, replace HF module if defective
W512	recording of mapping – please wait	recording active	wait a few seconds until alarm disappears
W601	linearization ch1 curve not monotone	linearization not monotonously increasing	correct linearization table
W611	less than 2 linearization points for channel 1	number of entered linearization points < 2	correct linearization table
W621	simulation ch. 1 on	simulation mode is active	switch off simulation mode
E641	no usable echo channel 1 check calibr.	echo lost due to application conditions or buildup on probe	check basic setup; clean probe (see Operating Instructions, Troubleshooting)
W650	signal/noise ratio too low or no echo	noise amplitude too high	eliminate electromagnetic interference
E651	level in safety distance – risk of overfill	level in safety distance	alarm will disappear as soon as level leaves safety distance perform reset where necessary
A671	linearization ch1 not complete, not usable	linearization table is in edit mode	activate linearization table

9.3 Application errors

Error	Output	Possible cause	Remedy
A warning or alarm has occurred	Depending on the configuration	See table of error messages (→ 🕮 82)	1. See table of error messages (→ 🕮 82)
Measured value (00) is incorrect		Measured distance (008) OK? yes →	1. Check empty calibr. (005) and full calibr. (006) 2. Check linearization: → Level/ullage (040) → Max. scale (046) →Diameter vessel (047) → Check table
		no ↓	
		An interference echo may have been evaluated. yes →	1. Carry out tank mapping → Basic setup
No change of measured value on filling/emptying		Interference echo from tank internals, nozzle or buildup on the probe	1. Carry out tank mapping → Basic setup 2. If necessary, clean probe 3. If necessary, select better mounting position
E641 (loss of echo) after switching on the power supply	**If the device is configured to HOLD in the event of echo loss the output is set to any value/ current.**	Noise level during the initialization phase too high.	Repeat empty calibr. (005) once more. Caution! Before confirmation change with ⊕ or ⊖ to the edit mode.

Error	Output	Possible cause	Remedy
Device displays a level when the tank is empty.	L00-FMP4xxxx-19-00-00-en-020	Incorrect probe length	1. Carry out automatic probe length detection when the tank is empty. 2. Carry out mapping over entire probe when the tank is empty (probe free!).
Measured value incorrect (slope error in the entire measuring range)	L00-FMP4xxxx-19-00-00-en-021	Tank properties incorrect.	LN < 4 m and "Aluminum tank" tank properties selected → Calibration not possible. → Selection → Select standard → Thresholds too high
		Medium properties incorrect.	Select lower medium properties.

9.4   Spare Parts

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

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

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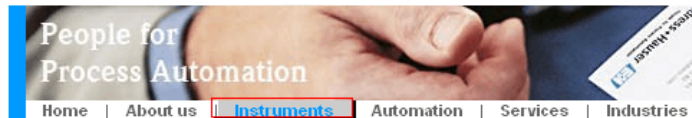
3.   Enter the product name into the "product name" field.
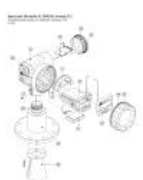
4.   Select the device.

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

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

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

9.5   Return

The following procedures must be carried out before a level transmitter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain fluid residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.
- Always enclose a duly completed "Declaration of contamination" form with the device (a copy of the "Declaration of contamination" can be found at the end of these Operating Instructions). 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:
- The chemical and physical characteristics of the fluid
- A description of the application
- A description of the error that occurred (specify error code if possible)
- Operating time of the device

9.6   Disposal

When disposing, separate and recycle the device components based on the materials.

9.7   Software history

Date	Software version	Software modifications	Documentation	Discription of Instrument Functions
07.2007	01.04.02	Original software.	BA358F/00/en/07.07 71041163 BA358F/00/en/03.09 71074937 BA00358F/00/EN/13.10 71120306	BA245F/00/en/07.07 71040940

9.8   Contact addresses of Endress+Hauser

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

10   Technical data

10.1   Additional technical data

10.1.1   Input

Measured variable

The measured variable is the distance between the reference point (see Fig., $\rightarrow$ 📄 11) and the product surface. The level is calculated subject to the empty distance entered "E" (see Fig., $\rightarrow$ 📄 54). Alternatively, the level can be converted by means of linearization (32 points) to other variables (volume, mass).

10.1.2   Output

Output signal

- PROFIBUS PA:
  - signal coding: Manchester Bus Powered (MBP)
  - data transmission rate: 31.25 KBit/s, voltage mode

Signal on alarm

Error information can be accessed via the following interfaces:
- Local display:
  - Error symbol ($\rightarrow$ 📄 33)
  - Plain text display
- Current output, failsafe mode can be selected (e.g. according to NAMUR recommendation NE43)
- Digital interface

Linearization

The linearization function of the Levelflex M allows the conversion of the measured value into any unit of length or volume and mass or %. Linearization tables for calculating the volume in cylindrical tanks are preprogrammed. Other tables with up to 32 value pairs can be entered manually or semi-automatically. The creation of a linearization table with FieldCare is particularly convenient.

10.1.3   Performance characteristics

Reference operating conditions

- Temperature = +20 °C ± 5 °C
- Pressure = 1013 mbar abs. ±20 mbar
- Relative humidity (air) = 65 % ±20 %
- Metallic tank, no internals, distance to tank wall > 500 mm
- Medium: water (DC > 7), respectively oil (DC = 2)
- Probe length > 500 mm

Maximum measured error

Is in Function group "basic setup" (00) starting from $\rightarrow$ 📄 56.

Resolution

Digital: 1 mm

Reaction time

The reaction time depends on the configuration.

Shortest time:
- 2-wire electronics: 1 s

Influence of ambient temperature

The measurements are carried out in accordance with EN 61298-3:
- Digital output:
  - average T_K: 0.6 mm/10 K, max. ±3.5 mm over the entire temperature range -40 °C to +80 °C

10.1.4   Operating conditions: Environment

Ambient temperature range	Ambient temperature for electronics: –40 °C to +80 °C. The functionality of the LCD display may be limited for temperatures $T_a < -20$ °C and $T_a > +60$ °C. A weather protection cover should be used for outdoor operation if the device is exposed to direct sunlight.
Ambient temperature limits	If the temperature (T_2) at the process connection is above 80 °C, the permitted ambient temperature (T_1) decreases as per the following diagram (temperature derating):

L00-FMP43xxx-05-00-00-en-002
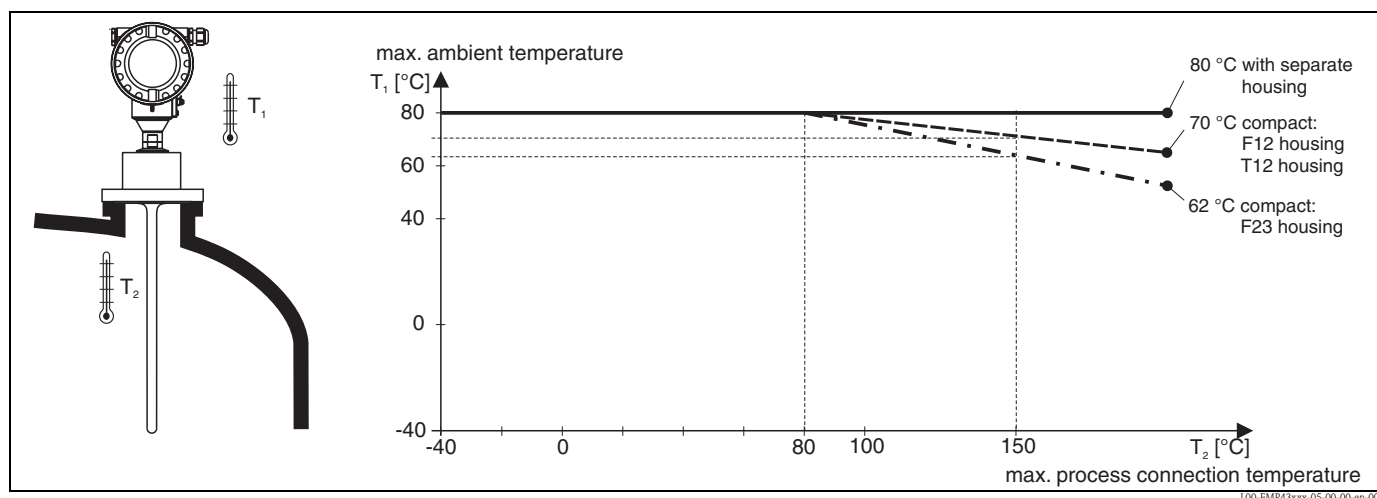
Storage temperature	–20 °C to +80 °C
Climate class	DIN EN 60068–2–38 (test Z/AD)

Degree of protection	■ With closed housing tested according to
	  – All housings
	    – IP68, NEMA6P (24 h at 1.83 m under water)
	    – IP66, NEMA4X
	  – Housing F23: IP69K in combination with cable entries M20, G½ and NPT½
	■ With open housing: IP20, NEMA1 (also ingress protection of the display)
	
	Caution!
	Degree of protection IP68 NEMA6P applies for M12 PROFIBUS PA connectors only when the PROFIBUS cable is plugged in.
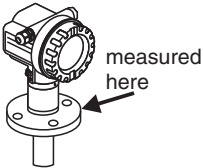
Vibration resistance	DIN EN 60068–2–64 / IEC 68–2–64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$
Cleaning the probe	Depending on the application, contamination or build–up can accumulate on the probe. A thin, even layer only influences measurements sligthly. Thick layers can dampen the signal and then reduce the measuring range. Severe, uneven build–up, adhesion e.g. through crystallization, can lead to incorrect measurement. In this case, we recommend that you use a non–contact measuring principle, or check the probe regularly for soiling.

| Electromagnetic compatibility (EMC) | Electromagnetic compatibility to EN 61326 and NAMUR Recommendation EMC (NE21). Details are provided in the Declaration of Conformity. A standard installation cable is sufficient if only the analog signal is used. |

When installing the probes in metal and concrete tanks and when using a coax probe:
- Interference emission to EN 61326 – x series, electrical equipment Class B.
- Interference Immunity to EN 61326 – x series, requirements for industrial areas and NAMUR Recommendation NE21 (EMC)

The measured value can be affected by strong electromagnetic fields when installing rod and rope probes without a shielding / metallic wall, e.g. plastiv, and in wooden silos.
- Interference emission to EN 61326 – x series, electrical equipment Class A.
- Interference Immunity: the measured value can be affected by strong electromagnetic fields.

10.1.5 Operating conditions: Process

Process temperature range

The maximum permitted temperature at the process connection (see figure measuring point) is determined by the O-ring material ordered:

O-ring material	Min. temperature	Max. temperature	
FFKM (Kalrez)	–20 °C	+150 °C	measured here
EPDM	–20 °C	+130 °C	

Process pressure limits

Pmax = 16 bar.
This range may be reduced by the selection of process connection (→ 🖹 12).
The pressure rating (PN) specified on the flanges refers to a reference temperatur of 20 °C, for ASME flanges 100 °F. Observe pressure–temperature dependency.

Please refer to the following standards for the pressure values permitted for higher temperatures:
- EN 1092–1: 2001 Tab.18
  With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092–1 Tab.18. The chemical composition of the two materials can be identical.
- ASME B 16.5a – 1998 Tab. 2–2.2 F316
- ASME B 16.5a – 1998 Tab. 2.3.8 N10276
- JIS B 2220

Dielectric constant

$\varepsilon r \geq 1.6$

10.1.6   Mechanical construction

Material   See TI00424F/00/EN, chapter "Material (not in contact with process)" and "Material (in contact with process)".

Tolerance of probe length

Tolerance	Rod length
+ 0 / – 3 mm	< 1000 mm
+ 0 / – 5 mm	1000 to < 4000 mm

Weight

Part	Weight	Part	Weight
T12 housing	approx. 2.7 kg	Compact probe, removable	approx. 0.8 kg
F12 housing	approx. 1.8 kg	Separate probe	approx. 2.1 kg
F23 housing	approx. 5 kg	Probe rod	approx. 0.4 kg/m
Compact probe	approx. 0.7 kg		

Process connection   See "Ordering structure", → 📄 6.

Probe   See "Ordering structure", → 📄 6.

✎   Note!
The modular structure of the probe makes a simple possible exchanges of the process seals, the probe rod and the process coupling ring.

10.1.7 Certificates and approvals

CE approval

The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

Certificates

The devices are certified for use in hazardous areas. The safety instructions to be observed are enclosed and referenced on the nameplate:
- Europe: EC type–examination certificate, safety instructions XA
- USA: FM Approval, Control Drawing
- Canada: CSA Certificate of Compliance, Control Drawing
- China: NEPSI Explosion Protection Certificate of Conformity, Safety Instructions XA
- Japan: TIIS Certificate for Ex–apparatus

Correlation of the certificates (XA, ZD) to the device:

Feature	Description	Variant	ZD021F	ZD110F	ZD109F	ZD107F	ZD106F	ZD078F	ZD077F	ZD076F	ZD075F	ZD117F	ZD116F	ZD114F	ZD113F	ZD083F	ZD082F	ZD081F	ZD080F	XA379F	XA378F	XA416F	XA415F	XA414F	XA413F	XA412F	XA411F	XA410F
10 Approval:	Non-hazardous area	A																										
	*NEPSI Ex ia IIC T6	I																		X	X							
	*TIIS Ex ia IIC T4	K																										
	FM DIP Cl.II Div.1 Gr. E-G, N.I.	M				X																						
	CSA General Purpose	N																										
	CSA DIP Cl.II Div.1 Gr. G + coal dust	P														X												
	FM IS Cl.I,II,III Div.1 Gr. A-G, N.I., zone 0, 1, 2	S	X	X	X	X	X		X	X																		
	FM XP Cl.I,II,III Div.1 Gr. A-G, zone 1, 2	T						X																				
	CSA IS Cl.I,II,III Div.1 Gr. A-D, G + coal dust, N.I., zone 0, 1, 2	U										X	X	X	X		X	X										
	CSA XP Cl.I,II,III Div.1 Gr. A-D, G + coal dust, N.I., zone 1, 2	V																	X									
	ATEX II 1/2G Ex ia IIC T6	1																									X	X
	ATEX II 1/2D, Alu blind cover [1]	2																				X	X	X				
	ATEX II 2G Ex e mb (ia) IIC T6	3																							X			
	ATEX II 1/3D [1]	4																				X	X	X				
	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D	5																					X					
	ATEX II 1/2G Ex d (ia) IIC T6	7																									X	
50 Power supply Output:	2-wire 4-20mA SIL HART	B		X		X		X		X		X		X		X		X		X	X	X		X	X			X
	2-wire PROFIBUS PA	D	X	X		X			X	X		X		X						X	X		X		X	X	X	X
	2-wire FOUNDATION Fieldbus	F	X	X		X			X	X		X		X						X	X		X		X	X	X	X
	4-wire 90-250VAC 4-20mA SIL HART	G					X									X								X				
	4-wire 10.5-32VDC 4-20mA SIL HART	H					X									X								X				
80 Housing:	F12 Alu, coated IP68 NEMA6P	A	X				X		X	X			X						X		X	X			X		X	X
	F23 316L IP68 NEMA6P	B	X		X	X								X	X						X		X				X	X
	T12 Alu, coated IP68 NEMA6P	C						X										X			X				X	X		
	T12 Alu, coated IP68 NEMA6P + OVP	D	X	X	X							X	X								X				X		X	X

1) Housing F12/F23/T12-OVP: In combination with electronics B, D or F supply intrinsically safe.
* In preparation

Sanitary compatibility	Overview of permitted process connections, → 📄 12.

Note!

The gap-free connections can be cleaned without residue using the usual cleaning methods.

Many versions of the Levelflex M meet the requirements of 3A-Sanitary Standard No. 74. Endress+Hauser confirms this by attaching the 3A symbol.

Pharma (CoC)	*Certificate of Compliance (CoC)*

- See "Ordering structure", → 📄 6, feature 100 "Additional Option:", option"P".
- Materials in Contact with process made of 316L with Δ ferrite < 3%
- Surface roughness Ra < 0,38 µm/15 µin
- Information on ASME BPE Conformity

Telecommunications	Complies with "Part 15" of the FCC rules for an "Unintentional Radiator". All probes meet the requirements for a "Class A Digital Device". In addition to this, all probes in metallic tanks meet the requirements for a "Class B Digital Device".

External standards and guidelines	The European directives and standards applied can be taken from the associated EC Declarations of Conformity. In addition, the following also applied for Levelflex M:

EN 60529
Protection class of housing (IP-code)

Namur – international user association of automation technology in process industries.
- NE21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NE43
  Standardization of the signal level for the failure information of digital transmitters.

10.1.8 Additional documentation

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

- Technical Information (TI00424F/00/EN)
- Operating Instructions "Description of Instrument Functions" (BA00245F/00/EN)
- Guideline for planning and commissioning (BA034S/04/DE)

11 Appendix

11.1 Operating menu PA (display module)

basic setup 00	tank properties 002	medium cond. 003	process proper. 004	end of probe 030	determine length 034	empty calibr. 005
	standard	**unknown**	**standard**	see Function group "legth adjustment 03"		enter value
	aluminium tank	DC: 1.4 … 1.6	fast change			
	plastic tank	DC: 1.6 … 1.9	slow change			
	bypass / pipe	DC: 1.9 … 2.5	test: no filter			
	coax probe	DC: 2.5 … 4				
	concrete wall	DC: 4 … 7				
		DC: > 7				

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

length adjustment 03	end of probe 030	probe length 031	probe 032	probe length 033	determine length 034
	free	not modified	covered		length OK
	tie down isolated			probe length 033	too short
	tie down gnd.	modified	free		too long

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

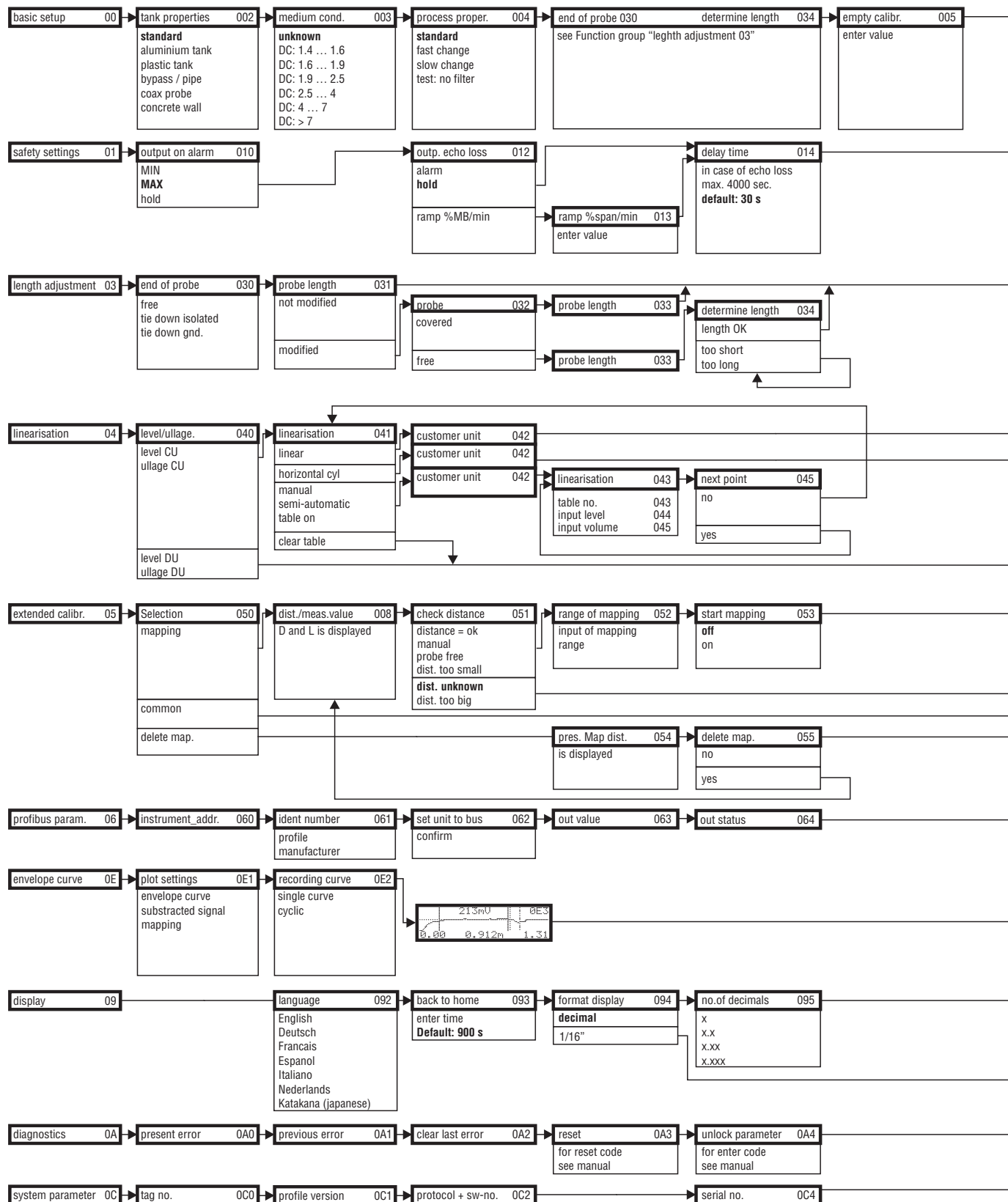| extended calibr. 05	Selection 050	dist./meas.value 008	check distance 051	range of mapping 052	start mapping 053
	mapping	D and L is displayed	distance = ok	input of mapping	**off**
			manual	range	on
			probe free		
			dist. too small		
	common		**dist. unknown**		
			dist. too big		
	delete map.			pres. Map dist. 054	delete map. 055
				is displayed	no
					yes

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

envelope curve 0E	plot settings 0E1	recording curve 0E2	
	envelope curve	single curve	213mV 0E3
	substracted signal	cyclic	0.00 0.912m 1.31
	mapping		

display 09		language 092	back to home 093	format display 094	no.of decimals 095
		English	enter time	**decimal**	x
		Deutsch	**Default: 900 s**	1/16"	x.x
		Francais			x.xx
		Espanol			x.xxx
		Italiano			
		Nederlands			
		Katakana (japanese)			

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

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

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

L00-FMP4xxxx-19-00-01-en-007

full calibr. 006	dist./meas.value 008	check distance 051	range of mapping 052	start mapping 053	dist./meas.value 008
enter value	D and L are displayed	distance = ok dist. too small **manual** probe free	input of mapping range	**off** on	D and L are displayed
		dist. unknown dist. too big			

safety distance 015	in safety dist. 016	ackn. alarm 017	overspill protection 018	brocken probe det 019
from blocking distance **default: 0.1m**	alarm **warning** self holding	**no** yes	**standard** german WHG	**off** on

max. scale 046

max. scale 046	diameter vessel 047

dist./meas.value 008
D und L is displayed

echo quality 056	offset 057	output damping 058	upper block.dist 059
is displayed	will be added to the measured level		

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

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

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

distance unit 0C5	download mode 0C8

Return to Group Selection

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11.2   Patents

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

- US 5,661,251 ≅ EP 0 780 664
- US 5,827,985 ≅ EP 0 780 664
- US 5,884,231 ≅ EP 0 780 665
- US 5,973,637 ≅ EP 0 928 9741

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Endress+Hauser

People for Process Automation

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

RA No. ☐☐☐☐☐☐☐

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

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

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

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

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

Process data/ *Prozessdaten*

Temperature / *Temperatur* _____ [°F] _____ [°C]   Pressure / *Druck* _____ [psi] _____ [Pa]

Conductivity / *Leitfähigkeit* _____ [µS/cm]   Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

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

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

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

Description of failure / *Fehlerbeschreibung* _____
_____
_____

Company data / *Angaben zum Absender*

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

Address / *Adresse*   Fax / E-Mail _____
_____
_____   Your order No. / *Ihre Auftragsnr.* _____

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

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

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

P/SF/Konta XIV

Endress+Hauser

People for Process Automation

www.endress.com/worldwide