Operating Instructions

Levelflex M FMP45

Guided Level–Radar
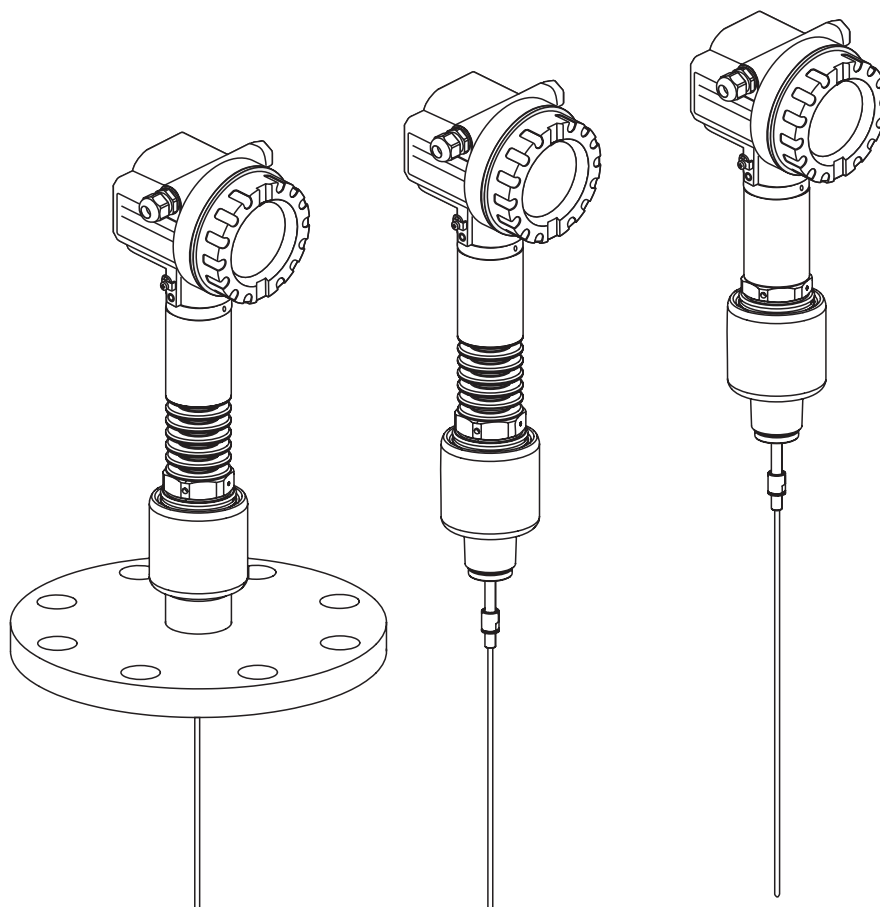
FOUNDATION

Endress+Hauser **EH**

People for Process Automation

Brief Operating Instructions
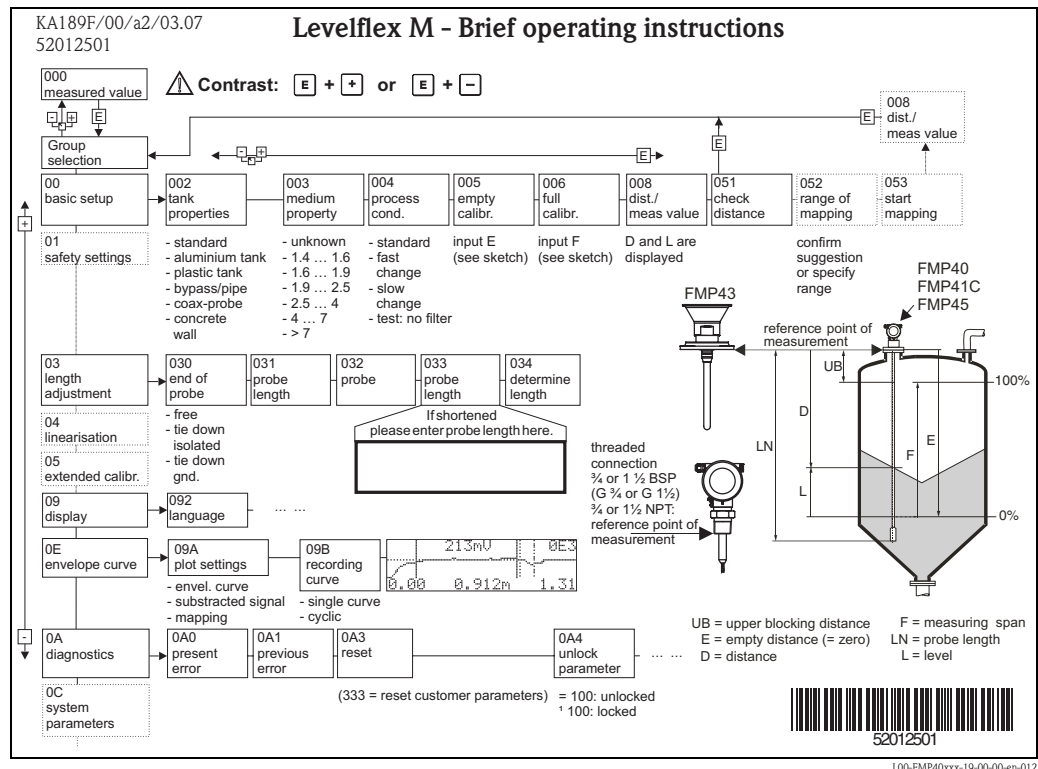
✎ Note!

This Operating Instructions explains how to install and commission the level transmitter.
All 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 device functions** can be found on Page 100.

The Operating Instructions BA00245F/00/EN "Description of Instrument Functions" provides an **extensive description of all 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 the continuous measurement of solids and liquids, measuring prinziple: Guided Level Radar / TDR: **T**ime **D**omain **R**eflectometry.

1.2   Installation, commissioning and operation

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

1.3   Operational safety and process safety

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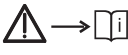
Hazardous areas

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

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

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

⚠→📖	**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:
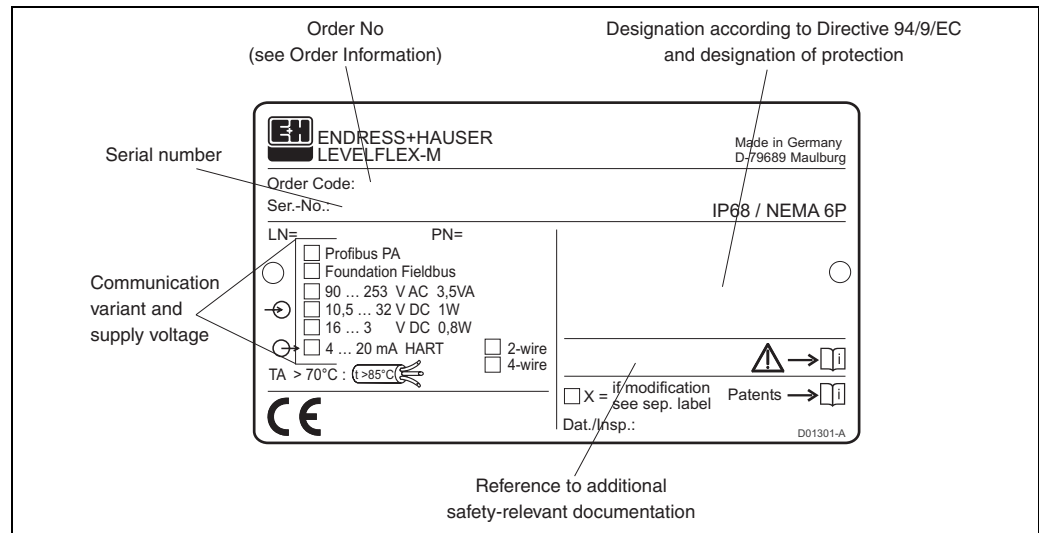
Information on the nameplate of the Levelflex M FMP45

2.1.2   Ordering structure

This overview does not mark options which are mutually exclusive.

10		Approval:
	A	Non-hazardous area
	F	Non-hazardous area, WHG
	1	ATEX II 1/2G EEx ia IIC T6/IECEx Zone 0/1
	2	ATEX II 1/2D / IEC Ex td A20/21, Alu blind cover
	3	ATEX II 1/2G EEx emb (ia) IIC T6/IECEx Zone 0/1
	4	ATEX II 1/3D / IEC Ex td A20/22
	5	ATEX II 1/2G EEx ia IIC T6, ATEX II 1/3D
	6	ATEX II 1/2G EEx ia IIC T6, WHG
	7	ATEX II 1/2G EEx d (ia) IIC T6 / IEC Ex d(ia) IIC T6
	8	ATEX II 1/2G EEx ia IIC T6, ATEX II 1/3D, WHG
	G	ATEX II 3G EEx nA II T6
	C	NEPSI Ex emb (ia) IIC T6
	I	NEPSI Ex ia IIC T6
	J	NEPSI Ex d (ia) IIC T6
	Q	NEPSI DIP (in preparation)
	R	NEPSI Ex nA II T6
	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 d (ia) IIC T1
	L	TIIS Ex d (ia) IIC T2
	Y	Special version, TSP-No. to be spec.

20						Process temperature:
	A					-200...+280 °C / -328...+536 °F (XT); saturated steam max. +200 °C / +392 °F
	B					-200...+400 °C / -328...+752 °F (HT)
	Y					Special version, TSP-No. to be spec.

30						Probe:
		A				..... mm, rope 4mm, 316
		C				..... inch, rope 1/6", 316
		K				..... mm, rod 16 mm, 316L
		L				..... mm, coax, 316L
		M				..... inch, rod 16 mm, 316L
		N				..... inch, coax, 316L
		S				..... mm, rod 16 mm, 316L, 500 mm divisible
		T				..... mm, rod 16 mm, 316L, 1000 mm divisible
		U				..... inch, rod 16 mm, 316L, 20 in divisible
		V				..... inch, rod 16 mm, 316L, 40 in divisible
		Y				Special version, TSP-No. to be spec.

40						Process connection:
			AFJ			2" 150lbs RF, 316/316L flange ANSI B16.5
			AGJ			3" 150lbs RF, 316/316L flange ANSI B16.5
			AHJ			4" 150lbs RF, 316/316L flange ANSI B16.5
			ARJ			2" 300/600lbs RF, 316/316L flange ANSI B16.5
			ASJ			3" 300/600lbs RF, 316/316L flange ANSI B16.5
			ATJ			4" 300lbs RF, 316/316L flange ANSI B16.5
			A1J			2" 1500lbs RF, 316/316L flange ANSI B16.5
			A2J			3" 1500lbs RF, 316/316L flange ANSI B16.5
			A3J			4" 600lbs RF, 316/316L flange ANSI B16.5
			A4J			4" 900lbs RF, 316/316L flange ANSI B16.5
			A5J			4" 1500lbs RF, 316/316L flange ANSI B16.5
			CHJ			DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
			CRJ			DN50 PN10-40 B1, 316L flange EN1092-1 (DIN2527 C)
			CSJ			DN80 PN10-40 B1, 316L flange EN1092-1 (DIN2527 C)
			CTJ			DN100 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
			C1J			DN50 PN63 B2, 316L flange EN1092-1 (DIN2527 E)
			C2J			DN50 PN100 B2, 316L flange EN1092-1 (DIN2527 E)
			C3J			DN80 PN63 B2, 316L flange EN1092-1 (DIN2527 E)
			C4J			DN80 PN100 B2, 316L flange EN1092-1 (DIN2527 E)
			C5J			DN100 PN63 B2, 316L flange EN1092-1 (DIN2527 E)
			C6J			DN100 PN100 B2, 316L flange EN1092-1 (DIN2527 E)
			KFJ			10K 50A RF, 316L flange JIS B2220
			KGJ			10K 80A RF, 316L flange JIS B2220
			KHJ			10K 100A RF, 316L flange JIS B2220
			K3J			63K 50A RF, 316L flange JIS B2220
			K4J			63K 80A RF, 316L flange JIS B2220
			K5J			63K 100A RF, 316L flange JIS B2220
			GGJ			Thread ISO228 G1-1/2, 200bar, 316L
			GJJ			Thread ISO228 G1-1/2, 400bar, 316L
			RGJ			Thread ANSI NPT1-1/2, 200bar, 316L
			RJJ			Thread ANSI NPT1-1/2, 400bar, 316L
			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 90-250VAC; 4-20mA SIL HART
				H		4-wire 10.5-32VDC; 4-20mA SIL HART
				K		2-wire; 4-20mA HART, interface measurement
				Y		Special version, TSP-No. to be spec.

60						Operation:
					1	W/o display, via communication
					2	4-line display VU331, envelope curve display on site
					3	Prepared for FHX40, remote display (accessory)
					9	Special version, TSP-No. to be spec.

70								Type of probe:
						B	Compact, centering disc d=45 mm, 316L, pipe diameter DN50/2"
						C	Compact, centering disc d=75 mm, 316L, pipe diameter DN80/3" + DN100/4"
						F	Remote, cable 3m, top, center d=45 mm, centering disk d=45 mm, 316L, pipe diameter DN50/2"
						G	Remote, cable 3m, top, center d= 75 mm, centering disk d=75 mm, 316L, pipe diameter DN80/3" + DN100/4"
						H	Remote, cable 3m, side, center d=45 mm, centering disk d=45 mm, 316L, pipe diamter DN50/2"
						I	Remote, cable 3m, side, center d=75 mm, centering disc d=75 mm, 316L, pipe diamter DN80/3" + DN100/4"
						1	Compact, basic version
						3	Remote, cable 3m, top entry
						4	Remote, cable 3m, side entry
						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], separate conn. compartment
	Y	Special version, TSP-No. to be spec.

90							Cable Entry:
		2	Gland M20 (EEx d > thread M20)
		3	Thread G1/2
		4	Thread NPT1/2
		5	Plug M12
		6	Plug 7/8"
		9	Special version, TSP-No. to be spec.

100								Additional options:
			A	Basic version
			B	EN10204-3.1 material, wetted parts, (316L wetted parts for rod/coax) inspection certificate
			C	EN10204-3.1 material, wetted parts, (316L pressurized for rope version) inspection certificate
			D	Steam boiler app.+EN10204-3.1 material, Steam boiler approval EN12952-11/12953-9, EN10204-3.1 material, wetted parts (316L wetted parts for rod/coax) inspection certificate
			H	5-point linearity protocol, see additional spec.
			J	5-point, 3.1, NACE, 5-point linearity protocol, see additional spec., EN10204-3.1 material, NACE MR0175 (316L wetted parts) inspection certificate
			N	EN10204-3.1 material, NACE MR0175, (316L wetted parts) inspection certificate
			U	Steam boiler app. 300 mm / 11" gas phase, Steam boiler approval EN12952-11/12953-9, Gas phase comp. 300 mm / 11" reference rod, EN10204-3.1 material, NACE MR0175 (316L wetted parts) inspection certificate
			V	Steam boiler app. 550 mm / 21" gas phase, Steam boiler approval EN12952-11/12953-9, Gas phase comp. 550 mm / 21" reference rod, EN10204-3.1 material, NACE MR0175 (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.

FMP45-										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", Page 10!

The scope of delivery consists of:
- Assembled device
- Accessories (→ 📄 75)
- Endress+Hauser operating program on the enclosed CD-ROM
- Brief operating instructions KA00189F/00/A2 (basic setup/troubelshooting), housed in the device
- Brief operating instructions KA01046F/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 complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.4 Registered trademarks

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

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

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

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

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

3 Installation

3.1 Quick installation guide

Mounting with threaded boss

F12 or T12 housing

1½"

Caution!
Use only the threaded boss ???

AF 60

max. torque
see table

Turn housing

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

F12 housing

Process temperature	torque
max. 280 °C	450 Nm
max. 400 °C	400 Nm

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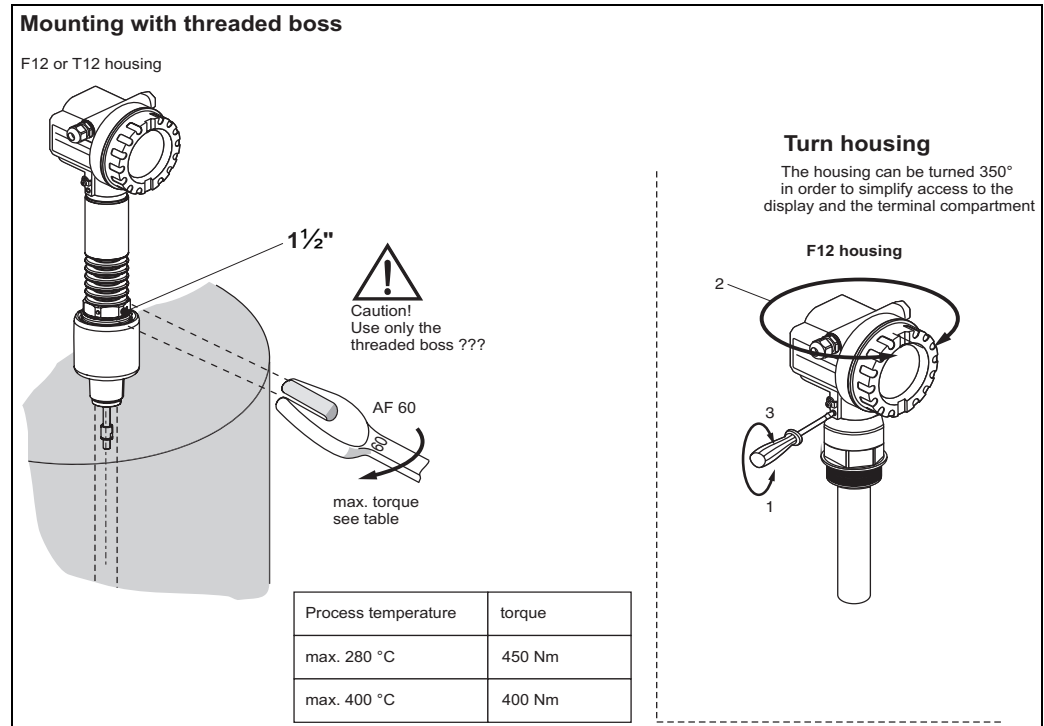
3.2 Incoming acceptance, transport, storage

3.2.1 Incoming acceptance

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

3.2.2 Transport

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

3.2.3 Storage

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

3.3   Installation conditions

3.3.1   Dimensions

Housing dimensions

max. 110 (4.33)   65 (2.56)   78 (3.07)

**F12 housing
(Aluminium)**

ø129 (ø5.08)   150 (5.91)

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)

**T12 housing
(Aluminium)**

ø129 (ø5.08)   162 (6.38)

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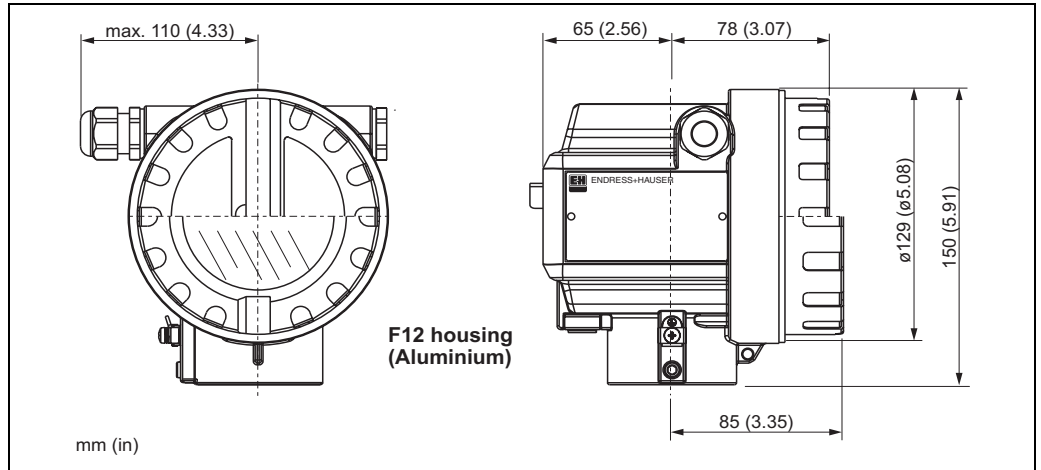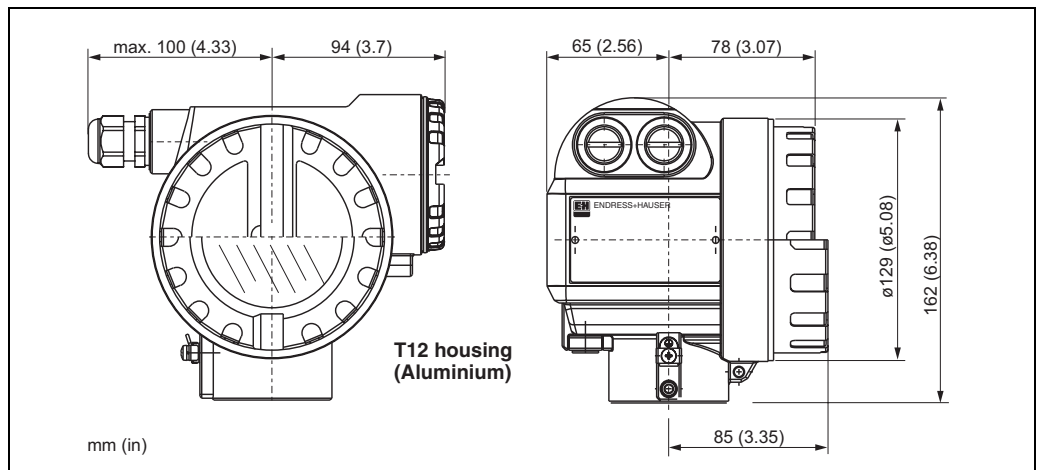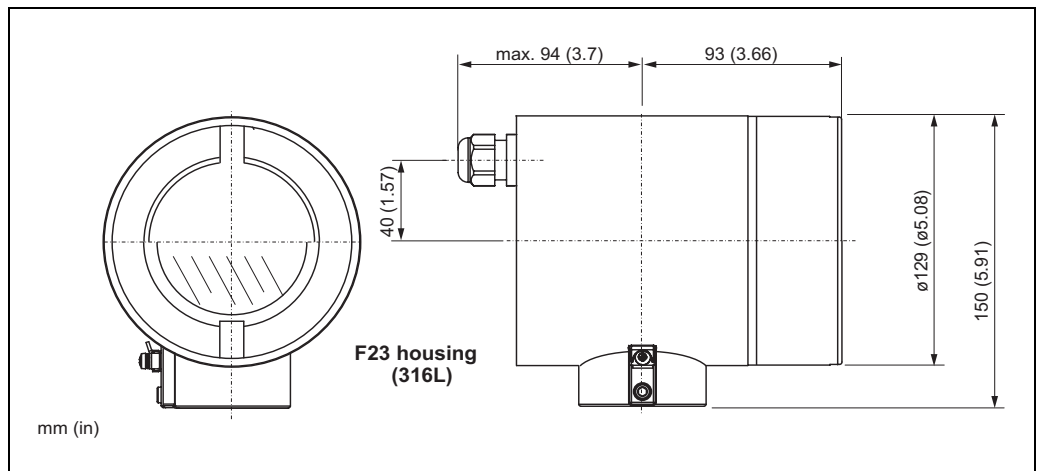
L00-F23xxxx-06-00-00-en-001

Process connection, type of probe

F12 / T12 / F23 housing

Variant "3" / "4":
remote electronic top entry

4 x ø8,5

88

123

2765

260 ø21.3

80

ø76

Variant "4":
remote electronic side entry

100

ø76

ø81

Type of Probe
(see feature 70 in "Ordering structure")

HT 400 °C

Threaded connection G1½ (1½BSP) or 1½NPT

Flange DN50 to 100 or equivalent

XT 280 °C

Threaded connection G1½ (1½BSP) or 1½NPT

Flange DN50 to 100 or equivalent

ø60 SW 60 311 132 8 37 ø90 M10x1.0 M40x1

ø60 338 159 8 ø90 M40x1 ø40

ø60 SW 60 236 132 8 37 ø90 M40x1

ø60 263 159 8 ø90 M40x1 ø40

reference point of measurement

rope probe

rod probe

coax probe for interface measurement or steam boiler approval[1]

coax probe

probe length LN (rope prope - special product) max. 14000

rope: ø4 (0.16")

internal thread: M14 on 4 (0.16") rope

150 20

ø22 (0.87")

ø16 (0.63")

ø45 / ø75

ø45 Option 70, feature "B, F, H"
ø75 Option 70, feature "C, G, I"

Ø 10

40

ø42,4 (1.67")
(on 1½" thread or flange)

25 15 20

3 x Ø 8

ø42,4 (1.67")

probe length LN

L00-FMP45Ixx-06-00-00-en-001

1) See SD00288F/00/EN "Steam boiler approval".

3.4   Installation

3.4.1   Mounting kit

In addition to the tool needed for flange mounting, you will require the following tool:
- For the mounting of threaded connection: 60 mm Open-end spanner for 1½".
- 4 mm Allen wrench for turning the housing.

3.4.2   Shortening probes

✎ Note!
When shortening the probe: Enter the new length of probe into the Quick Setup which can be found in the electronics housing under the display module.
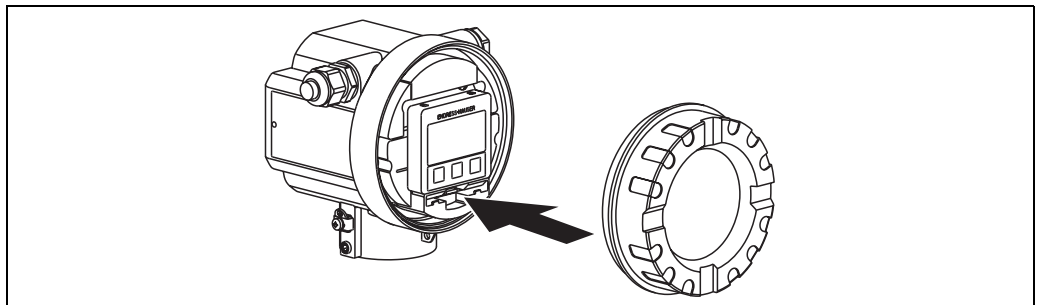
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Rod probe

The shortening is necessary if the distance to the container floor or outlet cone is less than 50 mm. The rods of a rod probe are shortened by sawing or separating at the bottom end.

Rope probes

The shortening is necessary if the distance to the container floor or outlet cone is less than 150 mm.
- Remove ballast weight:
  The weight is fixed to the probe rope with 3 Allen setscrews (M4, Allen key AF3). The screws are secured with Loctite. This may first have to be made plastic with a hot air apparatus.
- Remove released rope from the weight.
- Measure off new rope length.
- Wrap adhesive tape around the rope at the point to be shortened to prevent it from fanning out.
- Saw off the rope at a right angle or cut it off with a bolt cutter.
- Insert the rope completely into the weight,
  – 4 mm rope: 60 mm deep
  – 6 mm rope: 80 mm deep

The weight is then refixed to the rope:
- Reapply screw locking fluid (we recommend Loctite type 243) to the setscrews and screw into place.
- When doing so, observe the following torques:
  – 4 mm rope: 5 Nm
  – 6 mm rope: 15 Nm

M4
secured with
Loctite 243
torque
4 mm cable = 5 Nm
6 mm cable =15 Nm

60 / 80 mm

L00-FMP4xxxx-17-00-00-en-044

Coax probes

The shortening is necessary if the distance to the container floor or outlet cone is less than 10 mm. Coax probes can be shortened max. 80 mm from the end. They have centering units inside which fix the rod centrally in the pipe. The centerings are held with borders on the rod. Shortening is possible up to approx. 10 mm below the centering.

3.4.3   Mounting probes in an empty silo

Caution!
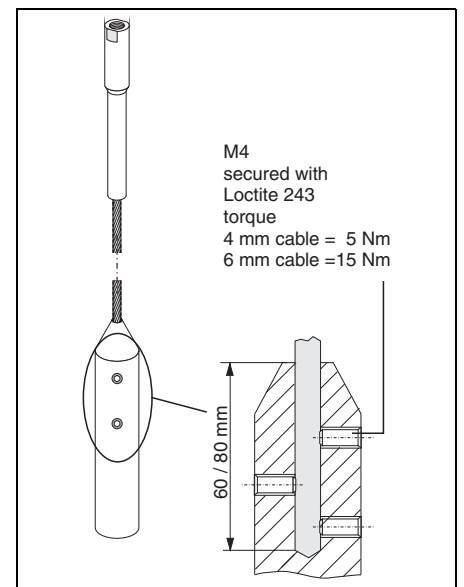If there is a risk of electrostatic discharge from the product, then both processconnection and rope must be earthed before the probe is lowered into the silo.

Levelflex can be screwed into a threaded socket or flange. Proceed as follows:

Insert probe
- Uncoil rope and lower it slowly and carefully into the silo.
- Do not kink the rope
- Avoid any backlash, since this mightdamage the probe or the silo fittings.

✎   Note!
For flange mounting: if a seal is used, be sure to use unpainted metal bolts toensure good electrical contact betweenprobe flange and process flange.

Uncoil rope and lower probe slowly and carefully into the silo

L00-FMP4xxxx-17-00-00-en-056

Screw down
- Screw the Levelflex into the process connection or to flange.
- Turn with the hexagonal nut only: torque 10 to 20 Nm.
- Levelflex functions in metal, concrete and plastic silos. When installing inmetal silos, take care to ensure goodmetallic contact between the processconnection and silo.

Screw in Levelflex

housing allignable

Tighten with the hexagonal nut only
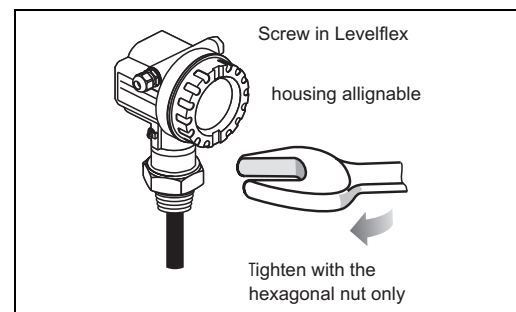
L00-FMP4xxxx-17-00-00-en-057

3.4.4   Mounting rope probes in a partially full silo

It is not always possible to empty a silo which is already in operation. Mounting in a partially filled silo is possible if the following conditions are met:

■ Mount when the silo is as empty as if possible. A minimum of 2/3 of the silo must be empty.

After mounting, map must be made should the installation conditions require it.

Caution!
If there is a risk of electrostatic discharge from the product, the housing must be earthed before the probe is lowered into the silo.

Screw down
■ If appropriate, screw the Levelflex into the threaded flange.
■ Turn with the hexagonal nut only: torque 10 to 20 Nm
■ For flange mounting: if a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.
■ When installing in metal silos, take care to ensure good metallic contact between the process connection and silo.

Screw in Levelflex

housing allignable

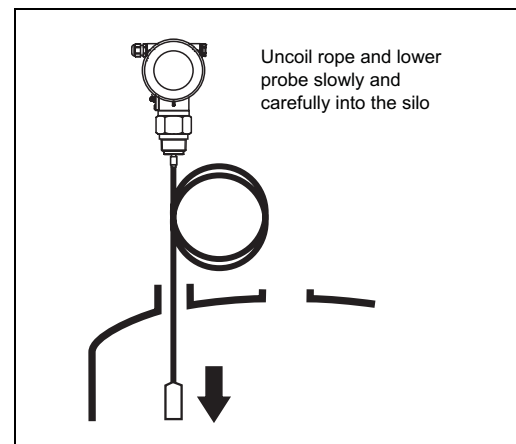Tighten with the hexagonal nut only
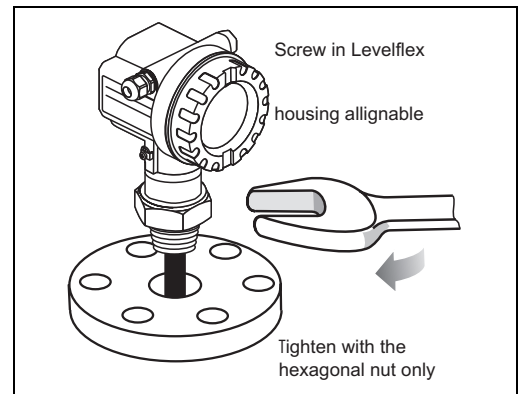
L00-FMP4xxxx-17-00-00-en-058

Insert probe
■ Uncoil rope and lower it slowly and carefully into the silo.
■ Avoid tangles.
■ Avoid any backlash, since this might damage the silo fittings.
■ If possible, make a visual check to see that the rope has not tangled or is lying such that it can knot when the level falls.
  This is particularly important if a flange was not used. Re-insert the probe if necessary.
■ Screw the flange to the counterflange on the nozzle.

Uncoil rope and lower probe slowly and carefully into the silo. Avoid tangles or knots.
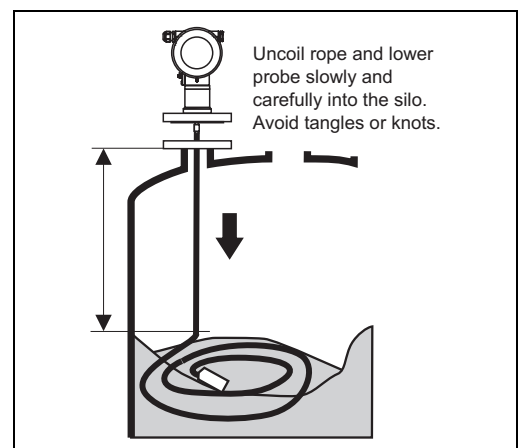
L00-FMP4xxxx-17-00-00-en-059

Note!
Before full accuracy is obtained the probe rope must hang fully extended.

3.4.5   Mounting the probe rod

See KA00228F/00/B8.

3.4.6   General instructions

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

Coax probes are not influenced by the installation conditions. They may also be operated:
- in the filling curtain
- in arbitrary proximity to internal fittings
- at viscositys up to 500 cSt.

Mounting location
- Do not mount rod or rope probes in the filling curtain (2).
- Mount rod and rope probes away from the wall (B) at such a distance that, in the event of build-up on the wall, there is still a minimum distance of 100 mm between the probe and the build-up.
- Mount rod and rope probes as far away as possible from installed fittings. "Mapping " must be carried out during commissioning in the event of distances < 300 mm.
- Minimum distance of probe end to the container floor (C):
  – Rope probe: 150 mm
  – Rod probe: 100 mm
  – Coax probe: 10 mm
- When installing outdoors, it is recommended that you use a protective cover (1). ("Accessories", Page 75).

L00-FMP4xxxx-17-00-00-xx-007
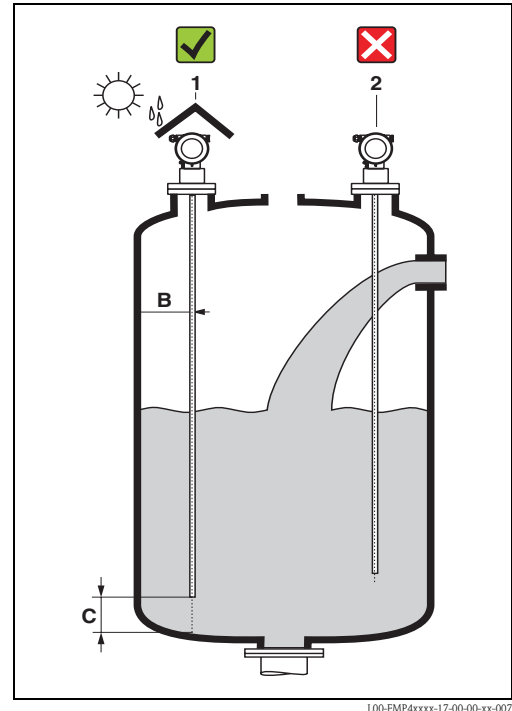
Note!
Seal for devices with G1½" thread
Sealing form at the FMP45 corresponds the DIN 3852 Part 1, screwed end form A. The screwed end has an overall length of 45 mm. In addition, suitable sealing ring as per DIN 7603 with dimensions 48x55 mm. Please use a sealing ring according to this standard in the form A, C or D and of a material that is resistant to the application.

Minimum distance B of rod and rope probes to the container wall:

The wall clearance can be chosen as desired as long as the probe does not touch the tank wall.

Note!
There should no bridges to the wall created by soiling or highly viscous media.

Welding the probe into the vessel

Caution!
Before welding the probe into the vessel, it must be grounded by a low-resistive connection. If this is not possible, the electronics as well as the HF module must be disconnected. Otherwise the electronics may be damaged.

Other installations

- Select the mounting location such that the distance to internals (5) (e.g. limit switch, struts) is > 300 mm over the entire length of the probe, also during operation.
- Probe must within the measuring span not touch any internals during operation.

Optimization options

- Interference echo suppression: Measurement can be optimised by electronically tuning out interference echoes.
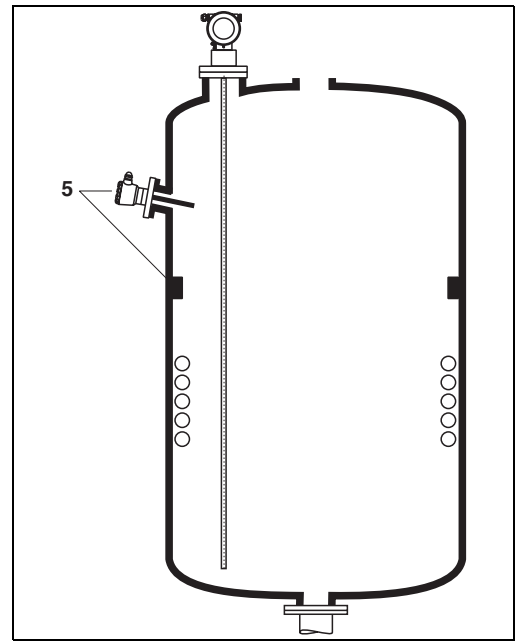
L00-FMP41Cxx-17-00-00-xx-001

Separable probes

If there is little mounting space (distance to the ceiling), it is advisable to use separable rod probes (∅16 mm).

- max. probe length 10 m (394 in)
- max. sideways capacity 20 Nm
- probes are separable several times with the lengths:
  - 500 mm (19.68 in)
  - 1000 mm (39.37 in)
- torque: 15 Nm
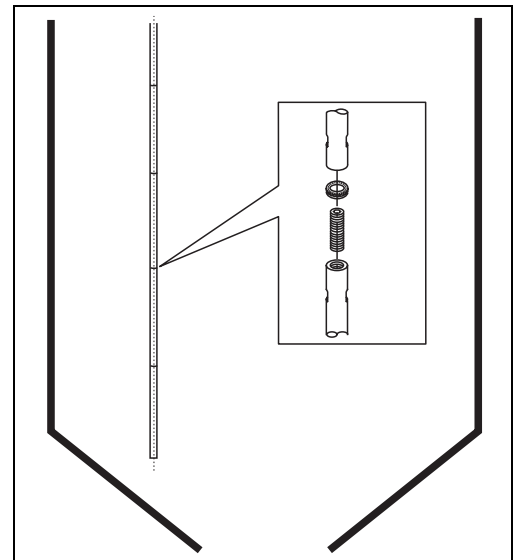
L00-FMP4xxxx-17-00-00-xx-015

Centering of probe end

If the centering disk is mounted at the end of the probe, it enables a reliable measuring.
See "Ordering structure", → 🗎 6.

- Centering disk for rod robes:
  - d = 45 mm (DN50 (2"))
  - d = 75 mm (DN80 (3") + DN100 (4"))

Tightening torque
15 Nm + 5 Nm
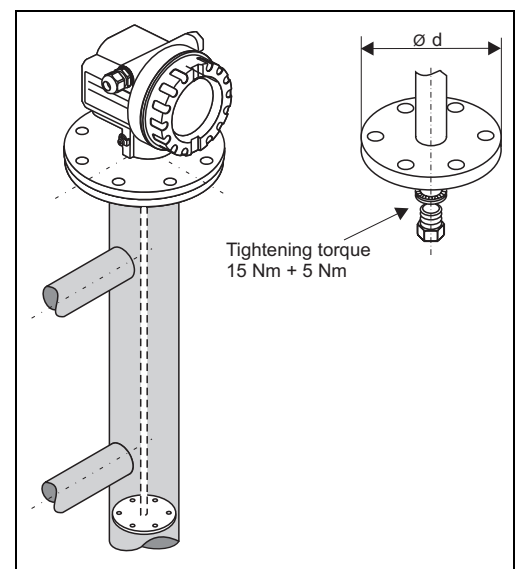
L00-FMP4xxxx-17-00-00-en-068

Supporting probes against warping

For WHG approval:
For probe lengths ≥ 3 m a support is required (see figure).

a.   Rod probes

L00-FMP4xxxx-17-00-00-en-055

b.   Coax probes

L00-FMP4xxxx-17-00-00-en-054
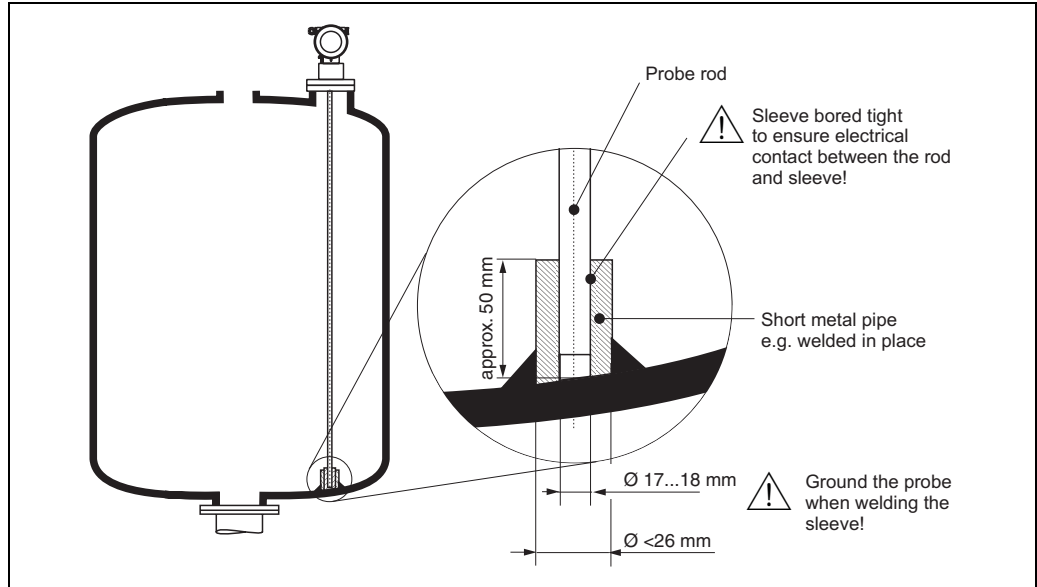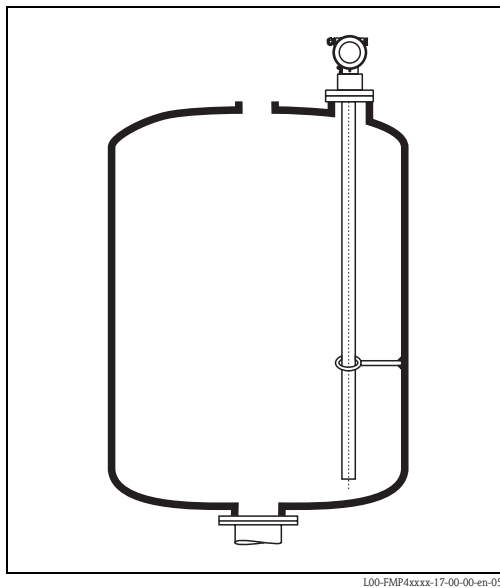
Installing with heat insulation

- If process temperatures are high (≥ 200 °C), FMP45 must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection.
- The insulation may not exceed beyond the points labelled "**MAX**" in the drawing.

Process connection with flange DN50 to DN100

L00-FMP45xxx-17-00-00-en-001
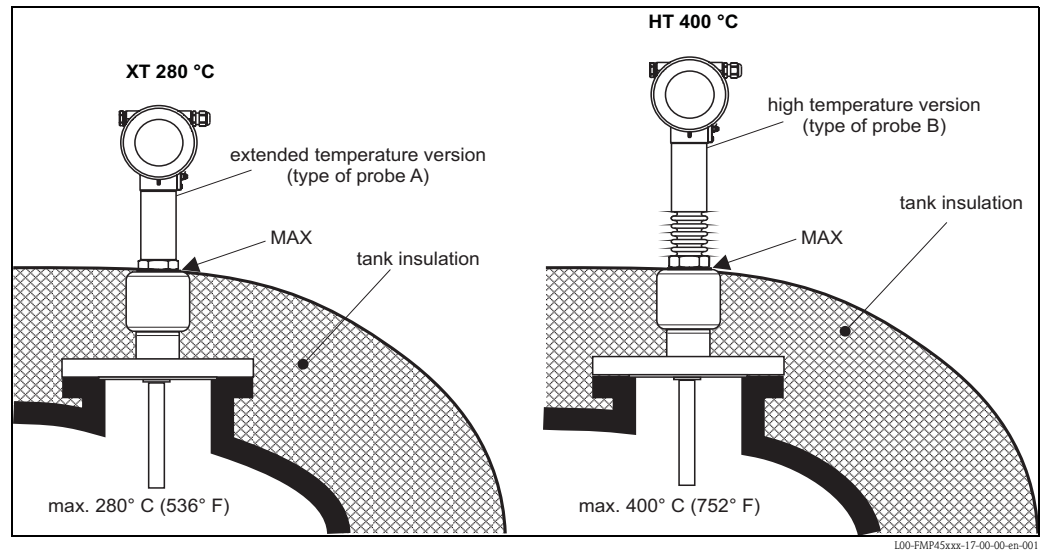
Process connection with adapter G1½" and 1½"NPT
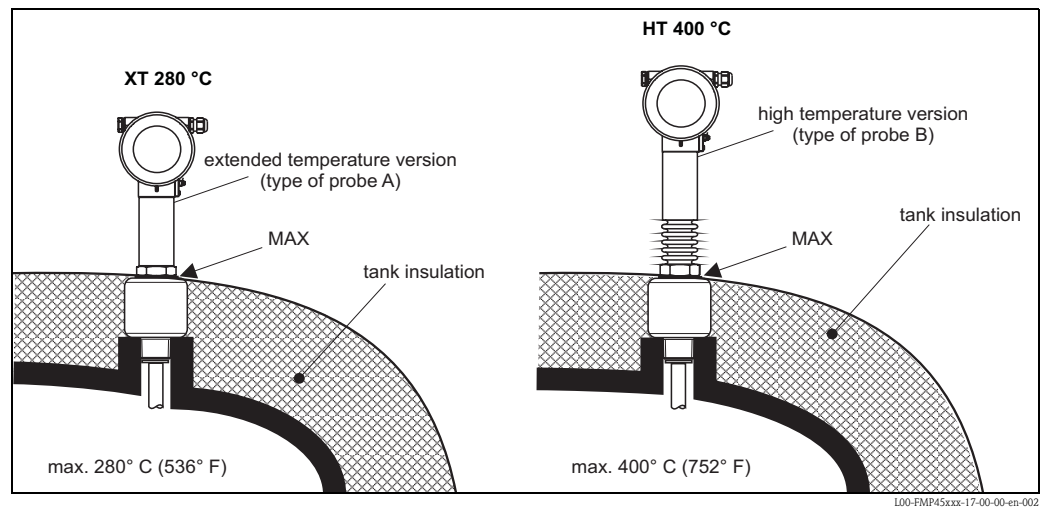
L00-FMP45xxx-17-00-00-en-002

✎ Note!
For saturated steam applications with FMP45 XT the process temperature should not exceed 200 °C (392 °F). For higher process temperatures use the HT version.

3.4.7   Special instructions

When installing in stirring tanks, observe lateral load of probes. Possibly check whether a non-contact radar would not be better suited, above all if the stirrer generates large mechanical loads on the probe.

Installation in horizontal cylindrical and standing tanks

- Use a rod probe for measuring ranges up to 4 m. For anything over this or if there is too free cover space use a rope probe.
- Any distance from wall, as long as occasional contact is prevented.
- When using metal tanks, it is preferable to mount probes (1) eccentrically.
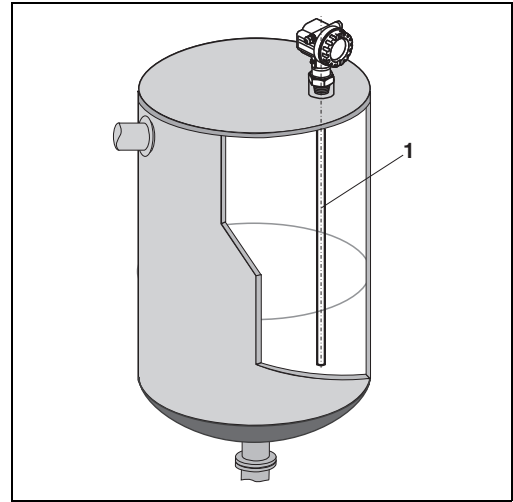
L00-FMP4xxxx-17-00-00-yy-049

Installation in stilling well or bypass

- Rod and rope probes can also be installed in pipes (stilling well, bypass).
- When installing in metal pipes up to DN150 (6"), the measuring sensitivity of the device increases such that liquids as of DC1.4 can be measured.
- Welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence measurement.
- If a rod probe is used, the probe length must be 100 mm longer than the lower disposal.
- It must be ensured that the probe does not come into contact with the side wall. Where necessary, use a centering disk at the lower end of the probe ("Type of probe:", → 🗎 8)
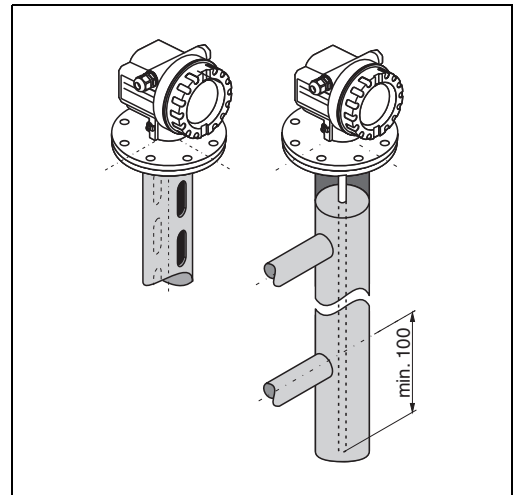
L00-FMP4xxxx-17-00-00-yy-023

Caution!
In vacuum applications and in applications where extremely condensate fermation may occur, there is the danger that the vessel is completely flooded. For media groups with high DC values, this may result in a measuring value lower than the actual level. Please contact your local Endress+Hauser representative for remedial actions.

3.4.8   Notes on special installation situations

Welding the probe into the vessel

Caution!
Before welding the probe into the vessel, it must be grounded by a low-resistive connection. If this is not possible, the electronics as well as the HF module must be disconnected. Otherwise the electronics may be damaged.

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°.
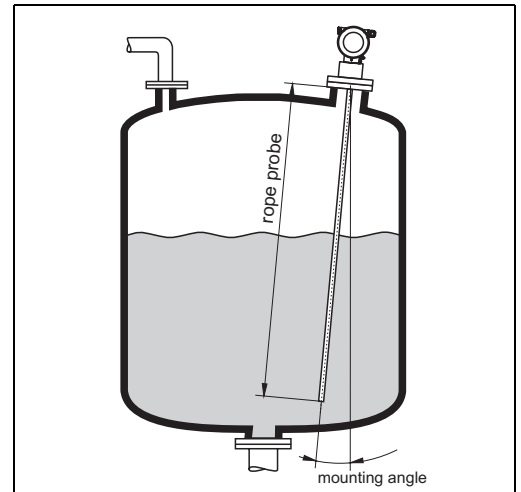
L00-FMP4xxxx-17-00-00-en-048

3.4.9 Installation for difficult to access process connections

Installation with remote electronic

- Wall and pipe bracket is contained in the scope of delivery and already mounted.
- Follow installation instructions, Page 16 ff.
- Mount housing on a wall or pipe as shown in the diagram.
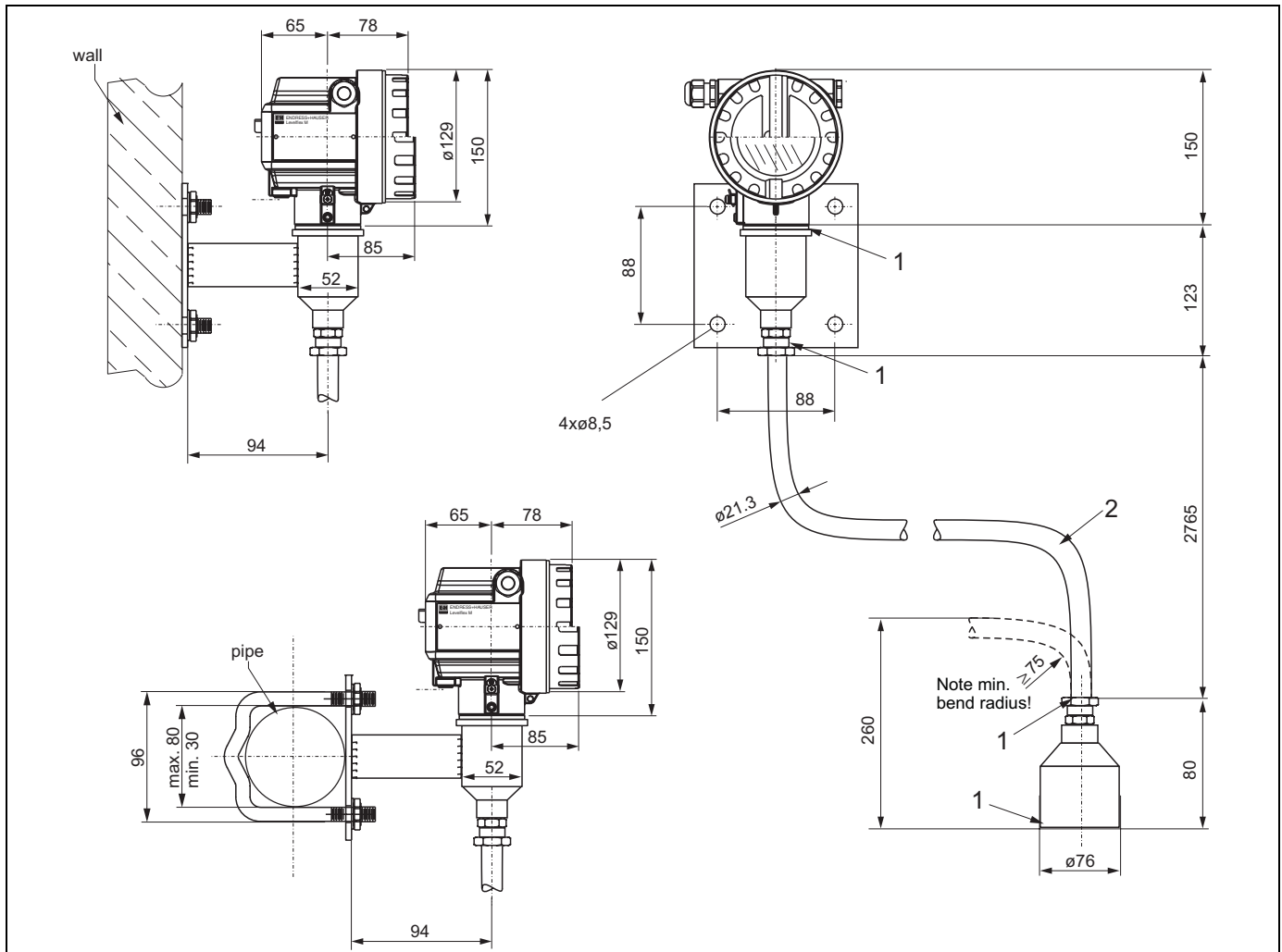
L00-FMP4xxxx-17-00-00-en-015

✎ Note!
The protective hose cannot be disassembled at these points (1).

The ambient temperature for the connecting line (2) between the probe and the electronics must not be greater than 105°C. For the remote electronics, temperatures up to 280 °C or 400 °C (depending on the instrumeent version) are admissible at the process connection. The version with remote electronics consists of the probe, a connecting cable and the housing. If they are ordered as a complete unit they will be delivered assembled and cannot be separated.

3.4.10   Turn housing

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

- Undo the fixing screws (1)
- Turn the housing (2) in the required direction
- Tighten up the fixing screws (1)
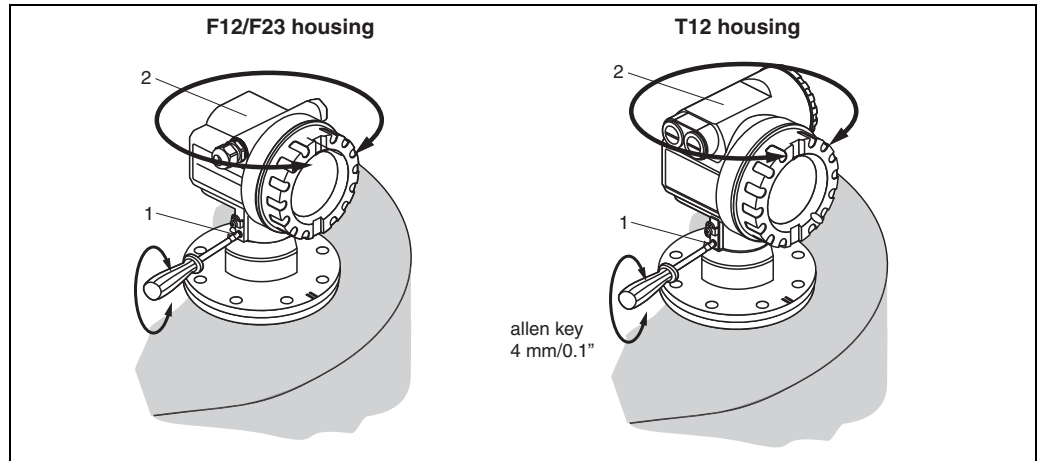
L00-FMP41Cxx-17-00-00-de-002

3.5   Post-installation check

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

- Is the measuring device damaged (visual check)?
- Does the measuring device correspond to the measuring point specifications such as process temperature/pressure, ambient temperature, measuring range, etc.?
- Are the measuring point number and labeling correct (visual check)?
- Is the measuring device adequately protected against rain and direct sunlight (Page 75)?

4   Wiring

4.1   Quick wiring guide

Wiring in F12/F23 housing

Before connection please note the following:

Caution!

FOUNDATION Fieldbus devices are marked on the nameplate (1). The voltage is determined by the FOUNDATION Fieldbus standard and the desired safety concept. (e.g. FISCO).

- 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).

Unplug display connector!

plant ground

FF-   FF+

Sealed terminal compartment

L00-FMP41Cxx-04-00-00-en-005

Wiring in T12 housing

Caution!

Before connection please note the following:

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

- Connect potential matching line to transmitter earth terminal before connecting up the device.
- Tighten the locking screw:
  It forms the connection between the probe and the housing earth potential.
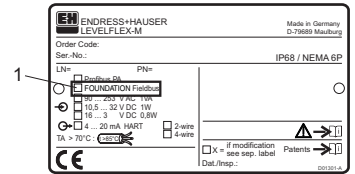
When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's).
Make sure you use the specific cable gland.

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.

plant ground

L00-FMP41Cxx-04-00-00-en-006
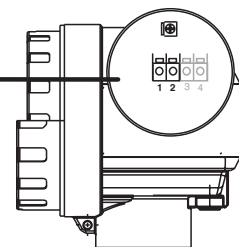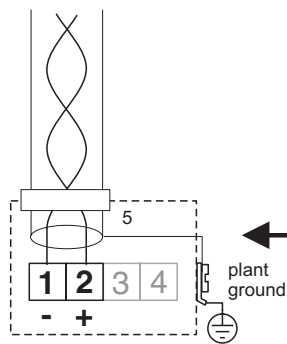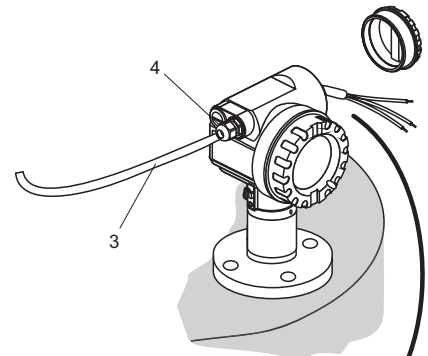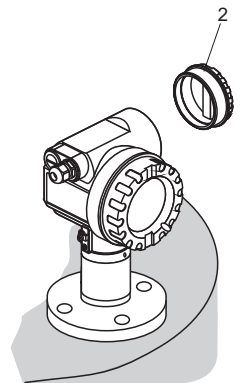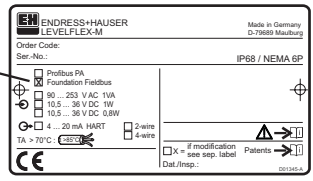
Wiring with FOUNADTION Fieldbus connector

Caution!

Before connection please note the following:

- Foundation Fieldbus devices are marked on the nameplate (1). The voltage is determined by the Foundation Fieldbus standard and the desired safety concept (e.g. FISCO).
- Connect potential matching line to transmitter earth terminal (4) before connecting up the device.

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).

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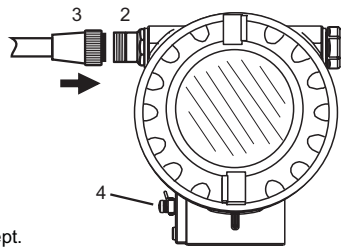
On devices supplied with a certificate, the explosion protection is designed as follows:

- Housing F12 - Ex ia:
  Power supply must be intrinsically safe (e.g. FISCO).
- 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-FMP41Cxx-04-00-00-en-007

Cable specification FOUNDATION Fieldbus

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

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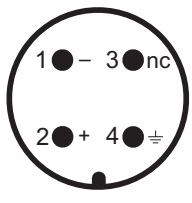
Ex–area:
- Siemens 6XV1 830–5AH10
- Belden 3076F
- Kerpen CEL–PE/OSCR/PVC/FRLA FB–02YS(ST)YFL

Connector

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

PIN assignment for 7/8" connector

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

A0011176

4.2   Connecting the measuring unit

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.

Cable gland

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

Terminals

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

Cable entry

- Cable gland: M20x1.5 (only cable entry for Ex d)
- Cable entry: G½ or ½NPT
- 7/8" FOUNDATION Fieldbus plug

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).

Current consumption

Nominal current	15 mA
Starting current	≤ 15 mA
Error current	0 mA
FISCO/FNICO conformal	Compliant
Polarity sensitive	No

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).

4.3 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
  – IP68, NEMA6P (24 h at 1.83 m under water surface)
  – IP66, NEMA4X
- with open housing: IP20, NEMA1 (also ingress protection of the display)

4.5 Post-connection check

After wiring the measuring device, perform the following checks:
- Is the terminal allocation correct (Page 24 ff., 25)?
- Is the cable gland tight?
- Is the M12 connector screwed tight?
- Is the housing cover screwed tight?
- If auxiliary power is available:
  Is the device ready for operation and is the liquid crystal display visible?

5 Operation

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

- Chapter 6: "Commissioning"
- Operating Instructions BA00245F/00/EN "Description of Instrument Functions"

5.1 Quick operation guide
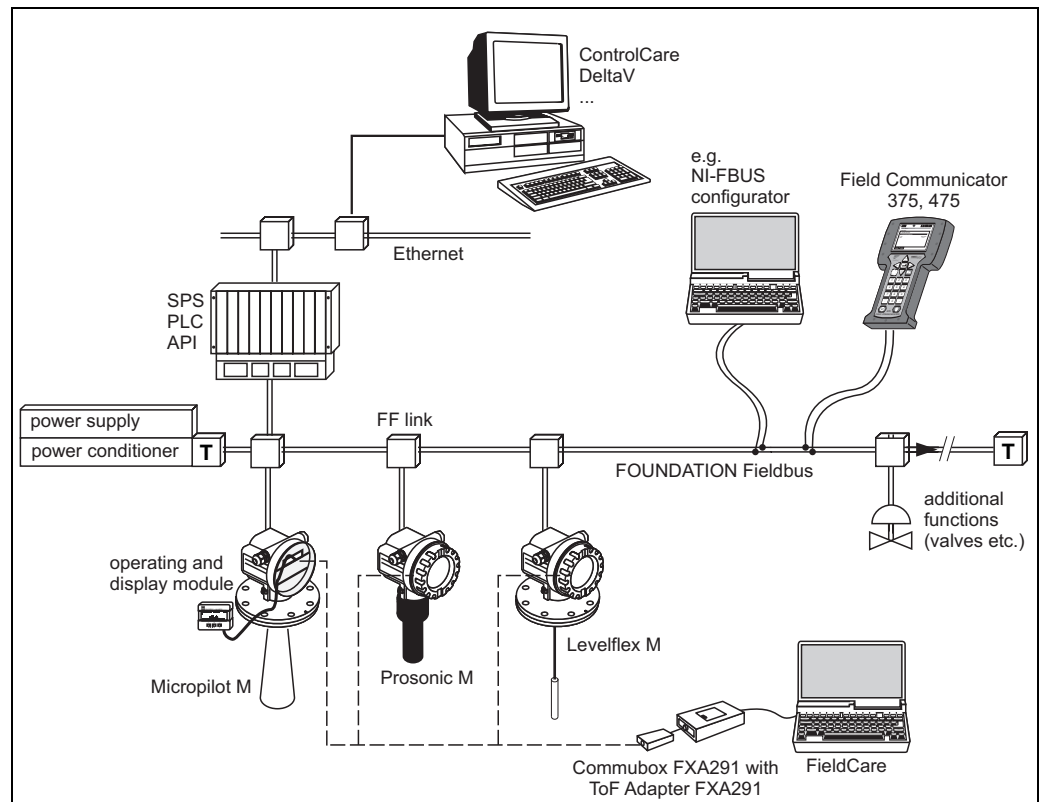
L00-FMxxxxxx-14-00-06-en-011

5.1.1 On-site operation

Options for on-site operation

- Display and operating module VU331
- Endress+Hauser operating software "FieldCare"

Parameter access by on-site operation

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

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

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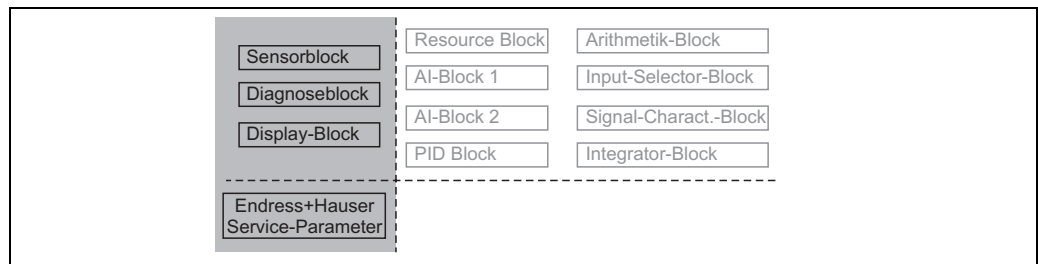
The highlighted parameters can be edited by on-site operation.

5.1.2 Remote operation

Options for remote operation

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

Parameter access by remote operation

The following parameters can be accessed by remote operation:

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

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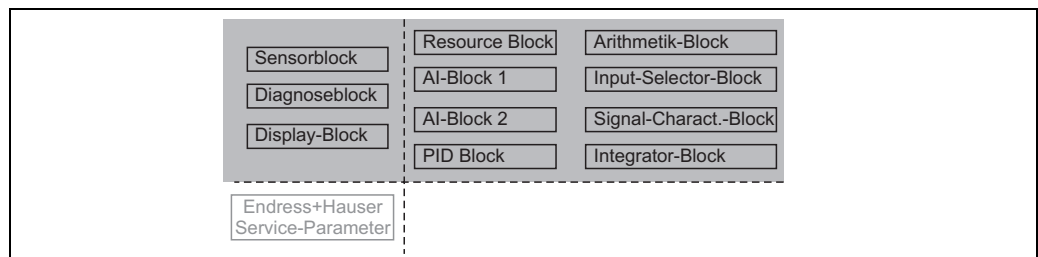
The highlighted parameters can be edited by remote operation.

5.2 Operation with the display and operating module VU331

5.2.1 Liquid crystal display (LCD)

Four lines with 20 characters each. Display contrast adjustable through key combination.
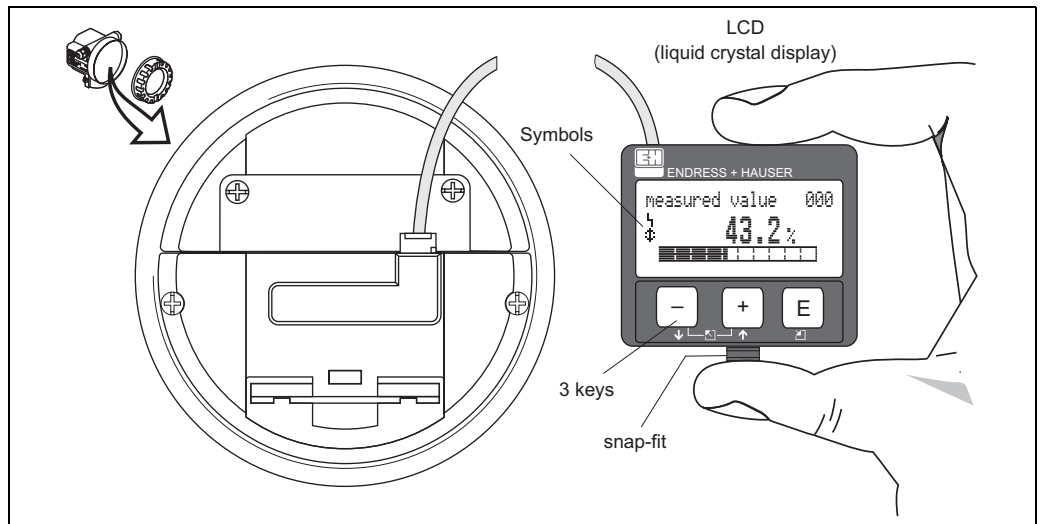
L00-FMxxxxxx-07-00-00-en-001

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
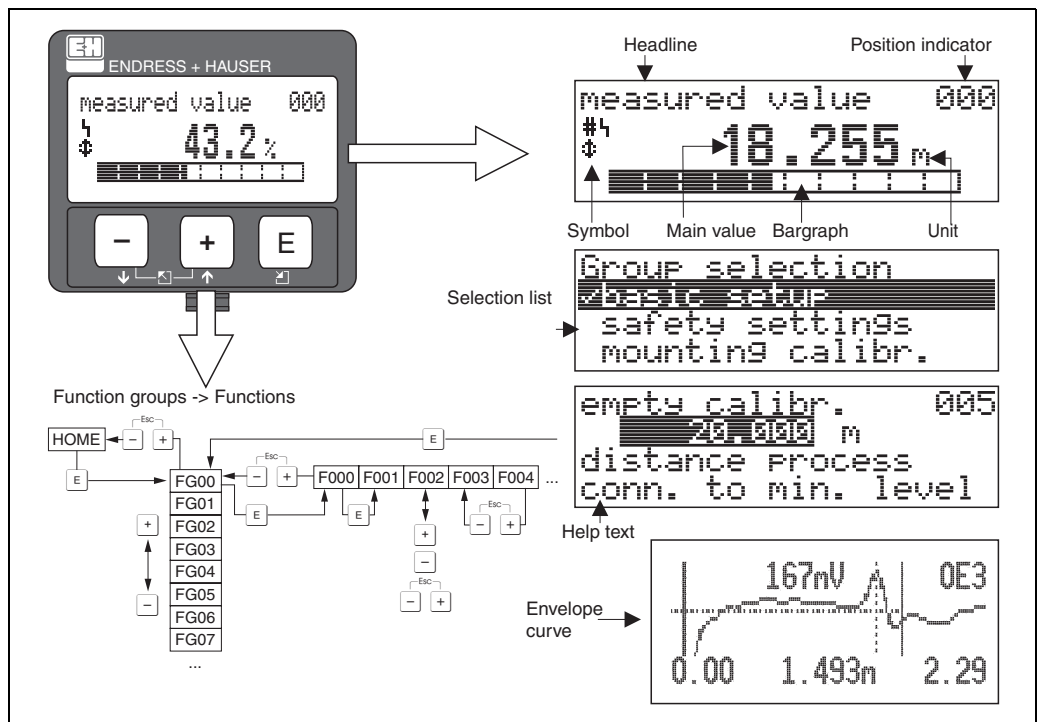
L00-FMRxxxxx-07-00-00-en-007

5.2.3 Display symbols

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

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

5.2.4 Function of the keys

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

5.2.5   The operating menu

General structure of the operating menu

The operating manu 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, e.g.: **"basic setup"**, **"safety settings."**, **"output"**, **"display"**, etc.
- **Functions (001, 002, 003, …, 0D8, 0D9)**:
  Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the device. Numerical values can be entered here and parameters can be selected and saved. The available functions of the **"basic setup" (00)** function group include, e.g.: **"tank properties" (002)**, **"medium property" (003)**, **"process cond." (004)**, **"empty calibr." (005)**, etc.

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

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

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

Identifying the functions

For simple orientation within the function menus, for each function a position is shown on the display.
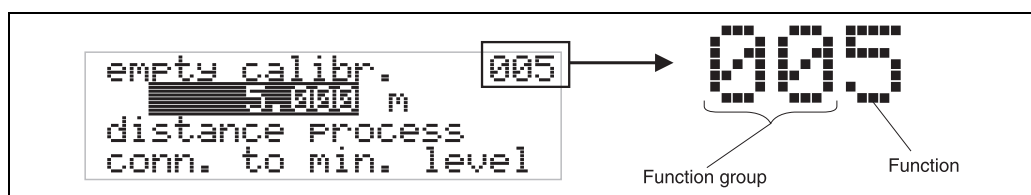
L00-FMRxxxxxx-07-00-00-de-005

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

. . .

The third digit numbers the individual functions within the function group:
- **basic setup**   00   →   - **tank properties**   002
                                      - **medium property**   003
                                      - **process cond.**   004

                                      . . .

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

Navigation within the menu
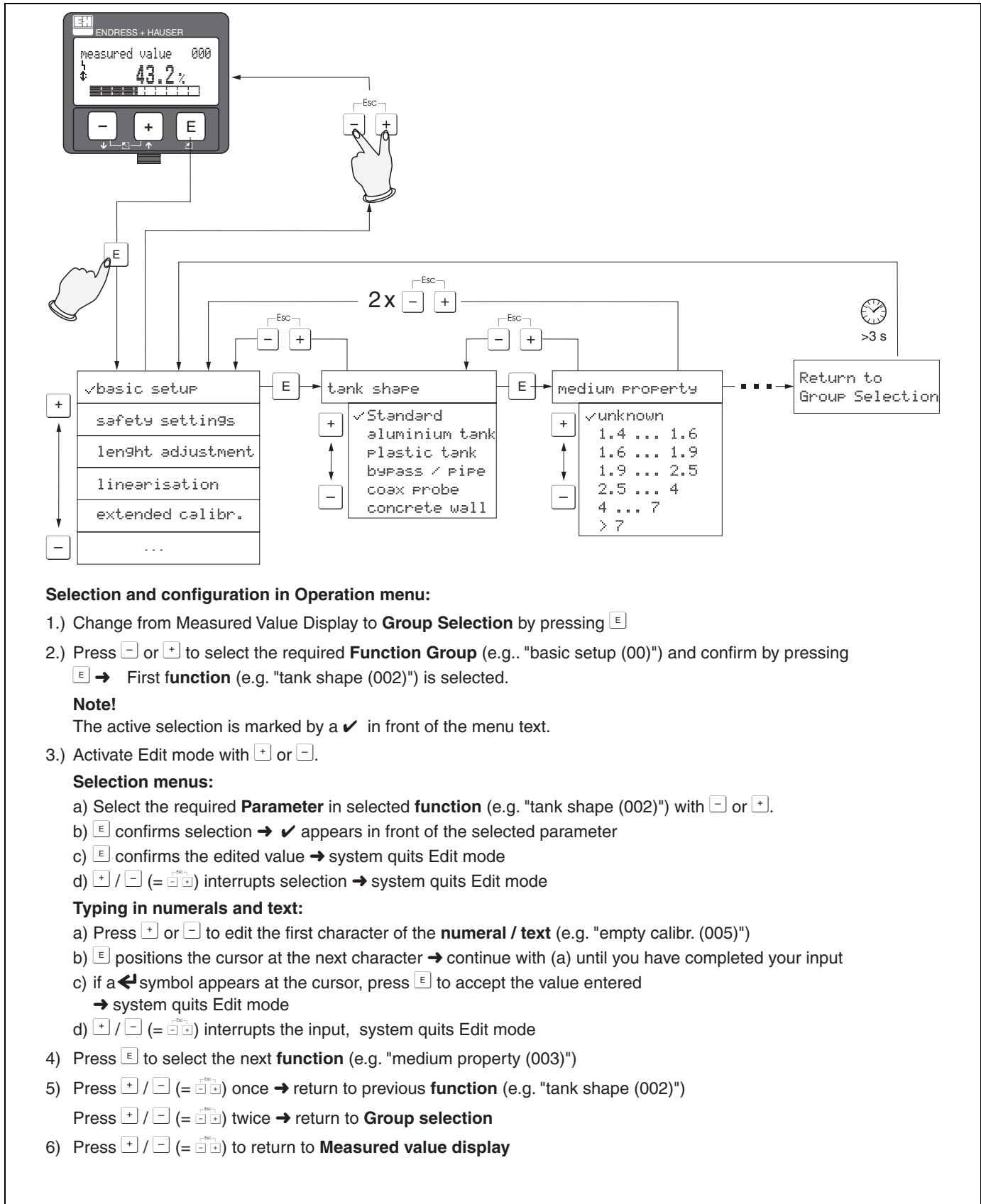
Selection and configuration in Operation menu:

1.) Change from Measured Value Display to **Group Selection** by pressing $\boxed{E}$

2.) Press $\boxed{-}$ or $\boxed{+}$ to select the required **Function Group** (e.g.. "basic setup (00)") and confirm by pressing
   $\boxed{E}$ ➜   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 $\boxed{+}$ or $\boxed{-}$.

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

   Typing in numerals and text:
   a) Press $\boxed{+}$ or $\boxed{-}$ to edit the first character of the **numeral / text** (e.g. "empty calibr. (005)")
   b) $\boxed{E}$ 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 $\boxed{E}$ to accept the value entered
      ➜ system quits Edit mode
   d) $\boxed{+}$ / $\boxed{-}$ (= ⌐Esc⌐$\boxed{-}\boxed{+}$) interrupts the input, system quits Edit mode

4) Press $\boxed{E}$ to select the next **function** (e.g. "medium property (003)")

5) Press $\boxed{+}$ / $\boxed{-}$ (= ⌐Esc⌐$\boxed{-}\boxed{+}$) once ➜ return to previous **function** (e.g. "tank shape (002)")

   Press $\boxed{+}$ / $\boxed{-}$ (= ⌐Esc⌐$\boxed{-}\boxed{+}$) twice ➜ return to **Group selection**

6) Press $\boxed{+}$ / $\boxed{-}$ (= ⌐Esc⌐$\boxed{-}\boxed{+}$) to return to **Measured value display**

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5.3   Operation with an Endress+Hauser operating program

The operating program FieldCare is an Endress+Hauser Plant Asset Management Tool based on FDT technology. You can use Field-Care 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:
- Commubox FXA291 with ToF Adapter FXA291 via service interface

Menu-guided commissioning

L00-FMP4xxxxx-20-00-00-en-001
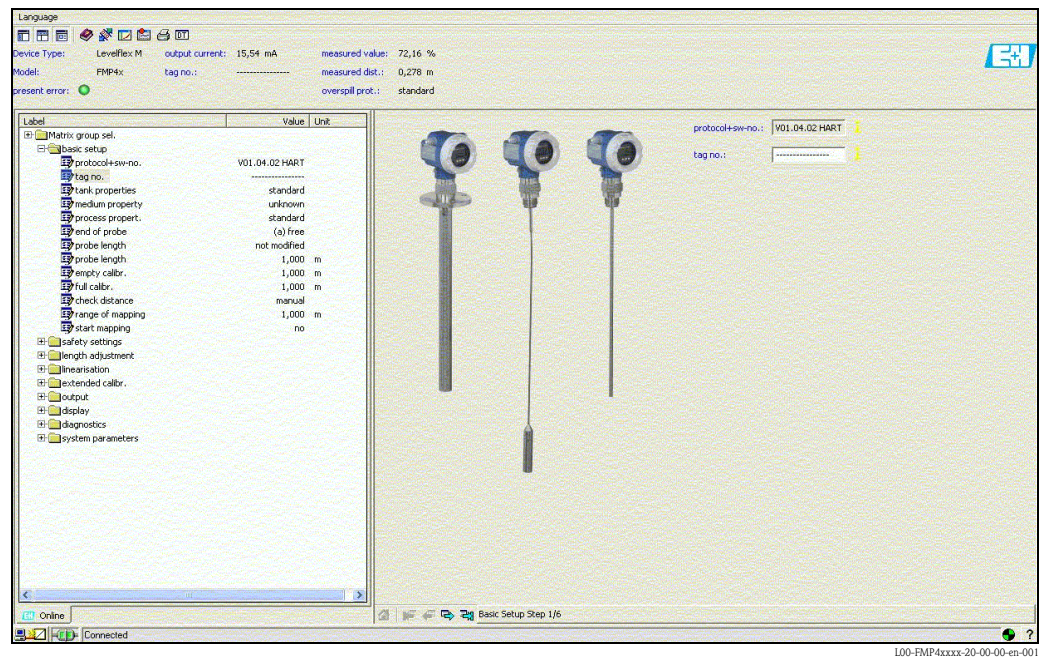
Signal analysis via envelope curve
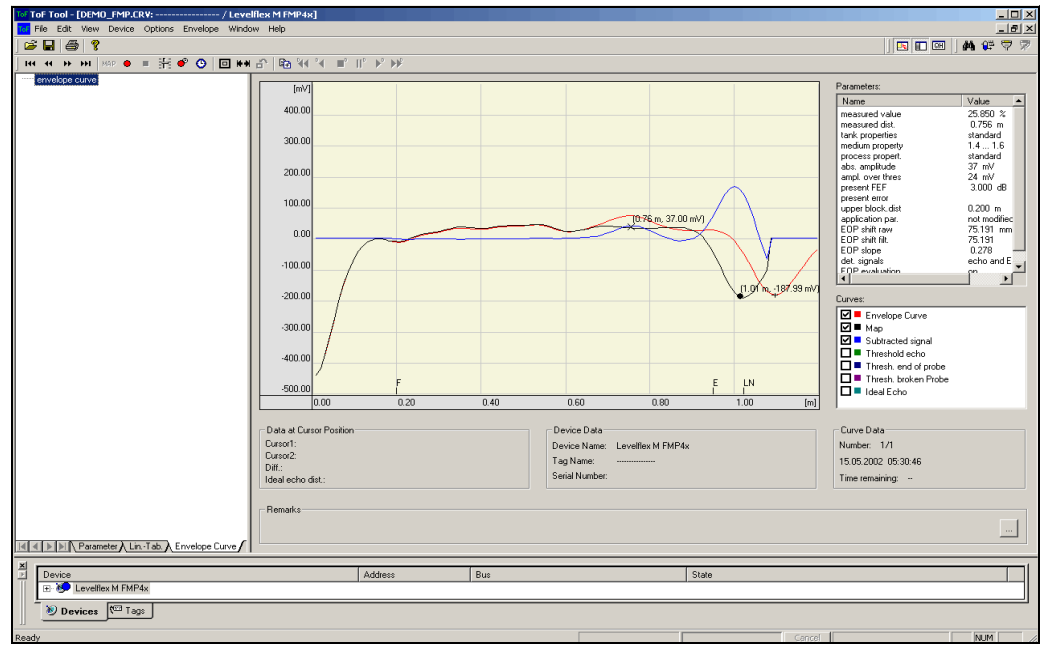
L00-FMP4xxxx-20-00-00-en-007

Tank linearization
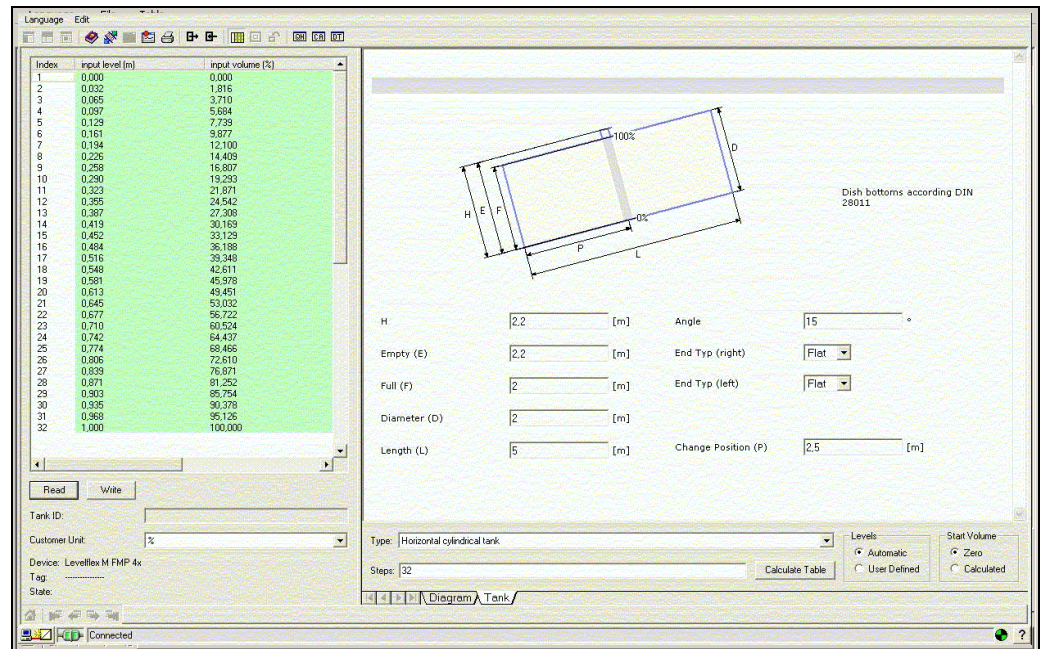
L00-fmp-Ixxx-20-00-00-en-041

5.4   Operation with a FOUNDATION Fieldbus configuration program

5.4.1   FOUNDATION Fieldbus configuration programs

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

5.4.2   Device Description files

File names

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

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

Example:

- Instrument Revision (0C3) = 04
- DD Revision (0C4) = 01
- CFF Revision = 02
- -> files to be used: "0402.sym", "0402.ffo", "040102.cff"

Directory structure

The files are normally stored in the following directory structure:

- /452B48/1012/*.sym
                     *.ffo
                     *.cff

The directory names have the following meaning:

- 452B48: manufacturer ID of Endress+Hauser
- 1012: ID-Code of Levelflex M

---

[1]   "Instrument Revision" (0C3) and "DD Revision" (0C4) can be obtained through the display and operating module VU331. For details refer to section 5.2: "Operation with the display and operating module VU331"

Source of supply

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

5.4.3   Representation of parameters

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

- **Representation by parameter name**
  Examples: "PAROPERATIONCODE", "PARRESET"
- **Representation by parameter label**
  (identical to the labels on the display module VU331 and in an Endress+Hauser operation tool)
  Examples: "unlock parameter", "reset"

5.5   Operation with Field Communicator 375, 475

5.5.1   Connection

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

5.5.2   Device Descriptions

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

5.5.3   User interface

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

5.5.4   Example
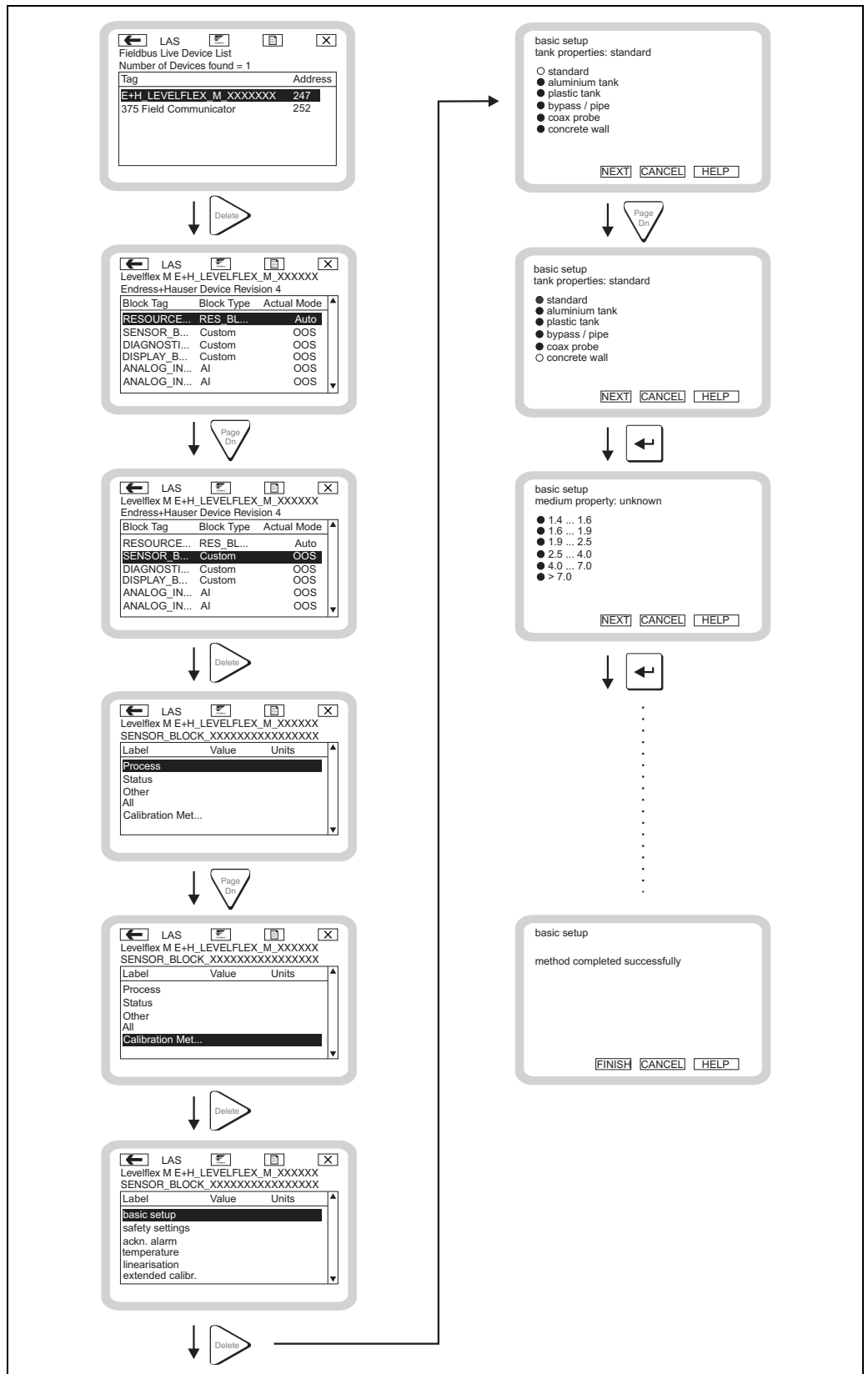
L00-FMU4xxxx-07-00-00-xx-001

6   Commissioning

This chapter consists of the following sections:

- "Function check", → 🗋 40
- "Unlocking the device", → 🗋 40
- "Resetting the device", → 🗋 42
- "Basic setup", → 🗋 44
- "Commissioning by the display and operating module VU331", → 🗋 46
- "Blocking distance", → 🗋 56
- "Basic setup with the Endress+Hauser operating program", → 🗋 62
- "Commissioning with a FOUNDATION Fieldbus configuration tool", → 🗋 68
- "Commissioning with the Field Communicator 375, 475", → 🗋 73

6.1   Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist "Post installation check", → 🗋 23.
- Checklist "Post connection check", → 🗋 28.

6.2   Unlocking the device

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

6.2.1   DIP switch (under the housing cover)

Locking and unlocking

default settings:
write protection OFF
simulation OFF

write protection

simulation

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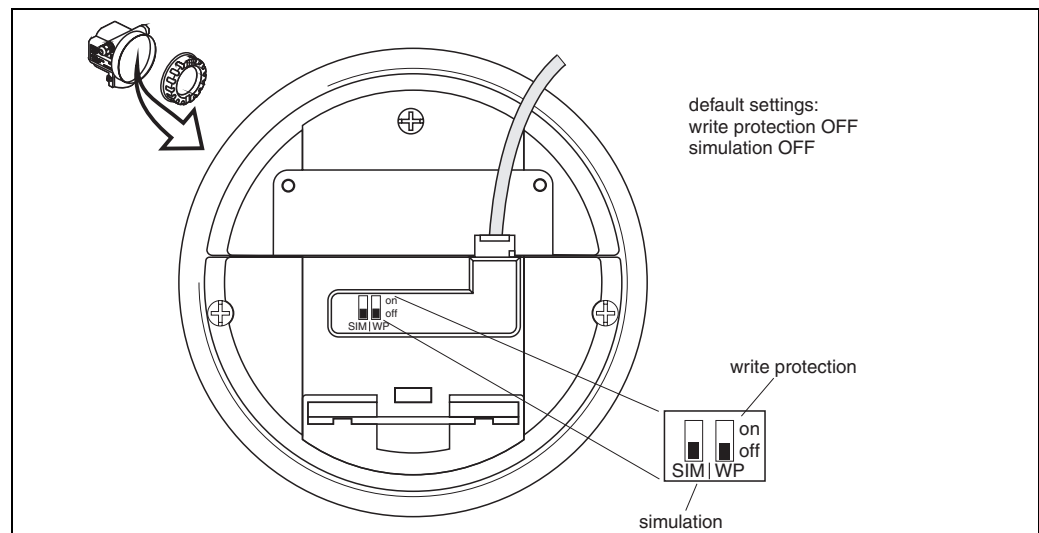
WP = on: parametrization locked
WP = off: parametrization unlocked
SIM = on: simulation possible in Analog Input Block by configuration tool
SIM = off: simulation not possible in Analog Input Block by configuration tool

Parameters affected

Locking by the DIP switch affects **all** parameters.
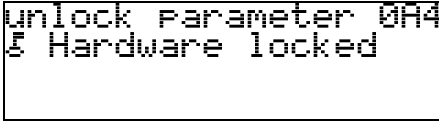
6.2.2 Key combination (display and operating module VU331)

Locking

Press ⊟, ⊞ and Ｅ simultaneously.

Unlocking

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

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

Press ⊟, ⊞ and Ｅ simultaneously. The **"unlock parameter" (0A4)** function appears.
Enter "2457". Now parameters can be changed.

Parameters affected

Locking by the key combination affects the following parameters:

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

6.2.3 Locking parameter

Locking

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

Unlocking

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

Parameters affected

Locking by the locking parameter affects the following parameters:

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

6.3 Resetting the device

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

6.3.1 Resetting the parameters of the FOUNDATION Fieldbus function blocks

Parameters affected

- All parameters of the FOUNDATION Fieldbus function blocks

L00-FMU4XXXX-02-00-00-YY-007
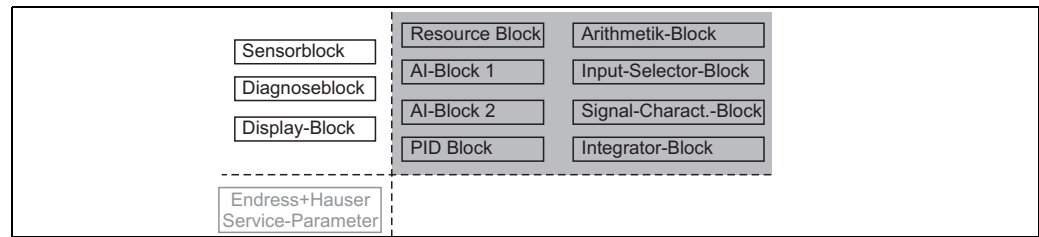
Performing the reset

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

6.3.2 Resetting the parameters of the transducer blocks

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

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

Parameters affected

- All parameters of the device specific blocks (Sensor Block, Diagnostic Block, Display Block)

L00-FMU4XXXX-02-00-00-YY-008
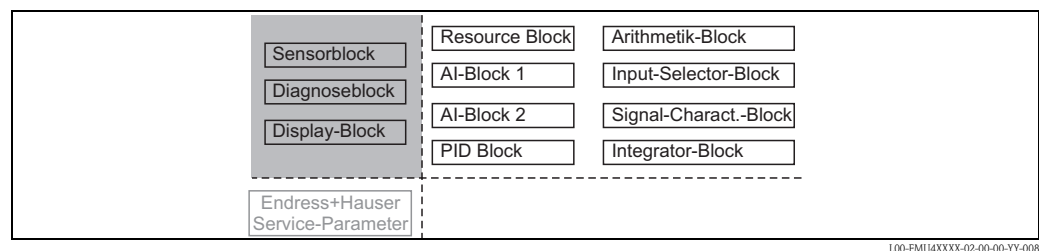
Effects of the reset

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

Performing the reset

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

6.3.3 Resetting an interference echo suppression (tank map)

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

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

Resetting the tank map with the VU331

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

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

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

Resetting the tank map with an Endress+Hauser operating program

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

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

Resetting the tank map with a FOUNDATION Fieldbus configuration tool

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

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

6.4   Basic setup

basic setup (standard)

```
tank shape
  Standard
```

```
measuring cond.
  Unknown
```

```
measuring cond.
  Standard
```

```
length adjustment
  probe length
```

```
empty calibr.
```

```
full calibr.
```

```
mapping
```

option

```
safety settings
```

```
linearisation
```

```
extended calibr.
```

```
...
```

(description see BA00245F/00/EN)

flange:
reference point of measurement

UB

D SD

LN

F E

L

E =	empty calibr. (= zero) setting in 005	LN = probe length setting in 033
F =	full calibr. (= span) setting in 006	UB = upper blocking distance setting in 059
D =	distance (distance flange / product) display in 0A5	SD = safety distance setting in 015
L =	level display in 0A6	

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Caution!
The basic setupis sufficient for successful commissioning in morst 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 the 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 bades 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 with 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 descriped, Page 29.
■ Certain functions (e.g. starting interference echo suppression (053)) prompt you to vonfirm 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 return 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 confured values remain safely stored in the EEPROM.
■ All functions are described in detail, as is the overview of the operating menu itself, in the manual **"BA00245F – Description of Instrument Functions"** on the enclosed CD-ROM.

6.5 Commissioning by the display and operating module VU331

6.5.1 Power up 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
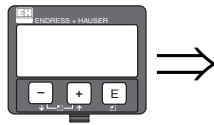
```
language          092
English
 Deutsch
 Français
```
⇩
```
distance unit     0C5
m
 ft
 mm
```
⇩
```
measured value    000
      63.460 %
▮▮▮▮▮▮▮▮▮▮▮▮▯▯▯▯▯
```
⇩
```
Group selection   00→
basic setup
 safety settings
 linearisation
```

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 $\boxed{E}$, you are taken to the group selection

This selection enables you to perform the basic standard

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

Function "measured value" (000)
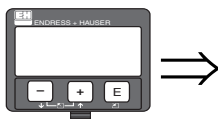
```
measured value    000
      63.460 %
▮▮▮▮▮▮▮▮▮▮▮▮▯▯▯▯▯
```

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

6.5.2   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
```
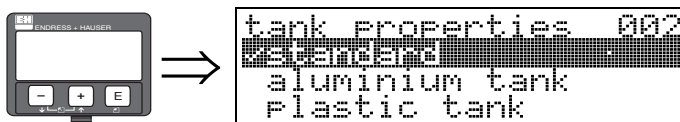
This function is used to select the tank properties.

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

standard

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

aluminium 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 "**aluminium 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**" optionis sufficient!

✏ Note!
In principle the employment of a metallic surface area should be prefferred 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

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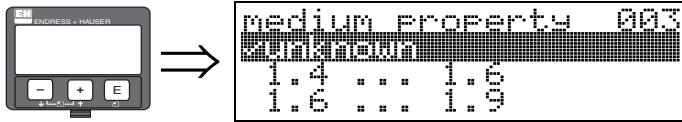
This function is used to select the dielectric constant.

Selection:
- unknown
- 1.4 ... 1.6 (use coaxial or Rod probe ith installation in metallic pipes ≤ DN150)
- 1.6 ... 1.9
- 1.9 ... 2.5
- 2.5 ... 4.0
- 4.0 ... 7.0
- > 7.0

Media group	DC (ϵr)	Typical liquids	Measuring range
1	1.4 to 1.6	– condensed gases, e.g. N_2, CO_2	4 m (157"), when installed in metallic pipes
2	1.6 to 1.9	– Liquefied gas, e.g. propane – Solvent – Frigen / Freon – Palm oil	9 m (354")
3	1.9 to 2.5	– Mineral oil, fuels	12 m (472")
4	2.5 to 4	– Benzene, styrene, toluene – Furan – Naphthalin	16 m (629")
5	4 to 7	– Chlorobenzene, chloroform – Cellulose spray – Isocyanat, aniline	25 m (984")
6	> 7	– Aqueous solutions – Alkohols – Acids, alkalis	30 m (1181")

The lower group applies to very loose or loosened bulk solids. Reduction of the max. possible measuring range by means of:

- Extremely loose surfaces of bulk solids, e.g. bulk solids with low piled density when filled pneumatically.
- Build-up, primarily of moist products.

Function "process propert" (004)

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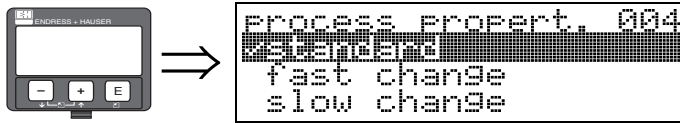
Use this funtcion to adapt the device to the filling speed in the tank. The setting impacts on an intelligent filter.

Selection:
- **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 fluids at low to medium filling speed and sufficiently large tanks.	Small tanks, primarily with fluids, at high filling speeds.	Applications with strong surface movement, e.g. coused by stirrer, primarily large tanks with slow to medium filling speed.	Shortest reaction time: ■ For test purposes ■ Measurement in small tanks at high filling speeds, if "rapid 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.
```
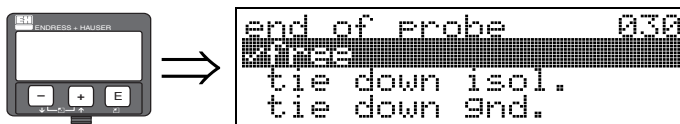
Use this function to selcet the polarity of the probe end signal. If the probe end is uncovered or in an insulated attachment, there is anegative probe end signal.
The signal from the probe end is positive if the attachement is grounded.

Selection:
- free
- tie down isol.
- tie down gnd. (if using a metallic centering of probe end)

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.

Selection:
- 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 at the time of the commissioning uncovered or convered.
If the probe is uncovered, the Levelflex can determine the probe length automatically "**determine length**" **(034)** function. If the probe is covered, a correct entry is required in the "**probe length**" **(033)** function.

Selection:
- **free**
- covered

Function "probe length" (033)

```
probe length       033
     0.000   m
```

Use this function, the probe length can be entered manually.

Function "determine length" (034)

```
determine length 034
 length ok
 too short
LN:     0.399m
```

Use this function, the probe length can be determined automatically.
Due to the mounting conditions, the automatically determined probe length may be larger than the actual probe (typically 20 to 30 mm longer). This has no influence on the measuring accuracy.
When entering the empty value for a linearisation, please use the "empty calibration" instead of the automatically determined probe length.

Selection:
- **length ok**
- length short
- length long

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

Function "empty calibr." (005)

```
empty calibr.     005
          1.000  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)
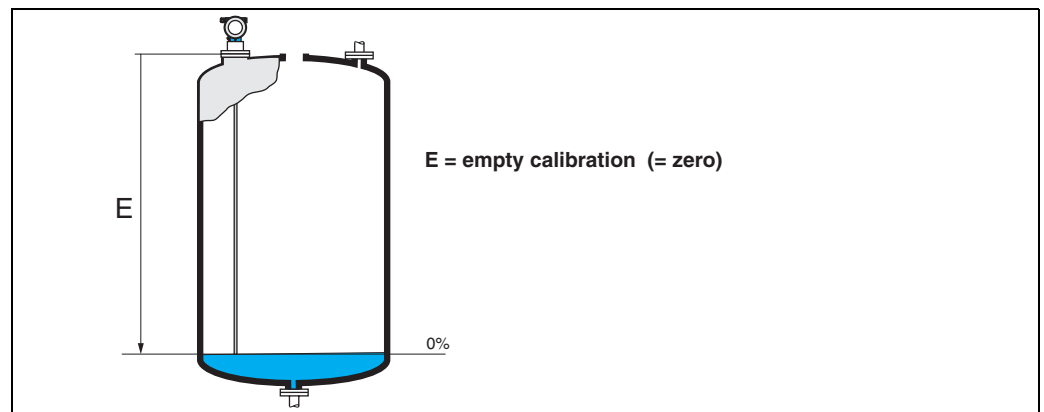
L00-FMP4xxxx-14-00-06-en-008.eps

Function "full calibr." (006)


```
full calibr.       006
       0.805  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

100%

0%

L00-FMP4xxxx-14-00-06-en-009
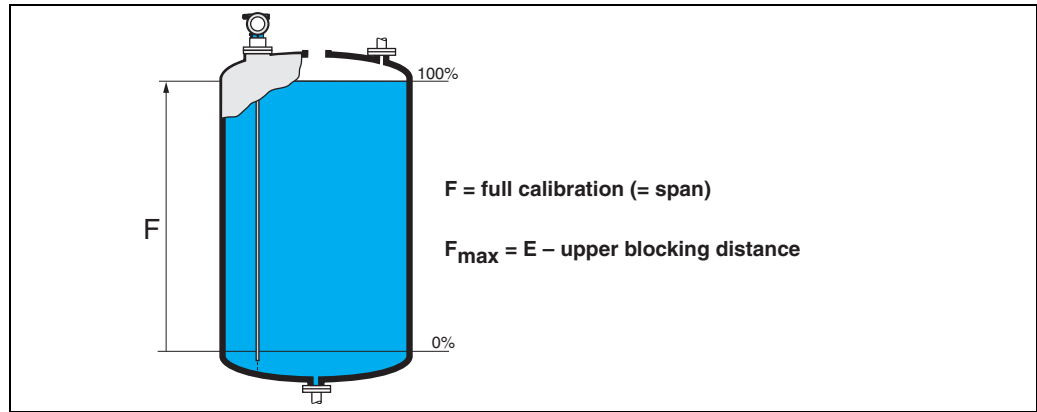
✎ Note!
The usable measuring range lies between the upper blocking distance and the probe end. The value for empty distance "E" and span "F" can be set independently of this.

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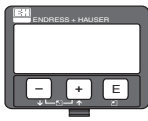
This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface. The following options are available:

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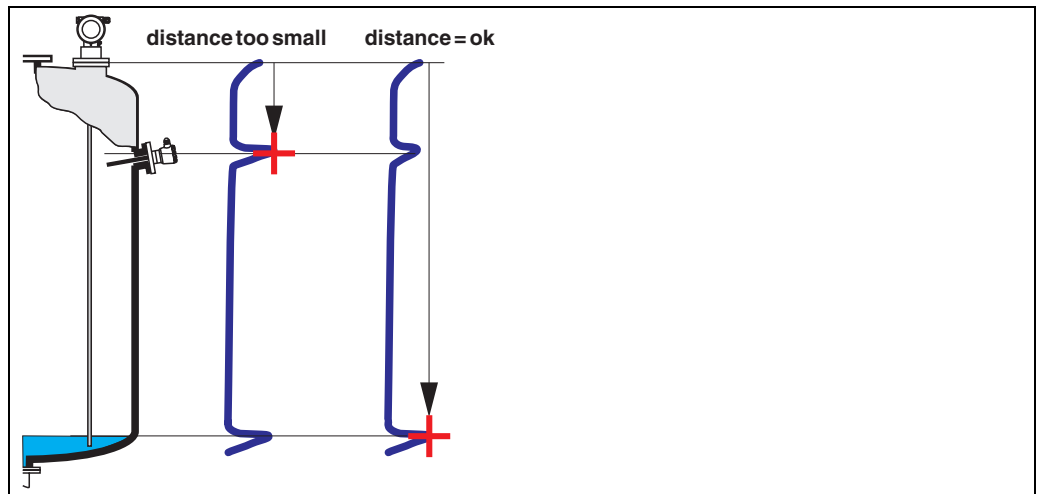
L00-FMP4xxxx-14-00-06-en-010

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)
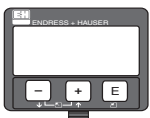
```
range of mapping 052
        0.000  m
input of
mapping range
```

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (→ 🖹 44). This value can be edited by the operator.
For manual mapping, the default value is 0.3 m.

Function "start mapping"(053)
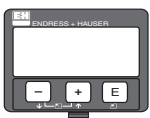
```
start mapping     053
✓off
 on
```

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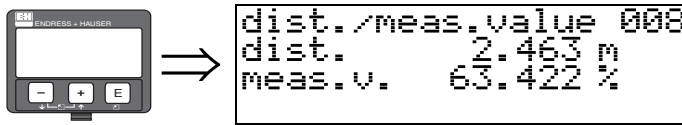
The distance measured from the reference point to the product surface and the measured value calculated with the aid of the empty calibration are displayed again. Check whether the values correspond to the actual meas. value or the actual distance. The following cases can occur:

- 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
```
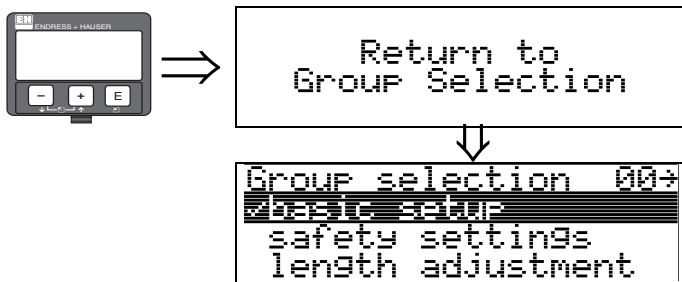
⇩   After 3 s, the following message appears

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

✎ Note!
After the basic setup, it is recommended to evaluate the measurement with the aid of the envelope curve ("**envelope curve**" **(0E)** function group) (Page 58).

Return to group selection

After the interference echo suppression the basic setting is finished and the device jumps automatically back into the group selection.

6.6   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. For rope probes with lengths of more than 8 m, the upper blocking distance is preset to 2.5 % of the probe length. For media with DC > 7, the upper blocking distance for rod and rope probes can be reduced to 0.1 m, if the probe is mounted flush with the wall or in a nozzle of maximum 50 mm.

Blocking distance and measuring range

At the lower end of the probe there is no blocking distance but a transition region with reduced accuracy, see section "Maximum measured error", Page 57.

FMP45	LN [m]		UB [m]
	min	max	min
Rod probe	0,3	4	0,2 [1]
Rope probe	1	35	0,2 [2]
Coax probe	0,3	4	0

[1]   The indicated blocking distances are preset. At media with DC > 7, the upper blocking distance UB can be reduced to 0.1 m for rod and rope probes. The upper blocking distance UB can be entered manually.

✎ Note!
Within the upper and lower blocking distance, a reliable measurement can not be guaranteed.

For stilling well applications

The upper blocking distance (UB) is preset to 100 mm when the "bypass/pipe" parameter has been selected in the "**tank properties**" **(002)** function.

Maximum measured error

Typical statements for reference conditions:
DIN EN 61298-2, percentage of the span.

Output:	Digital	Analogue
sum of non-linearity, non-repeatability and hysteresis	measurig range: – up to 10 m: ±3 mm – > 10 m: ± 0.03 % **for PA coated rope** measuring range: – up to 5 m: ±5 mm – > 5 m: ± 0.1 %	± 0.06 %
Offset / Zero	±4 mm	± 0.03 %

If the reference conditions are not met, the offset/zero arising from the mounting situation may be up to ±12 mm. This additional offset/zero 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 probe end:
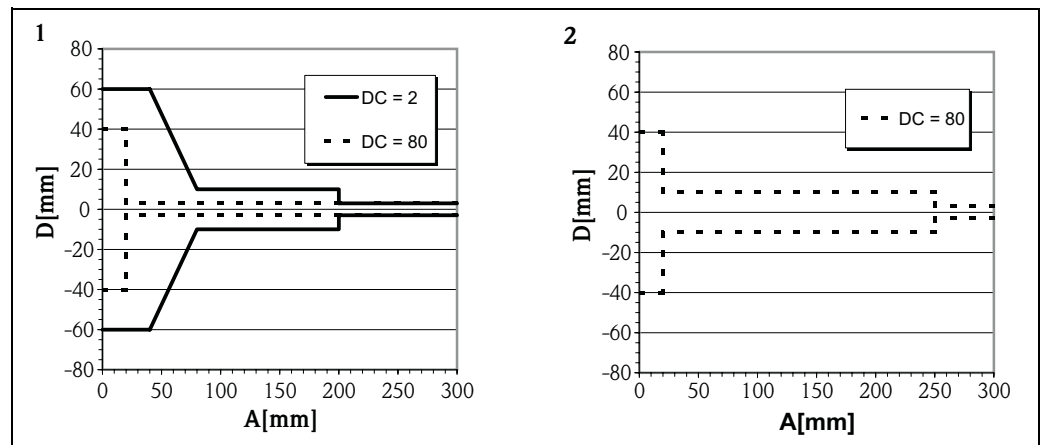
1   Rod and coax probe
2   Rope probe
A   Distance from end of probe
D   Sum of non-linearity, non-repeatability and hysteresis

✎ Note!
Please reenter the blocking distance in the function group "**extended calibr.**" **(05)** function "**upper block.dist**" **(059)** when installing the device in a high nozzle:
upper blocking distance (UB) = nozzle height (H) + 50 mm.
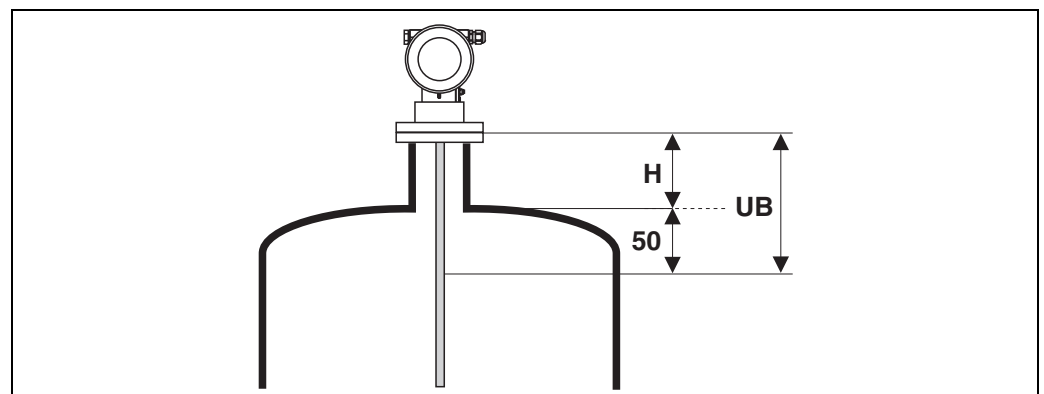
<div align="right">L00-FMP4xxxxx-14-00-06-xx-001</div>

6.7 Envelope curve

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

6.7.1 Function "plot settings" (0E1)

In this function, select whether you want to display
- just the envelope curve
- The envelope curve and the echo evaluation line FAC
- The envelope curve and interference echo suppression (map)

⟹

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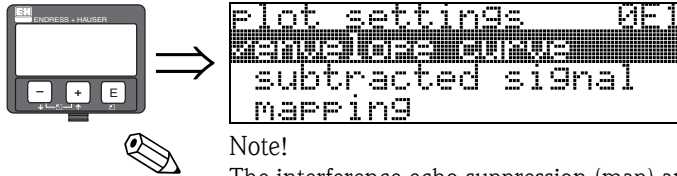
✎ Note!
The interference echo suppression (map) are explained in BA00245F/00/EN "Description of
Instrument Functions".

6.7.2 Function "recording curve" (0E2)

In this function, specify whether you want to display
- an individual envelope curve
- the current envelope curve, with cyclical refreshment.

⟹

```
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
optimised.

6.7.3   Function "envelope curve display" (0E3)
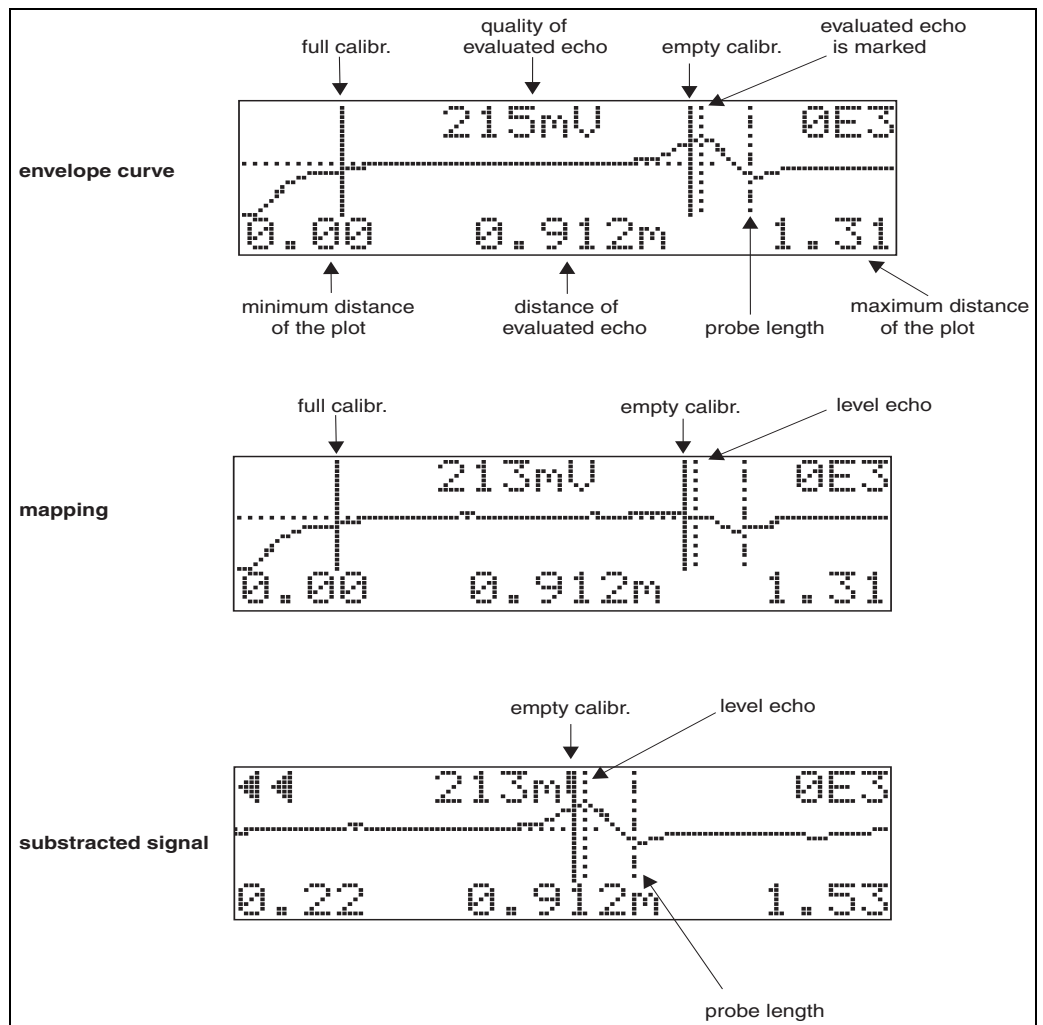
L00-FMPxxxxx-07-00-00-en-003

Check that the following conditions are fulfilled:
- The echo quality at the end of measuring range should be at least 10dB.
- There should be practically no interference echoes in front of the level signal.

✎ Note!
If the cyclical envelope curve display is still active on the display, the measured value is updated at a slower cycle time. We therefore advise you to exit the envelope curve display after optimising the measuring point. To do this, press ⑤. (The device does not leave the envelope curve display automatically.)

6.7.4   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".

6.7.5   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.

6.7.6   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.

6.7.7   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.

6.7.8   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
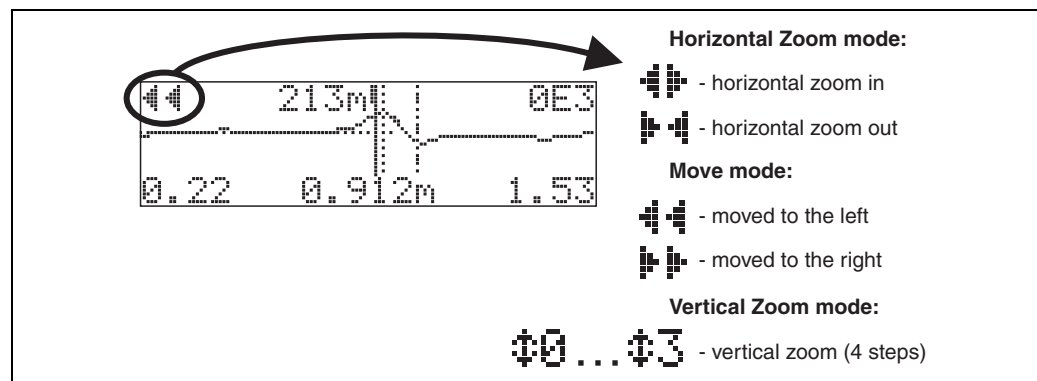
Horizontal Zoom mode

Firstly, go into the envelope curve display. Then press ⊞ or ⊟ to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either ⊹⊹ or ⊹⊹ is displayed.
- ⊞ increases the horizontal scale.
- ⊟ reduces the horizontal scale.

L00-FMPxxxxx-07-00-00-xx-001
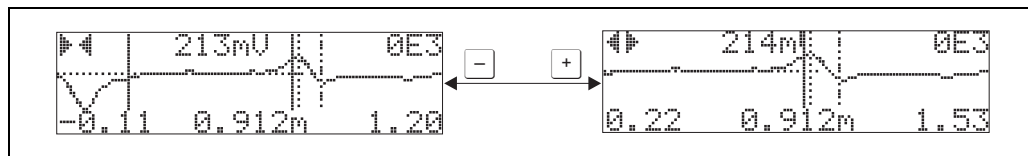
Move mode

Then press ⒠ to switch to Move mode. Either ⊹⊹ or ⊹⊹ is displayed.
- ⊞ shifts the curve to the right.
- ⊟ shifts the curve to the left.

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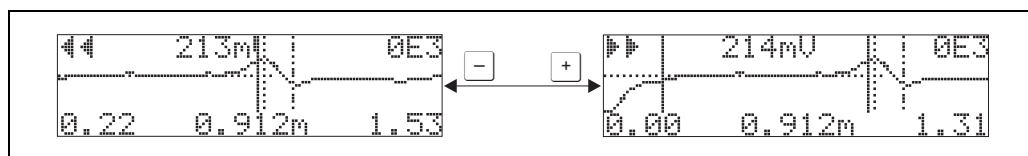
Vertical Zoom mode

Press ⒠ once more to switch to Vertical Zoom mode. ⇕1 is displayed. You now have the following options.
- ⊞ increases the vertical scale.
- ⊟ reduces the vertical scale.

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

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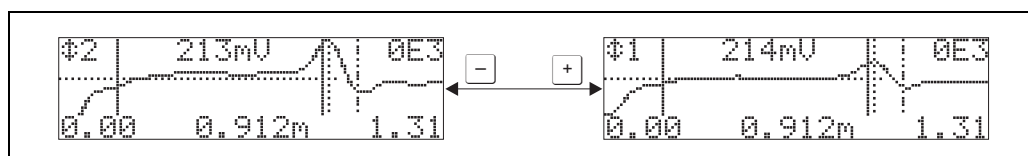
Exiting the navigation

- Press ⒠ again to run through the different modes of the envelope curve navigation.
- Press ⊞ and ⊟ to exit the navigation. The set increases and shifts are retained. Only when you reactivate the "**recording curve**" **(0E2)** function the display settings return to their standard values.

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-FMP4xxxx-20-00-00-en-001
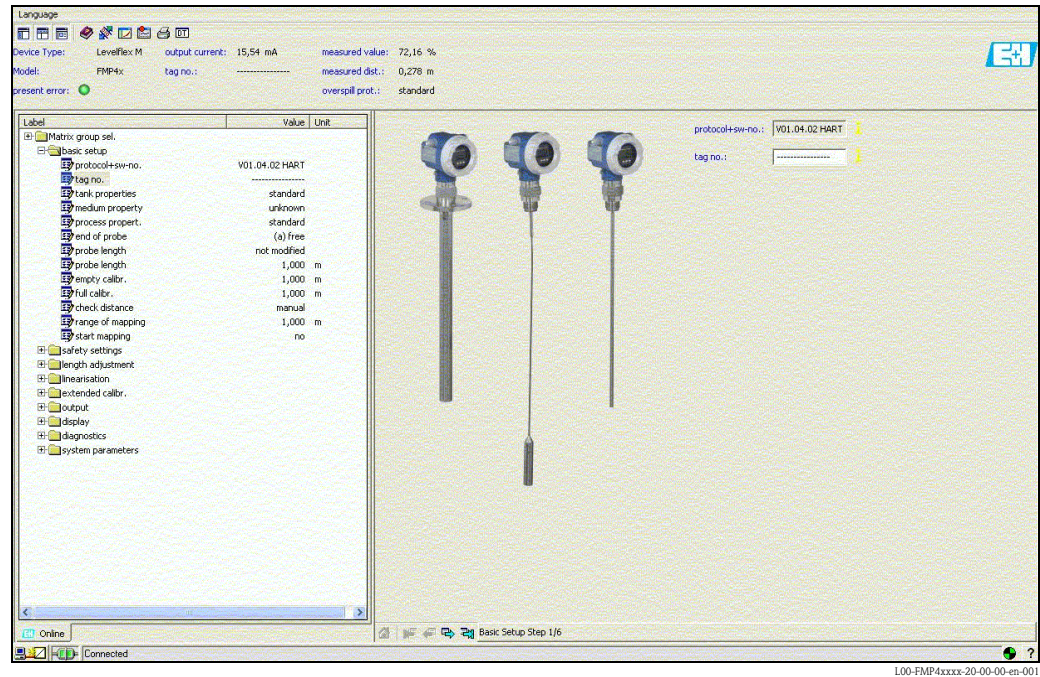
✎ **Note!**
- Each parameter that is changed must be confirmed with the **RETURN** key!
- The "**Next**" button takes you to the next screen:

Basic setup step 2/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
  - Tank properties
  - Medium properties
  - Process properties
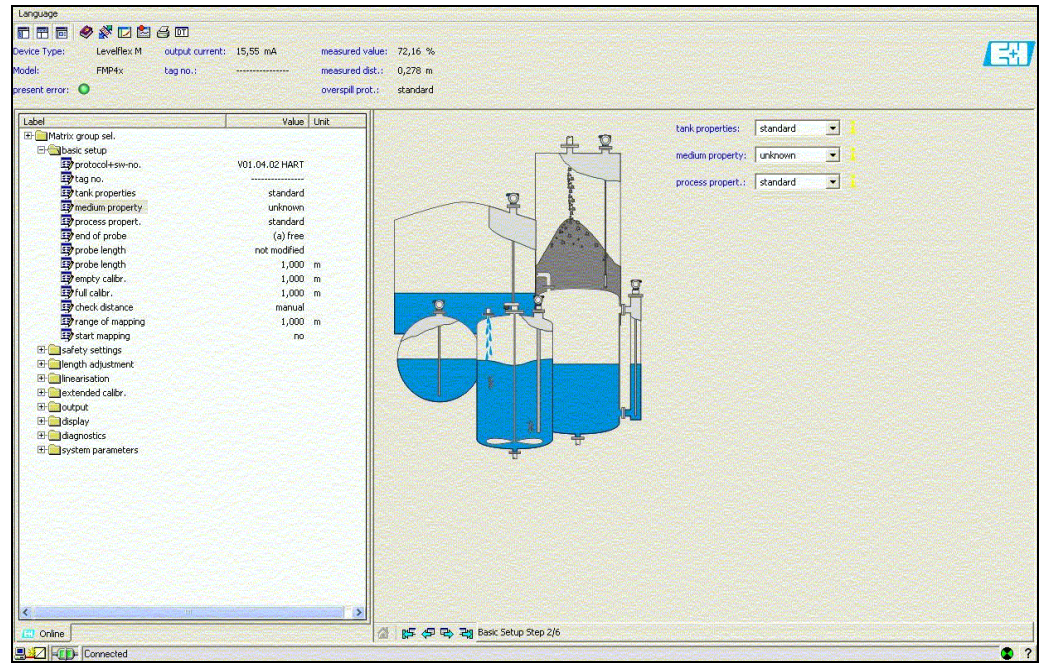
l00-fmp4xxxx-20-00-00-en-002

Basic setup step 3/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
  - End of probe
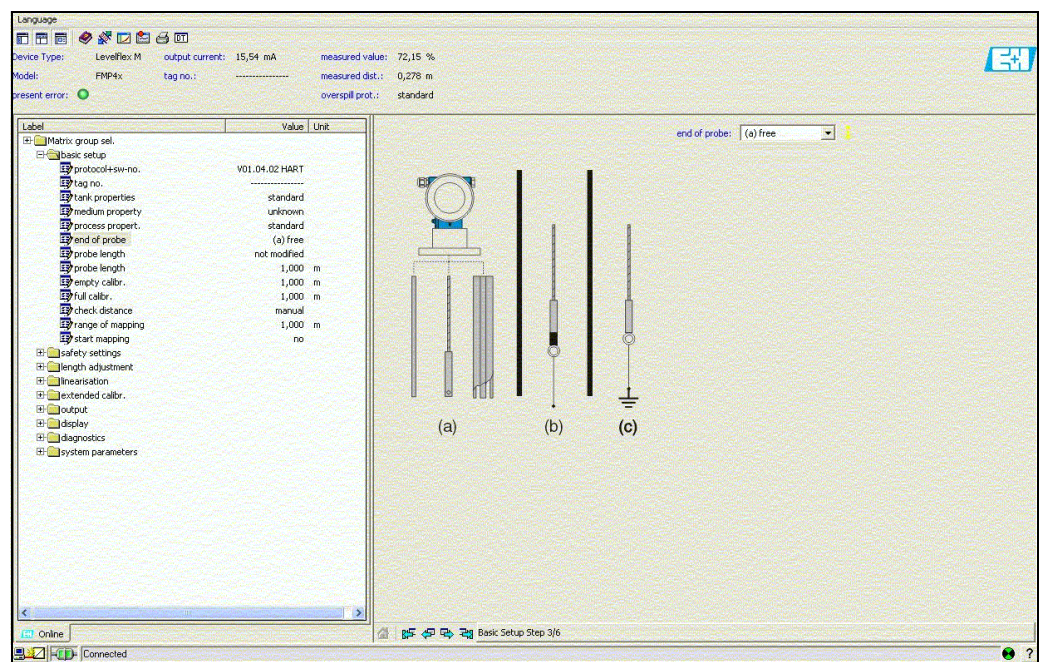
l00-fmp4xxxx-20-00-00-en-003

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
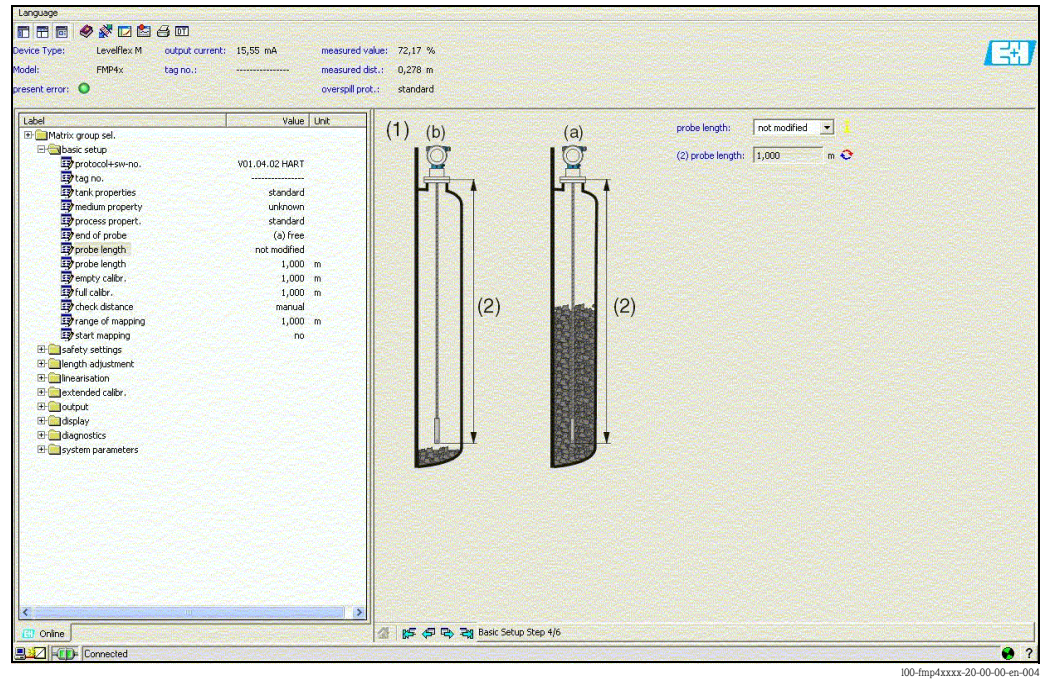
Basic setup step 5/6:
■ Enter the application parameters (see chapter basic setup with "VU331"):
  – Empty calibration
  – Full calibration

I00-fmp4xxxx-20-00-00-en-005
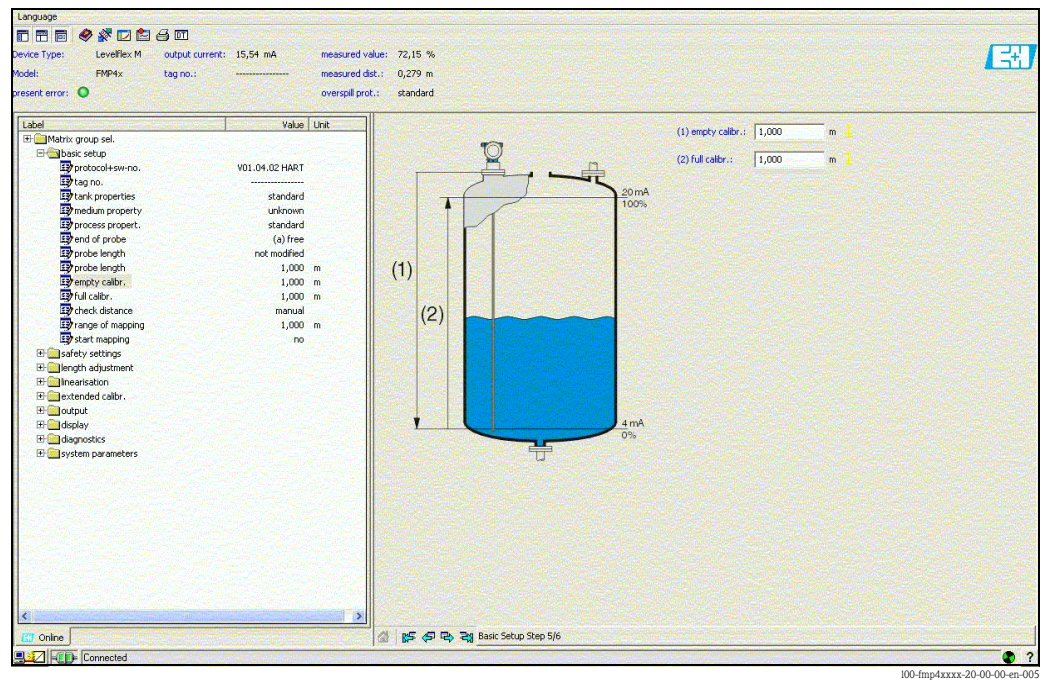
Basic setup step 6/6:

- Interference echo suppression takes place in this step
- The measured distance and the current measured value are always displayed in the header
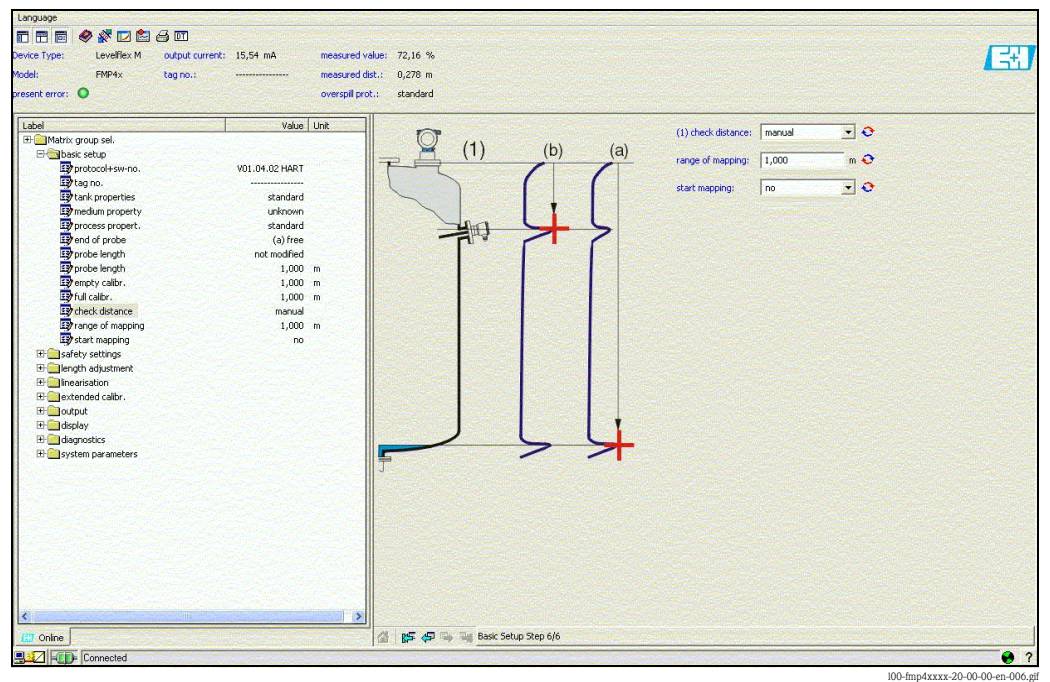
L00-fmp4xxxx-20-00-00-en-006.gif

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
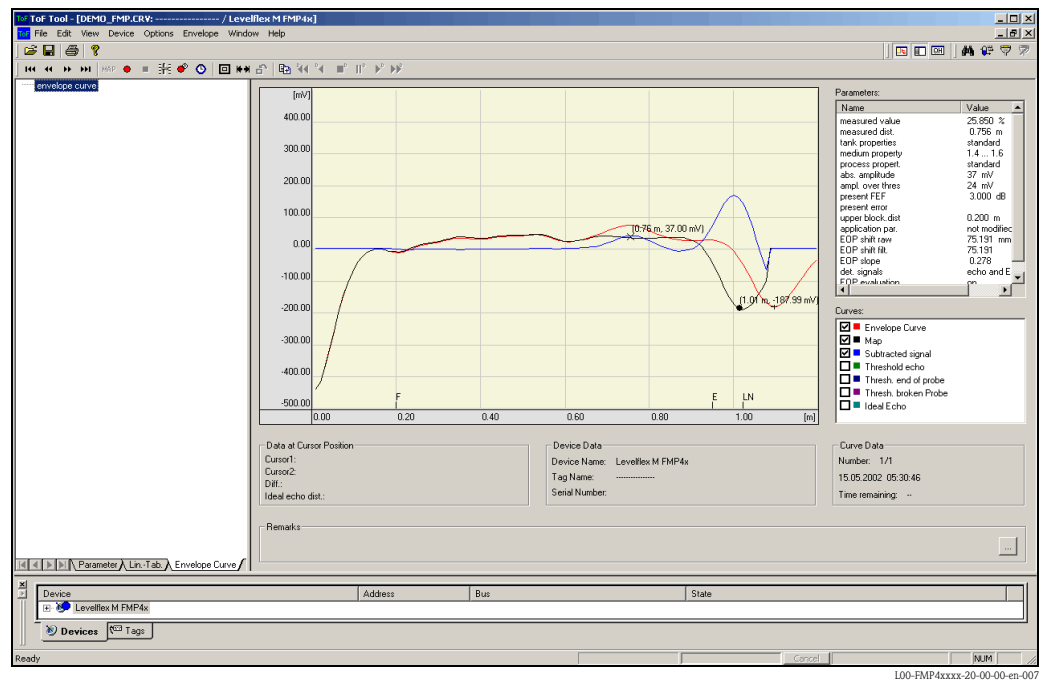
✎ **Note!**
In the event of severe interference echoes, installing the Levelflex at another point can optimize the measurement routine.

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
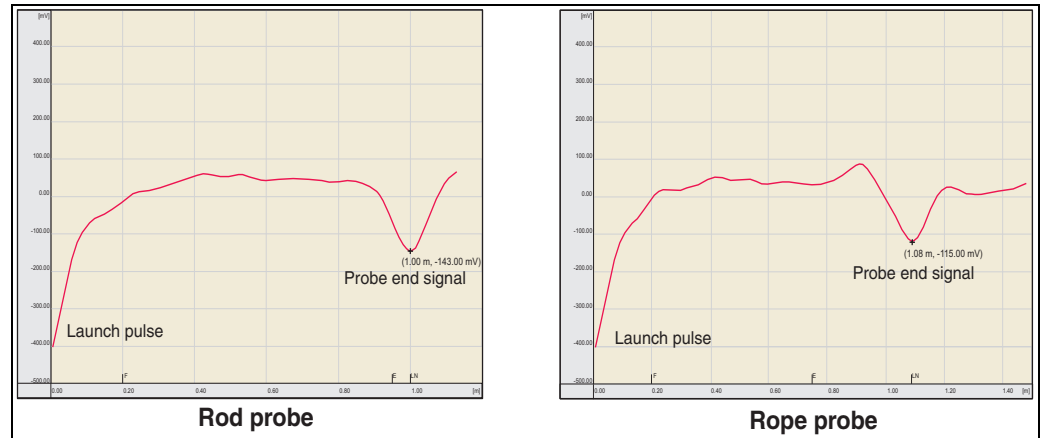
Level echoes are indicated as positive signals in the envelope curve. Interference echoes can be both positive (e.g. reflections from internals) and negative (e.g. nozzles). The envelope curve, the map and the differential curve are used for the evaluation. Level echoes are searched for in the differential 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
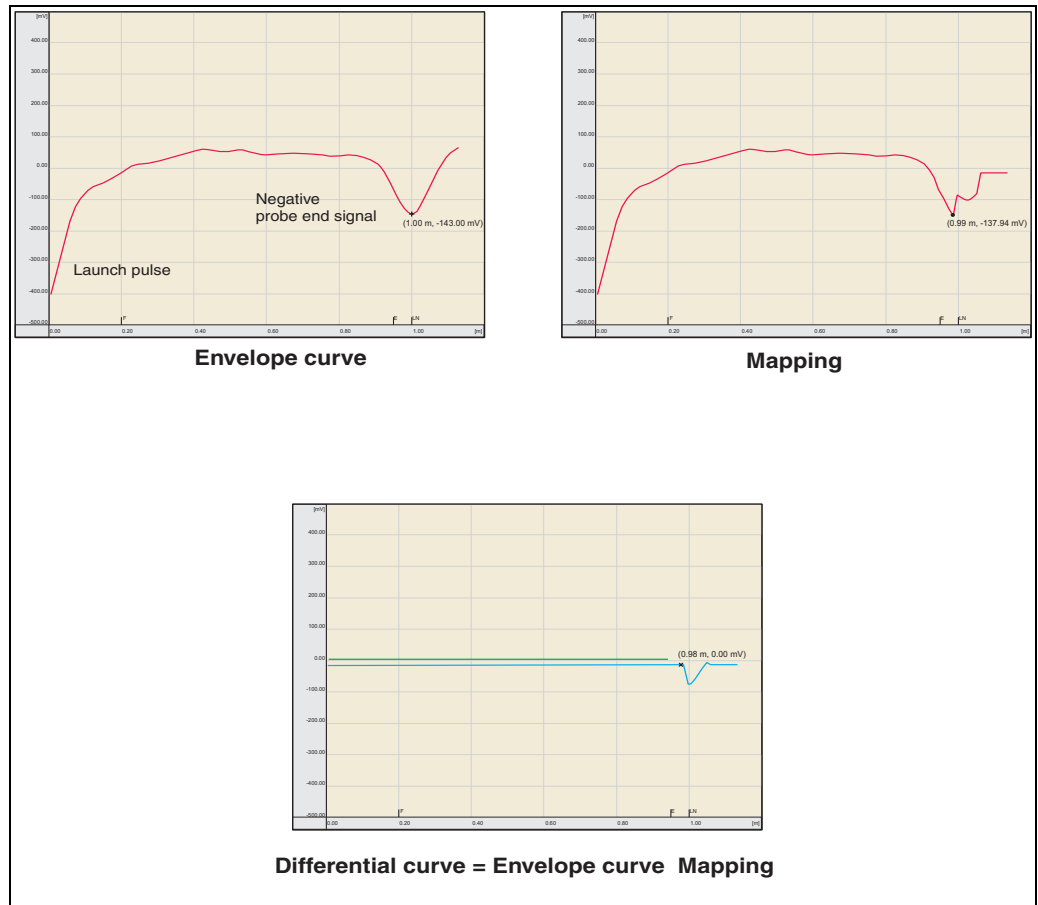
L00-FMP40xxx-05-00-00-en-025

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.

6.9   Commissioning with a FOUNDATION Fieldbus configuration tool

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

Instrument_ID = 452B481012–XXXXXXXX

whereby:

452B48	ID code for Endress+Hauser
1012	ID code for Levelflex M
XXXXXXXX	device serial number, as printed on the nameplate

6.9.1   Fist setup

1. Open the configuration tool and load the device Descriptions (*.ffo, *.sym and – if required by
    the tool – *.cff). Ensure you use the correct files (→ 🖹 37).

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

NI-FBUS-FMP-4x-en-002
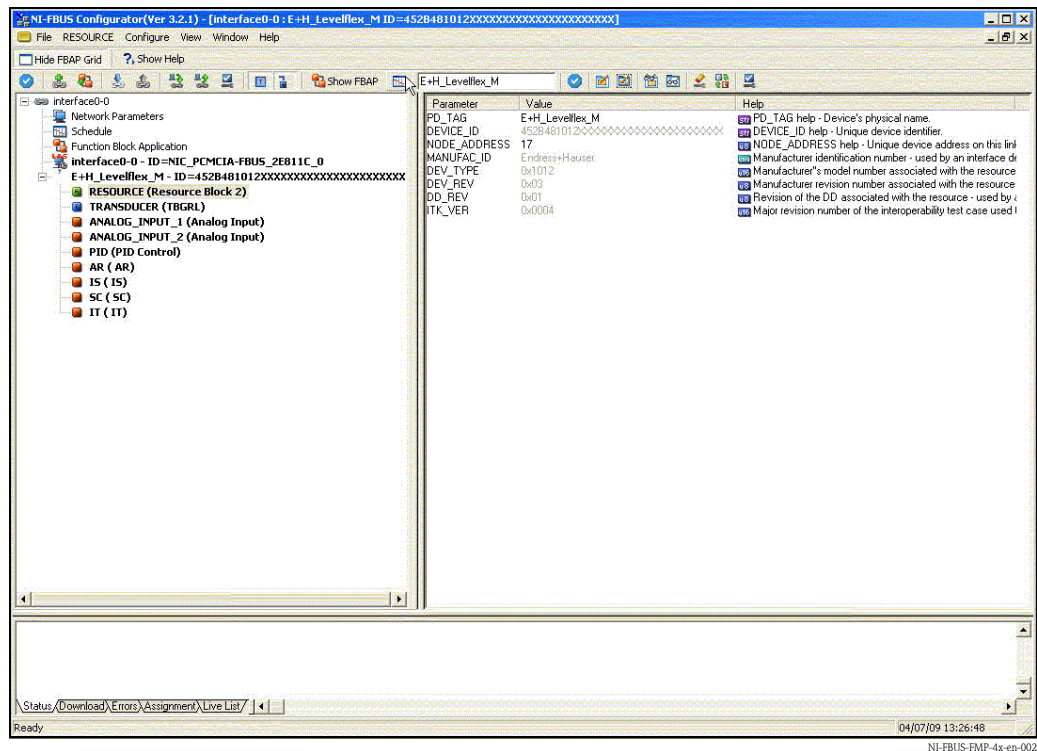
3. Identify the device using the INSTRUMENT_ID and assign the desired field device tag name
    (PD_TAG).
    Factory setting: PD_TAG = E+H_LEVELFLEX_M_XXXXXXXX

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

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

2. Opern the Resource Block

3. On delivery, write protection is disabled so that you can access the write parameters via
    FOUNDATION Fieldbus. Check this status by the parameter WRITE_LOCK:
    – Write protectin activated: WRITE_LOCK = LOCKED
    – Write protection deactivated: WRITE_LOCK = NOT LOCKED
    Deactivate the write protection if necessary, → 📄 40.

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

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

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

2. Open the Sensor Block. The following display appears:

NI-FBUS-FMU4x-en-003
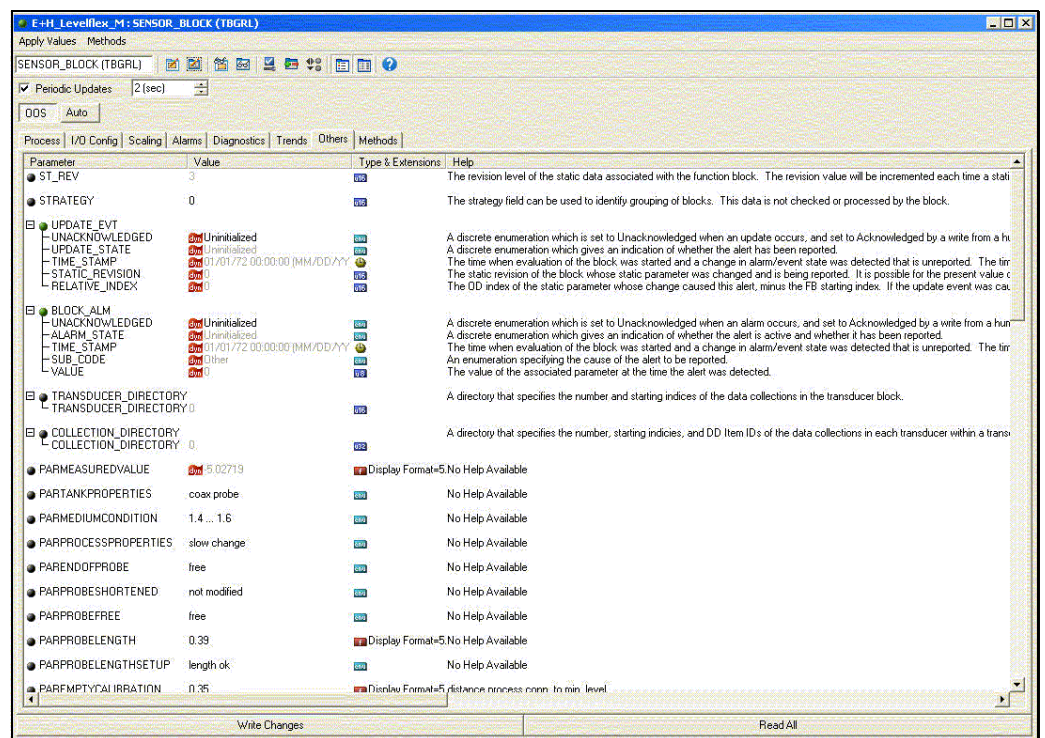
✎ Note!
There are two possibilities to edit the parameters of the block:
- A parameter from the list can be opened for editing by a double click.
- You can open one of the FOUNDATION Fieldbus methods. Each method guides you
  automatically through a number of parameters which are required for a specific configuration
  task. The following sections describe the parametrization by the "basic setup" method.

3. Open the FOUNDATION Fieldbus method "basic setup":
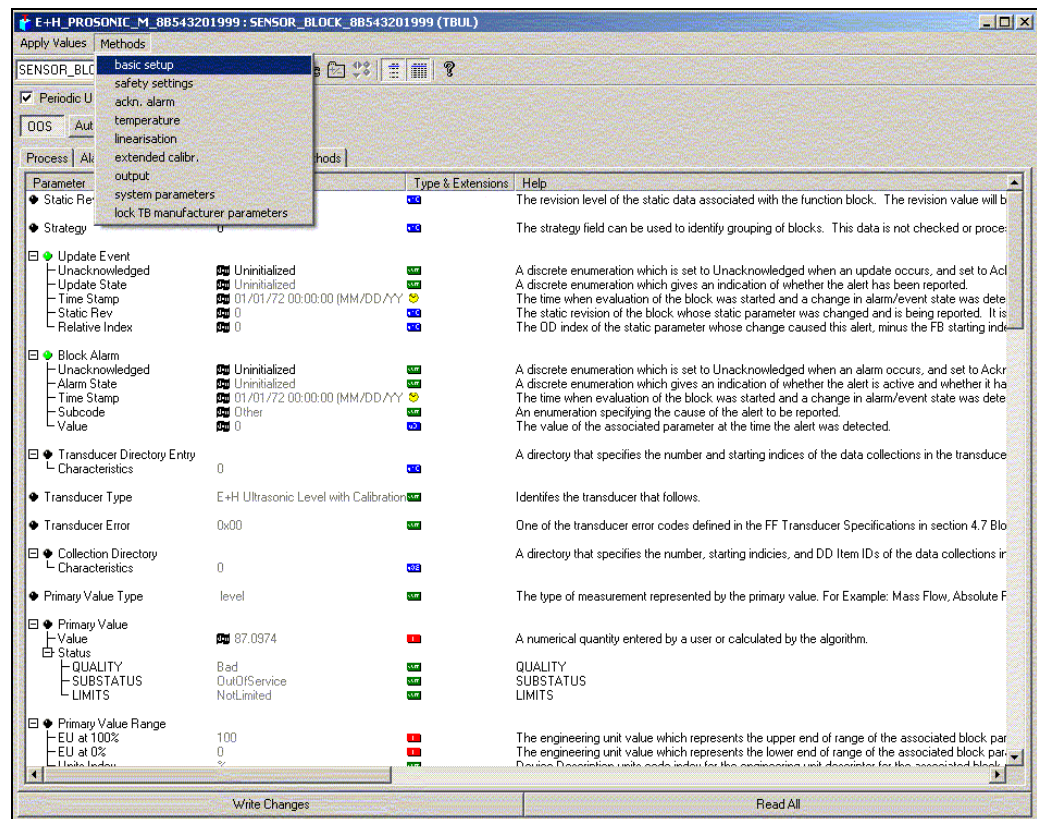
NI-FBUS-FMU4x-en-003

4. The method contains the following parameters[2]:
    a. Application parameters ($\rightarrow$ 📄 47)
        – PARTANKPROPERTIES (tank properties)
        – PARMEDIUMCONDITION (medium property)
        – PARPROCESSPROPERTIES (process condition)

    b. Empty and full calibration ($\rightarrow$ 📄 51)
        – PAREMPTYCALIBRATION (empty calibration)
        – PARFULlCALIBRATION (full calibration)

    c. Interference echo suppression ($\rightarrow$ 📄 53)
        – PARCHECKDISTANCE (check distance)
        – PARSUPPRESSIONDISTANCE (range of mapping)
        – PARSTARTMAPPINGRECORD (start maping)
        – PARPRESMAPRANGE (pres. map. dist.)
        – PARCUSTTANKMAP (cust. tank map)

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

6. If measuring errors occur or if the measuring value seems unreliable, it is advisable to check
    the quality of the measurement by the envelope curve display. This can be done in two
    different ways:
    – by the display and operating module VU331 ($\rightarrow$ 📄 31)
    – by an Endress+Hauser operating program ($\rightarrow$ 📄 35)

___

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

6.9.4   Parametrization of the Analog Input Blocks

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

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

2. Open the Analog Input Block.

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

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

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

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

6. In the L_TYPE prameter, select the mode of linearization for the input variable (Direct, Indirect, Indirect Sq Root). For details, → 🖹 108.

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

Example:

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

The following settings are to be made:

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

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

8. In addition to the limit values you must also specify the action taken if a limit value is exceeded using the alarm priorities (parameters HI_HI_PRI, HI_PRI, LO_PRI, LO_LO_PRI). Reporting to the the fieldbus host system only takes place if the alarm priority is higher than 2. For details, → 📄 108.

6.9.5   Connection of the function blocks

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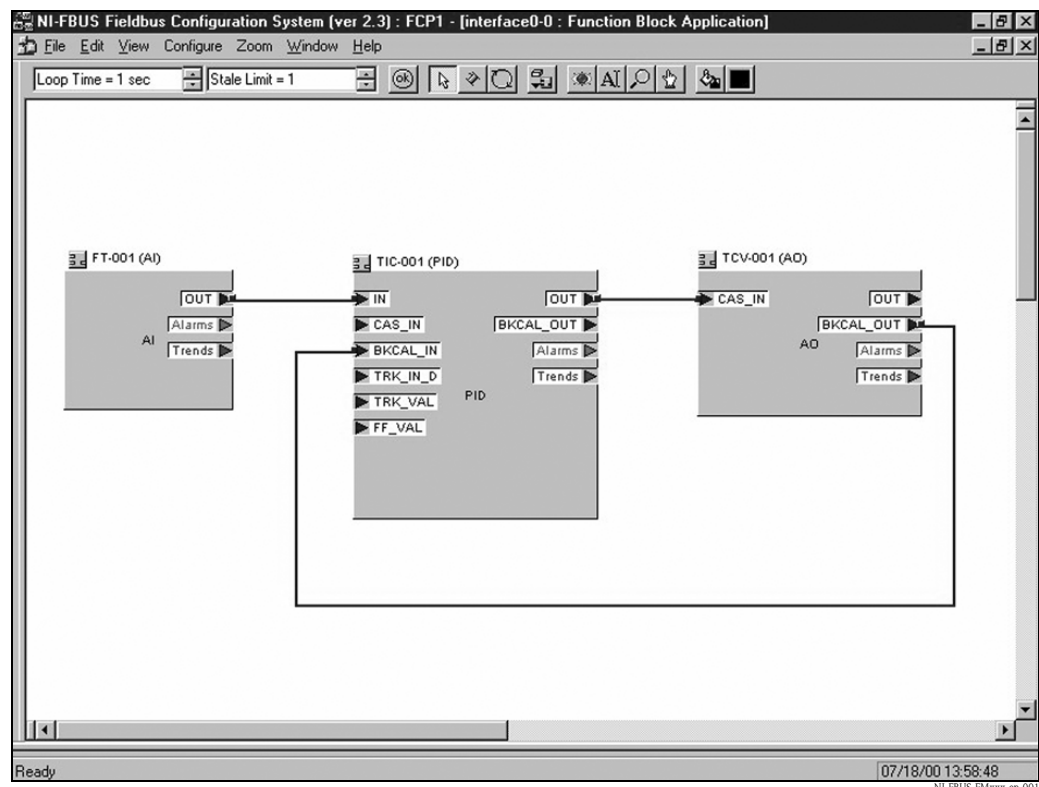
Example: Connection of the function blocks with the NI-FBUS Configurator

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

3. Set the oerating mode of the AI Block to AUTO (parameter group MODE_BLK, parameter TARGET). However, this is only possible under the following conditions:
    – The function blocks are correctly connected with each other.
    – The parametrization of the AI Block is correct (→ 📄 71, steps 5 and 6).
    – The Resource Block is in operating mode AUTO.

6.10 Commissioning with the Field Communicator 375, 475

The steps of the commissioning procedure are the same as with a FOUNDATION Fieldbus configuration tool (→ 🖹 68). The blocks should be parametrized in the following order:
- the RESOURCE BLOCK
- the SENSOR BLOCK (the "basic setup" method can be used for this, see chapter "basic setup")
- the ANALOG INPUT BLOCKS

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   Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves ("Spare Parts", Page 85). 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 original spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry our the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

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. Prerequisite to this is that the data were uploaded to the PC beforehand using the FieldCare.
Measurement can continue without having to carry out a new setup.

- You may have to activate linearisation (see BA00245F/00/EN on the enclosed CD-ROM.)
- You may need to record the tank map again (see Basic Setup)

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

8 Accessories

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

8.1 Weather protection cover

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

L00-FMR2xxxx-00-00-06-en-001
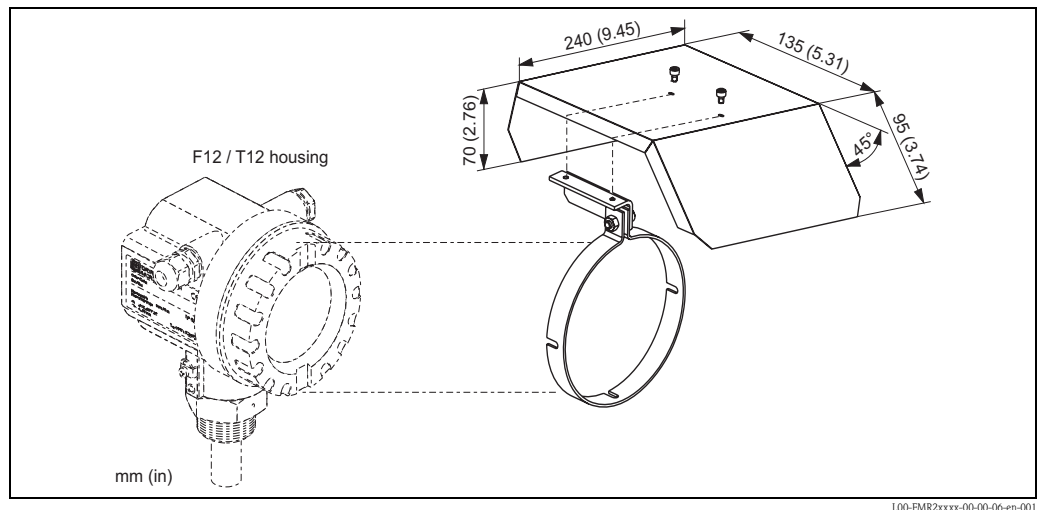
8.2 Mounting-kit isolated

Mounting-kit	Order-No.	
for 4mm rope probe	52014249	
for 6mm rope probe	52014250	
If a rope probe has to be fixed and a secure grounded mounting is not possible, we recommend using the insulating sleeve made of PEEK GF-30 with accompanying DIN 580 eye-bolt made of stainless steel. Max. process temp. 150 °C. Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded (→ 🗎 21).	 L00-FMP4xxxx-17-00-00-en-036	

8.3   Remote display and operation FHX40

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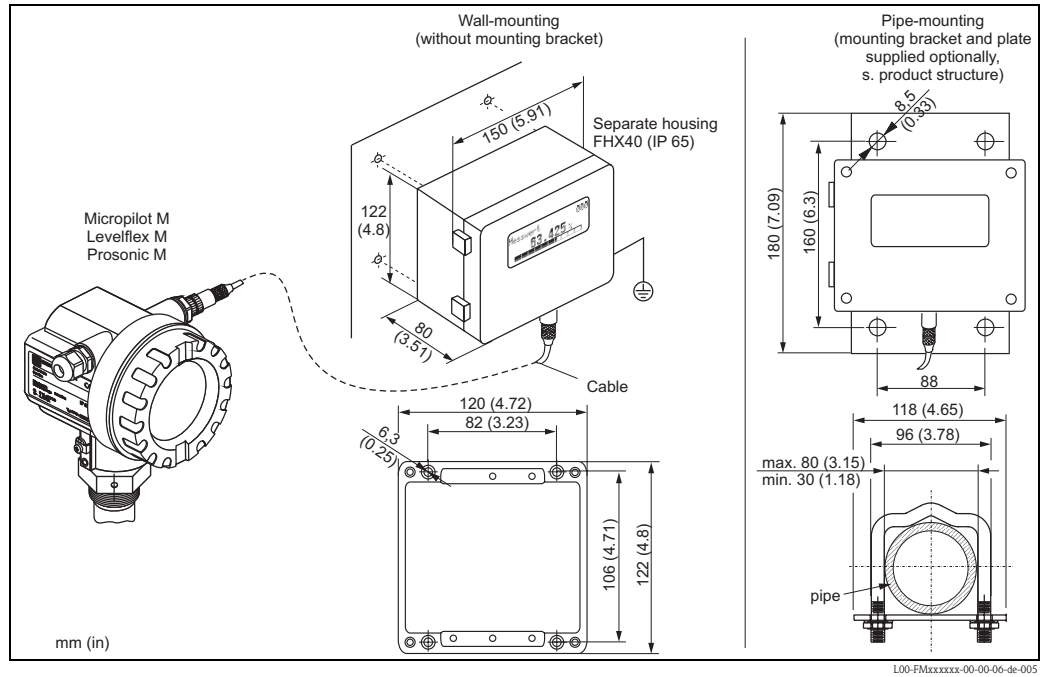
Technical data (cable and housing) and product structure:

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   Centering disks

If the probes with rod version are used in stilling well or bypass, it must be ensured that the probe does not come into contact with the wall. The centering disk fixes the rod probe in the middle of the pipe.

8.4.1   Centering disk PEEK Ø1.89 - 3.74 inch

The centering disk is suitable for probes with a rod diameter of Ø 0.63in and can be used in pipes from DN40 (1½") up to DN100 (4"). Markings on the 4-leg centering disk ensure a simple tailoring. Hence the centering disk can be adapted to the pipe diameter.
See also Operating Instruction BA00377F/00/A2.

- PEEK (statically dissipative)
- Measuring range: −60 °C to +200 °C

Order-no. 71069064

Note!
If the centering disk is inserted in an bypass, it must be positioned below the lower bypass outlet. The has to be accounted for when choosing the probe length.
Generally, the centering disk should not be mounted higher than 50 mm from the probe end.
It is recommended not to insert the PEEK centering disk in the measuring range of the rod probe.
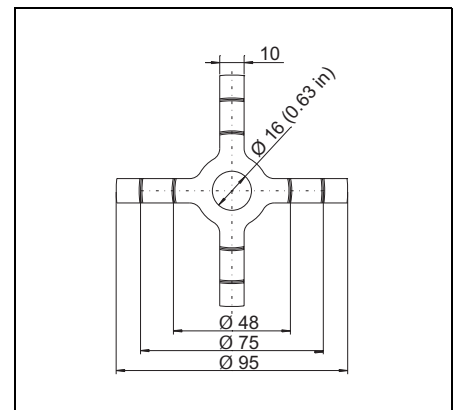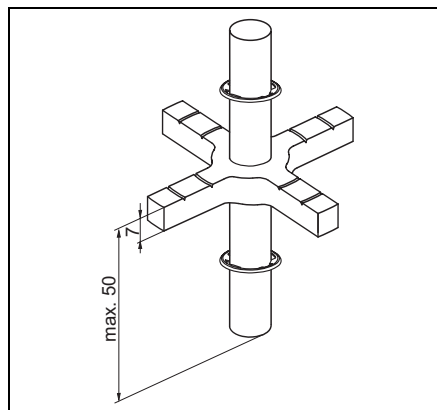
8.4.2   Centering disk PFA Ø1.46 inch

The centering disk is suitable for probes with a rod diameter of 0.63 inch (also coated rod probes) and can be used in pipes from DN40 (1½") upto DN50 (2").
See also Operating Instruction BA00378F/00/A2.

- Measuring range.: –200 °C to +150 °C

Order-no. 71069065
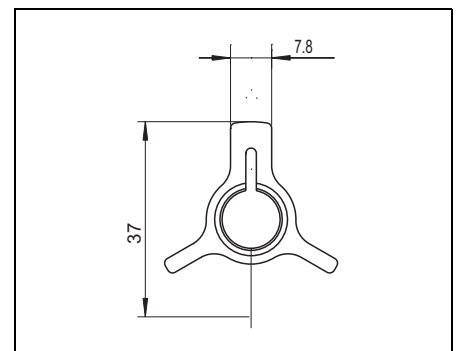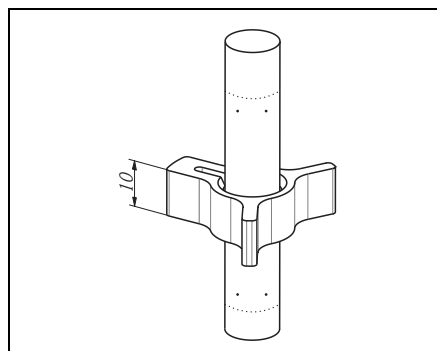
8.5   Commubox FXA291

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.

8.6   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.

8.7 Special process connection

8.7.1 Fisher flange 249B/259B (MVTF N0123)
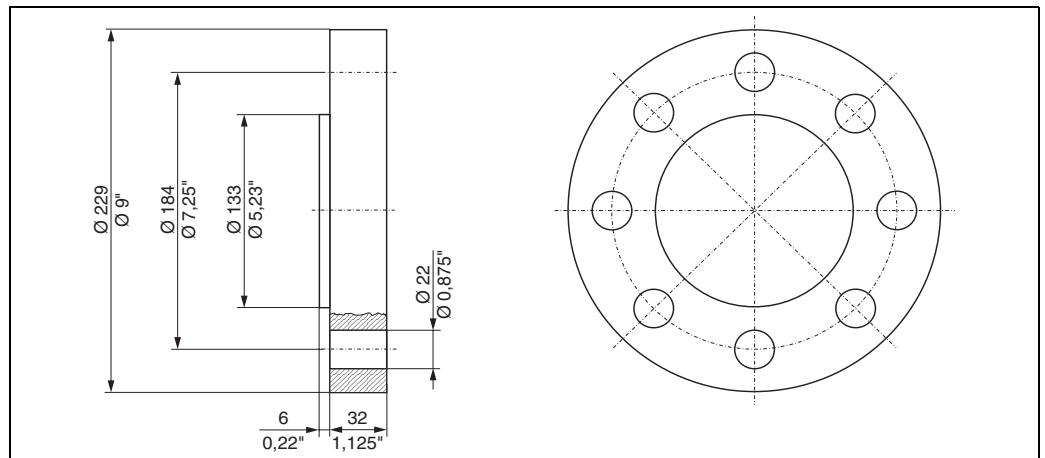
L00-FMP45xxx-00-00-06-en-001

8.7.2 Fisher flange 249C (MVTF N0124)
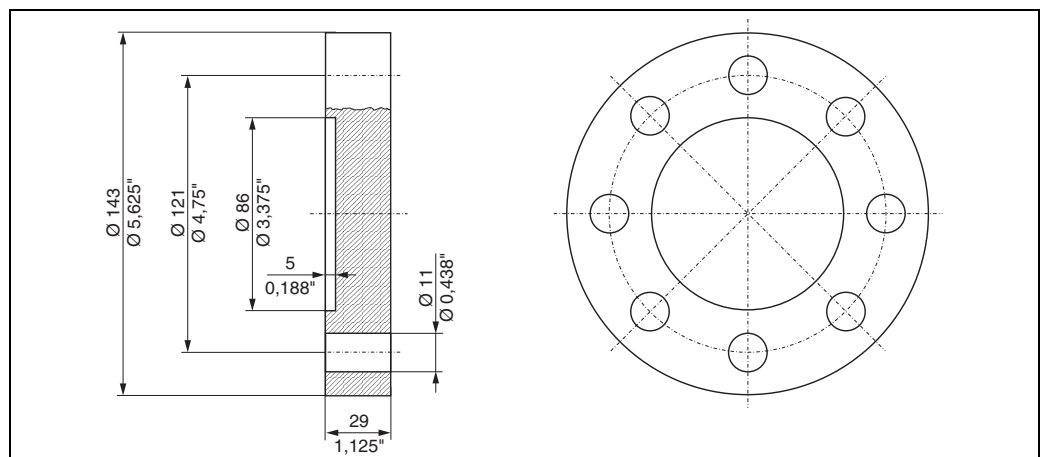
L00-FMP45xxx-00-00-06-en-002

8.7.3 Masoneillan flange (MVTF N0125)
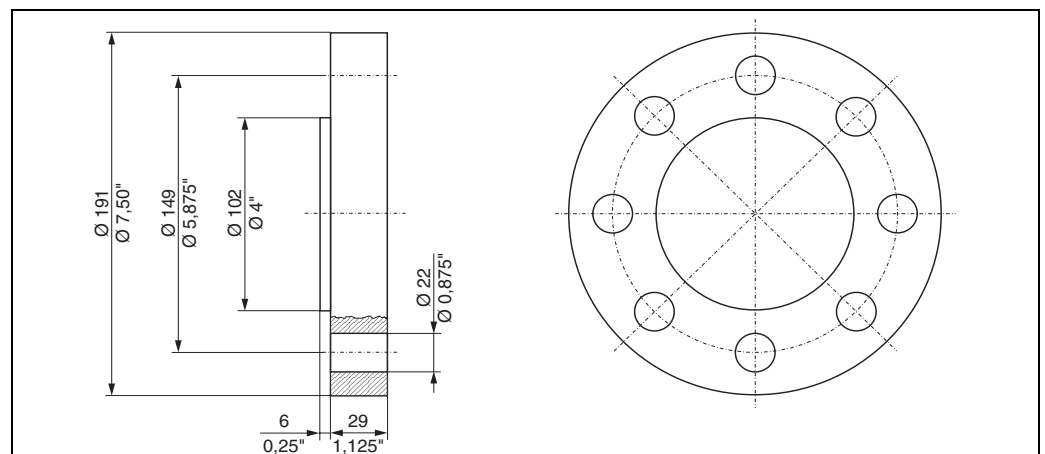
L00-FMP45xxx-00-00-06-en-003

9 Trouble-shooting

9.1 Trouble-shooting instructions

Levelflex M -Trouble Shooting
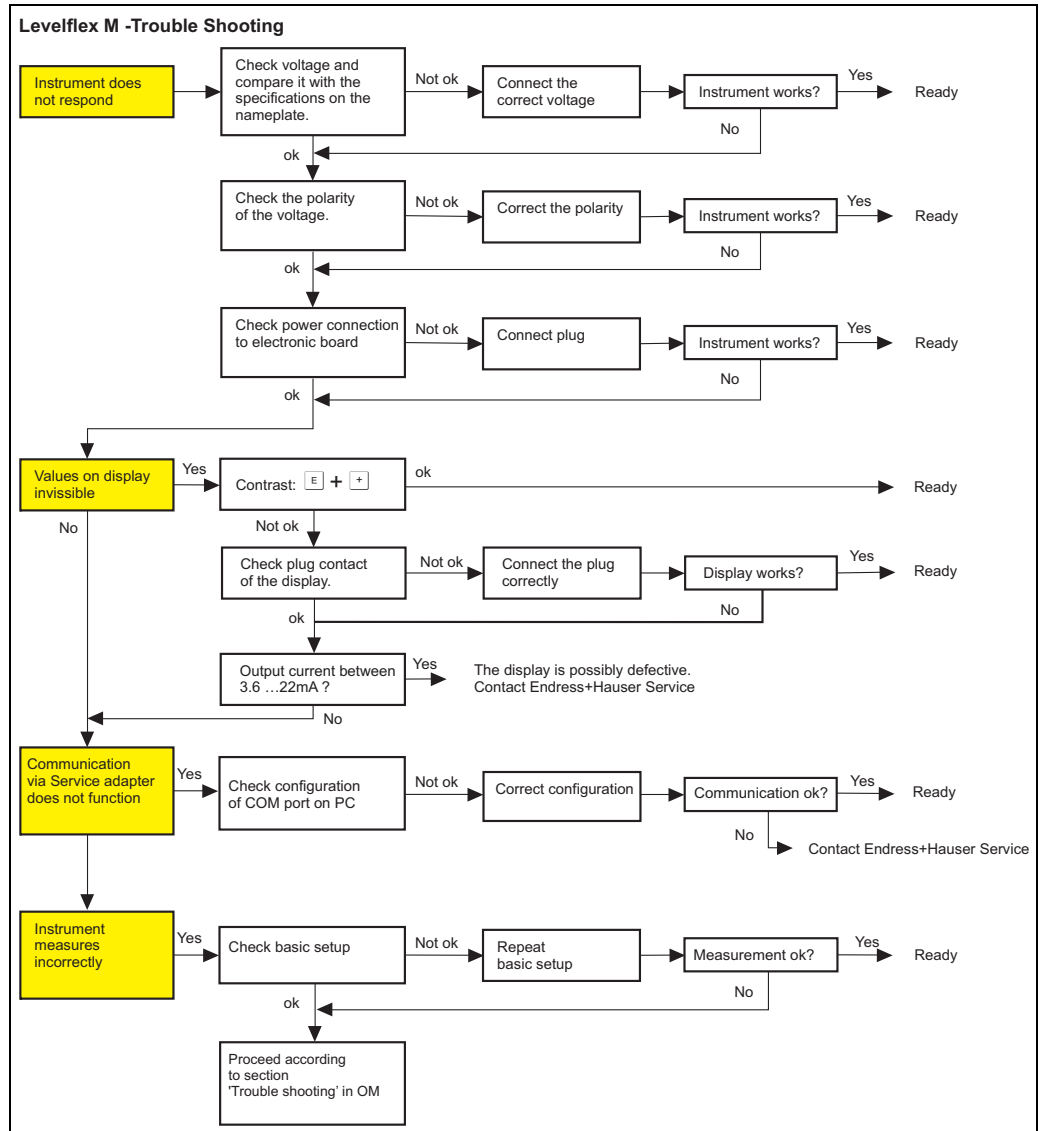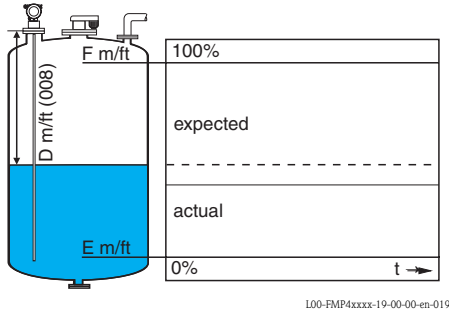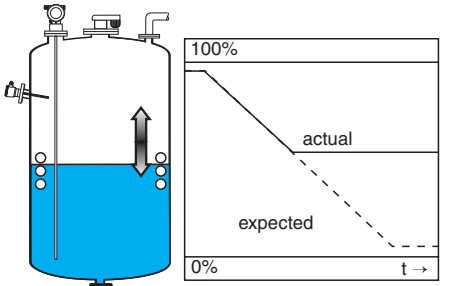
L00-FMP4xxxx-19-00-00-en-100
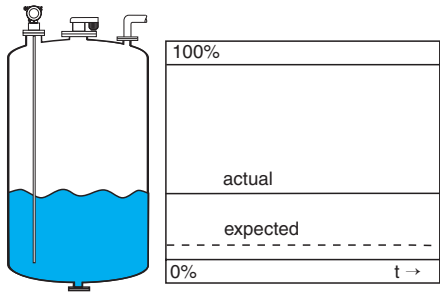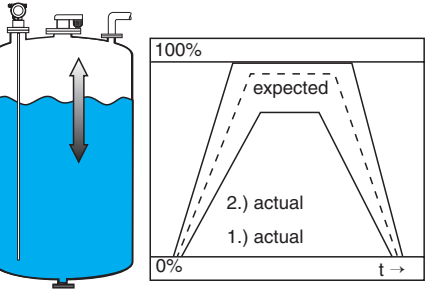
9.2 System error messages

Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr. required	device has been powered off before data could be stored; emc problem; EEPROM defect	reset avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising – please wait	EEPROM storage not yet finished	wait some seconds; if warning prevails, exchange electronics
A106	downloading please wait	processing data download	wait until warning disappears
A110	checksum error general reset & new calibr. required.	device has been powered off before data could be stored; emc problem; EEPROM defect	reset avoid emc problem; if alarm prevails after reset, exchange electronics
A111	electronics defect	RAM defective	reset if alarm prevails after reset, exchange electronics
A113	electronics defect	ROM defective	reset if alarm prevails after reset, exchange electronics
A114	electronics defect	EEPROM defective	reset if alarm prevails after reset, exchange electronics
A115	electronics defect	general hardware problem	Reset if alarm prevails after reset, exchange electronics
A116	download error repeat download	checksum of stored data not correct	restart download of data
A121	electronics defect	no factory calibration existant; EEPROM defective	contact service
W153	initialising – please wait	initialisation of electronics	wait some seconds; if warning prevails, power off device and power on again
A160	checksum error general reset & new calibr. required.	device has been powered off before data could be stored; emc problem; EEPROM defect	reset avoid emc problem; if alarm prevails after reset, exchange electronics
A164	electronics defect	hardware problem	reset if alarm prevails after reset, exchange electronics
A171	electronics defect	hardware problem	reset if alarm prevails after reset, exchange electronics
A221	Probe pulse deviation from average 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	Broken probe orvalue for probe length is too long	Check the probe length in 033, Check the probe itself,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 feedtrough
A261	HF cable defective	HF cable defective or HF connector removed	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	mapping active	wait some seconds until alarm disappears
W601	linearisation ch1 curve not monotone	linearization not monotonously increasing	correct linearisation table
W611	less than 2 linearisation points for channel 1	number of entered linearization points < 2	correct linearisation table
W621	simulation ch. 1 on	simulation mode is active	switch off simulation mode
E641	no usable echo channel 1 check calibr.	echo lost due to application conditions of built up on antenna	check installation; clean probe (cf. Operating Instructions)
W650	Signal/noise ratio too low or no echo	noise on signal to high	eliminate electromagnetic interference
E651	level in safety distance – risk of overspill	level in safety distance	alarm will disappear as soon as level leaves safety distance
A671	linearisation ch1 not complete, not usable	linearisation table is in edit mode	activate linearisation 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 (see Page 81)		1. See table of error messages (see Page 81)
Measured value (00) is incorrect	L00-FMP4xxxx-19-00-00-en-019	Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006) 2. Check linearisation: → level/ullage (040) → max. scale (046) → diameter vessel (047) → Check table
		no ↓		
		An interference echo may have been evaluated.	yes →	1. Carry out tank mapping → basic setup
No change off measured value on filling/emptying	L00-FMR2xxxx-19-00-00-en-014	Interference echo from installations, nozzle or extension on the probe		1. Carry out tank mapping → basic setup 2. If necessary, clean probe 3. If necessary, select better mounting position
E 641 (loss of echo) after turn on the power supply	**If the device is configured to Hold by loss of echo the output is set to any value/current.**	noise level during the initialisation phase to high.		Repeat once more empty calibr. (005). Caution! Before conformation change with + or − to the edit mode.

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. Medium properties incorrect.	LN < 4 m and "Aluminium tank" tank properties selected → Calibration not possible. → Selection → Select standard → Thresholds too high 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".
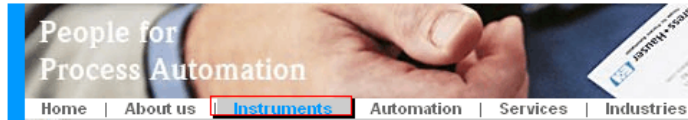
3.   Enter the product name into the "product name" field.

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 transmitter is sent to Endress+Hauser e.g. for repair or calibration:

- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- Always enclose a duly completed "Declaration of contamination" form (a copy of the "Declaration of contamination" is included at the end of this operating manual).
  Only then can Endress +Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.

Additionally specify:
- An exact description of the application
- The chemical and physical characteristics of the product
- A short description of the error that occurred (specify error code if possible)
- If necessary, give the error code

9.6   Disposal

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

9.7   Software history

Date	Software version	Software modifications	Documentation	Description of Device Functions
08.2003	01.02.02	Original software. Operated via: – ToF Tool – Commuwin II (as of Version 2.08-1 Update C) – HART-Communicator DXR375 withRev. 1, DD 1.	BA281F/00/en/04.04 52021043	——
07.2004	01.02.04	■ "mapping" function improved	BA281F/00/en/06.04 52021043 BA281F/00/en/04.05 52021043 BA281F/00/en/01.06 52021043	BA245F/00/en/06.04 52011936 BA245F/00/en/01.06 52011936
01.2005	01.02.06	Function "echo lost" improved	——	——
03.2006	01.04.00	■ function "detection window"	BA281F/00/en/05.06 52021043 BA281F/00/en/11.06 52021043 BA281F/00/en/12.06 52021043	BA245F/00/en/06.06 52011936
07.2007	01.04.02	■ "Echo" and "linearisation" improved ■ Improved echo detection with completely flooded bypasses	——	——
10.2008	01.04.04	Function "LAS" improved	BA281F/00/en/03.09 71074933 BA281F/00/en/08.09 71102353 BA00281F/00/EN/13.10 71120324 BA00281F/00/EN/14.11 71134042 BA00281F/00/EN/15.11 71154975	——

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 a reference point (see Fig., see Page 12) and the product surface. Subject to the input empty distance "E", the level is calculated. Alternatively, the level can be converted by means of linearisation (32 points) into other variables (volume, mass).

10.1.2   Output

Output signal

- FOUNDATION Fieldbus (H1):
  – 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 (see Page 32)
  – Plain text display
- Current output, signal on error can be selected (e.g. according to NAMUR recommendation NE43)
- Digital interface

Linearization

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

Data of the FOUNDATION
Fieldbus interface

Basic Data

Device Type	1012 (hex)
Device Revision	04 (hex)
DD Revision	02 (hex)
CFF Revision	02 (hex)
ITK Version	4.61
ITK–Certification Driver–No.	www.endress.com / www.fieldbus.org
Link–Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Devce
Number VCRs	24
Number of Link-Objects in VFD	24

Virtual communication references (VCRs)

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

Link Settings

Slot time	4
Min. Inter PDU delay	6
Max. response delay	10

Transducer Blocks

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

1)   depending on the configuration of the sensor-block

Function Blocks

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

10.1.3   Auxiliary energy

Terminals	Cable cross-section: 0.5 to 2.5 mm^2

Cable entry	■ Cable gland M20x1.5 (only cable entry for Ex d) ■ Cable entry G½ or ½NPT ■ 7/8" FOUNDATION Fieldbus plug

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).

FISCO

U_i = 17,5 V

I_i = 500 mA; with overvoltage protection 273 mA

P_i = 5,5 W; with overvoltage protection 1,2 W

C_i = 5 nF

L_i = 0,01 mH

FNICO	Yes

Polarity sensitive	No

In-rush current	≤ 15 mA

Basic current	Max. 15 mA

10.1.4   Performance characteristics

Reference operating conditions	▪ Temperature = +20 °C ±5 °C ▪ Pressure = 1013 mbar abs. ±20 mbar ▪ Humidity = 65 % ±20 % ▪ Reflection factor ≥ 0.8 (surface of the water for coax probe, metal plate for rod and rope probe with min. 1 m ⌀) ▪ Flange for rod or rope probe ≥ 30 cm ⌀ ▪ Distance to obstructions ≥ 1 m
Maximum measured error	Is in Function group "basic setup".
Resolution	Digital: 1 mm
Reaction time	The reaction time is dependent on the configuration. Shortest time: ▪ 2-wire electronics: 1 s
Influence of ambiente 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
Influence of gaslayer	High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the kind of gas/vapor and if its temperature. This results in a measuring error that gets bigger as the distance increases between the device zero point (flange) and product surface. The following table illustrates this measured error for a few typical gases/vapors (with regard to the distance; a positive value means that too large a distance is being measured):

Gaslayer	Temperature		Pressure					
	°C	°F	1 bar (14.5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	200 bar (2900 psi)	400 bar (5801 psi)
Air	20	68	0,00 %	0,22 %	1,2 %	2,4 %	4,9 %	9,5 %
	200	392	–0,01 %	0,13 %	0,74 %	1,5 %	3,0 %	6,0 %
	400	752	–0,02 %	0,08 %	0,52 %	1,1 %	2,1 %	4,2 %
Hydrogen	20	68	–0,01 %	0,10 %	0,61 %	1,2 %	2,5 %	4,9 %
	200	392	–0,02 %	0,05 %	0,37 %	0,76 %	1,6 %	3,1 %
	400	752	–0,02 %	0,03 %	0,25 %	0,53 %	1,1 %	2,2 %

Gaslayer	Temperature		Pressure				
	°C	°F	1 bar (14.5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	200 bar (2900 psi)
Water (saturated steam)	100	212	0,20 %	-	-	-	-
	180	356	-	2,10 %	-	-	-
	263	507	-	-	8,6 %	-	-
	310	592	-	-	-	22,0 %	-
	364	691	-	-	-	-	58 %

| Installing FMP45 with Gasphase Compensation (Coax only) | *Application* |

For level measurement in steam applications at high pressures and temperatures.
At high pressures and temperatures, the speed at which microwave signals are propagated in steam (polar media) is reduced above the liquid being measured. Automatic gas phase compensation allows this physical effect to be corrected from a measurement technology point of view.
The accuracy of measurement is the higher the larger the reference Lref and the smaller the measuring range is:
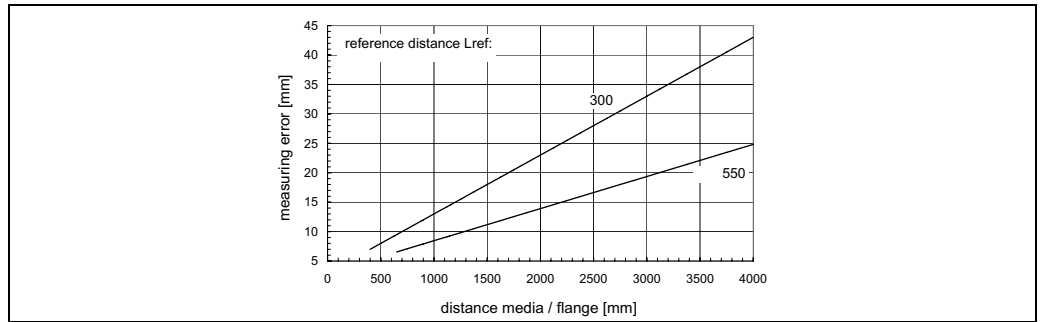
L00-FMP4xxxx-05-00-00-yy-003

If there are fast changes in pressure, there may be an additional error, since the measured reference distance is filtered with twice the time constant of the level measurement.
In addition, condition of imbalance (e.g. due to heating) may cause density and pressure gradients within the medium and condensation of steam at the probe. As a result, the level readings at different locations inside the tank may very slightly.
Caused by this application influences the measuring error may be increased by a factor up to 2 to3.

✎ Note!
Coax probes with reference reflection can be installed in any tank (free in the tank or into a bypass). Coax probes are completely mounted and adjusted ex work. After mounting they are ready for use, additional settings are not necessary.

Installation

This version of Levelflex M generates a reference reflection in the distance Lref from the flange (→ 🖺 6, "Ordering structure" option U: 300 mm/11"; option V: 550 mm/21"). The reference reflection must be at least 150 mm above the highest level. By means of the shift of the reference reflection the actual propagation speed is measured and the level value will be automatically corrected.

Limitations for coax probes

Maximum probe length LN	LN ≤ 4000 mm
Minimum probe length LN	LN > Lref + 200 mm
Reference distance Lref	300 mm / 550 mm
Maximum level relative to sealing surface of flange:	Lref + 150 mm
Minimum DC-value of medium:	$D_K > 7$
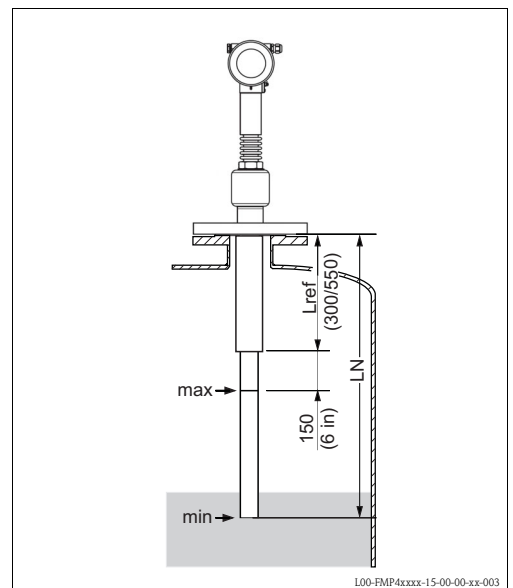
L00-FMP4xxxx-15-00-00-xx-003

10.1.5 Operating conditions: Environment

Ambient temperature range

Ambient temperature for the transmitter: –40 °C to +80 °C. The functionality of the LCD display may be limited for temperatures Ta < –20 °C and Ta > +60 °C. A weather protection cover should be used for outdoor operation if the device is exposed to direct sunlight.

Ambient temperature limits

FMP45 (XT 280 °C)

If the temperature (T_2) at the process connection is below –40 °C or above +80 °C, the permitted ambient temperature (T_1) is limited as shown in the following diagram (temperature derating):

L00-FMP45xxx-05-00-00-en-002

FMP45 (XT 280 °C)

If the temperature (T_2) at the process connection is below –40 °C or above +80 °C, the permitted ambient temperature (T_1) is limited as shown in the following diagram (temperature derating):

L00-FMP45xxx-05-00-00-en-003

✎ Note!
For saturated steam applications with FMP45 XT the process temperature should not exceed 200 °C (392 °F). For higher process temperatures use the HT version.

Storage temperature	–40 °C to +80 °C
Climate class	DIN EN 60068–2–38 (test Z/AD)
Vibration resistance	DIN EN 60068–2–64 / IEC 68–2–64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$
Cleaning the probe	Depending on the application, contamination or build–up can accumulate on the probe. A thin, even layer only influences measurements slightly. Thick layer 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. plastic, 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.

10.1.6   Operating conditions: Process

Process temperature range

The maximum permitted temperature at the process connection (see Figure for measuring point) is determined by the process connection ordered:
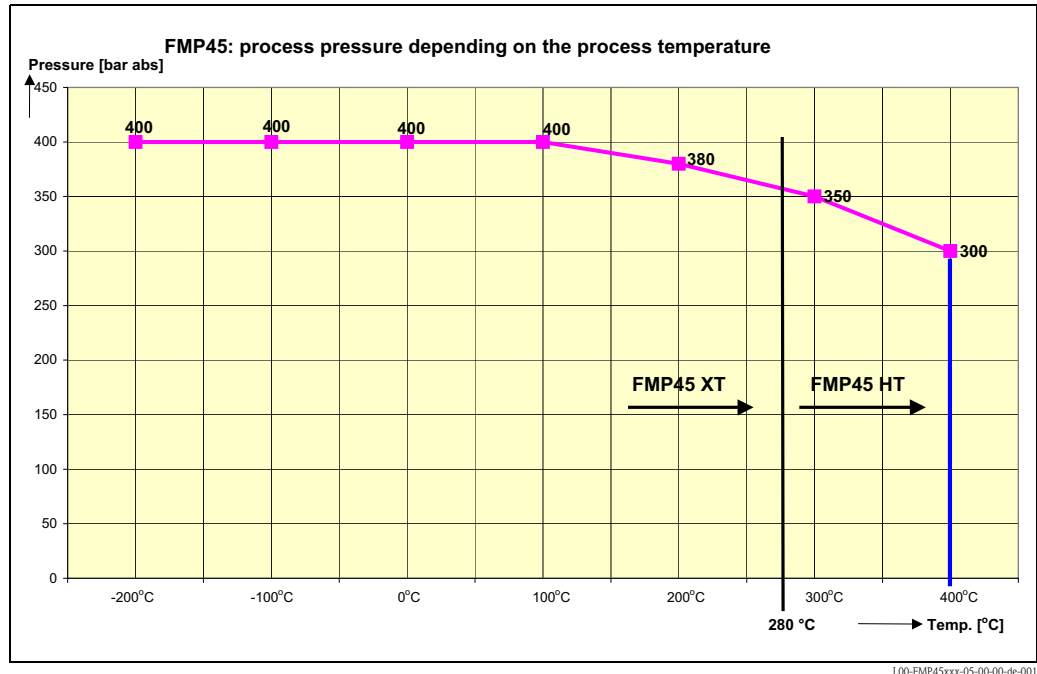
FMP45: process pressure depending on the process temperature

L00-FMP45xxx-05-00-00-de-001

✎ Note!
For saturated steam applications with FMP45 XT the process temperature should not exceed 200 °C (392 °F). For higher process temperatures use the HT version.

Process pressure limits

The specified range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for ASEM 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 stablility 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

- Rod and rope probe: $\varepsilon r \geq 1.6$, when installing in pipes DN $\leq$ 150 mm: $\varepsilon r \geq 1.4$
- Coax probes: $\varepsilon r \geq 1.4$

10.1.7   Mechanical construction

Material

See TI00386F/00/EN, chapter "Material (not in contact with process)" and "Material (in contact with process)".

Tolerance of probe length

	Rod probes			Rope probes		
over (m / ft)		1 (3.2)	3 (9.8)	6 (20)		1 (3.2)	3 (9.8)	6 (20)
up to (m / ft)	1 (3.2)	3 (9.8)	6 (20)		1 (3.2)	3 (9.8)	6 (20)	
admissible tolerance (mm / in)	– 5 (– 0.2)	– 10 – 0.4)	– 20 (– 0.8)	– 30 (– 1.2)	– 10 (– 0.4)	– 20 (– 0.8)	– 30 (– 1.2)	– 40 (– 1.6)

Weight

Levelflex M	XT version (max. 280 °C)		
	Rod probe	**Rope probe**	**Coax probe**
Weight with F12 or T12 housing	approx. 8.5 kg + approx. 1.6 kg/m Probe length + Flange weight	approx. 8.5 kg + approx. 0.1 kg/m Probe length + Flange weight	approx. 8.5 kg + approx. 3.5 kg/m Probe length + Flange weight
Weight with F23 housing	approx. 12 kg + approx. 1.6 kg/m Probe length + Flange weight	approx. 12 kg + approx. 0.1 kg/m Probe length + Flange weight	approx. 12 kg + approx. 3.5 kg/m Probe length + Flange weight

Levelflex M	HT version (max. 400 °C)		
	Rod probe	**Rope probe**	**Coax probe**
Weight with F12 or T12 housing	approx. 9.5 kg + approx. 1.6 kg/m Probe length + Flange weight	approx. 9.5 kg + approx. 0.1 kg/m Probe length + Flange weight	approx. 9.5 kg + approx. 3.5 kg/m Probe length + Flange weight
Weight with F23 housing	approx. 13 kg + approx. 1.6 kg/m Probe length + Flange weight	approx. 13 kg + approx. 0.1 kg/m Probe length + Flange weight	approx. 13 kg + approx. 3.5 kg/m Probe length + Flange weight

10.1.8 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.

Manufacturer declaration

Permitted pressures, temperatures and load cycles as per EN 13445 and AD- data sheet S2 (for FMP45).

Ex approval

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 Safety Instructions (XA) and Certificates (ZE) to the device:

Feature		Variant	ZE256F	ZD117F	ZD116F	ZD114F	ZD113F	ZD083F	ZD082F	ZD081F	ZD080F	ZD021F	ZD110F	ZD109F	ZD107F	ZD106F	ZD078F	ZD077F	ZD076F	ZD075F	XA386F	XA380F	XA379F	XA378F	XA376F	XA330F	XA217F	XA216F	XA215F	XA212F	XA213F	XA211F	XA173F	XA172F	XA168F	XA167F	XA166F	XA165F	XA164F
10 Approval:	Non-hazardous area	A																																						
	NEPSI Ex emb (ia) IIC T6	C																								X													
	Non-hazardous area, WHG	F	X																																				
	ATEX II 3G Ex nA II T6	G																							X														
	NEPSI Ex ia IIC T6	I																					X	X															
	NEPSI Ex d(ia) IIC T6	J																						X															
	TIIS Ex d (ia) IIC T1	K																																					
	TIIS Ex d (ia) IIC T2	L																																					
	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, N.I.	P					X																																
	*NEPSI DIP	Q																																					
	NEPSI Ex nA II T6	R																				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	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/IECEx Zone0/1	1																						X	X		X	X										X	X
	ATEX II 1/2D/IEC Ex td A20/21, Alu blind cover	2																			X		X			X	X	X										
	ATEX II 1/2G Ex emb (ia) IIC T6/IECEx	3																															X						
	ATEX II 1/3D/IEC Ex td A20/22 [1]	4																			X		X			X	X	X										
	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D	5																			X		X				X											
	ATEX II 1/2G Ex ia IIC T6, WHG	6	X																		X	X		X	X				X	X							
	ATEX II 1/2G Ex d (ia) IIC T6/IEC Ex d (ia) IIC T6	7																														X						
	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D, WHG	8	X																		X		X			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	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	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	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							
	2-wire 4-20mA HART, Interface	K		X		X		X		X			X		X		X		X		X		X	X	X	X	X		X	X		X	X	X		X	X		X
80 Housing:	F12 Alu, coated IP68 NEMA6P	A				X		X	X	X			X		X	X	X		X	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		X	X		X	X	X									
	T12 Alu, coated IP68 NEMA6P,	C					X						X				X		X	X		X		X	X					X				X		X	X		
	T12 Alu, coated IP68 NEMA6P + OVP	D		X	X						X	X	X								X	X	X	X	X	X												
90 Cable entry:	thread M20 (EEx d > thread M20)	2																			X	X	X	X	X														
	thread G1/2	3																			X	X	X	X	X														
	thread NPT1/2	4																			X	X	X	X	X														
	Plug M12	5																			X		X	X															
	Plug 7/8"	6																			X		X	X															

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

Overspill protection	WHG. See "Ordering structure", → 🖹 6 (ZE00256F/00/DE)
Telecommunication	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, all probes in metallic tanks as well as the coax probe 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.

Pressure Equipment Directive	The FMP45 corresponds to the 97/23/EC Directive (Pressure Equipment Directive). It is a pressure accessory with a volume < 0.1 l, corresponding to Category I. Conformity assessment was carried out as per Module A, the design as per EN 13445 and AD 2000 technical specifications. FMP45 is not suitable for use with unstable gases at nominal pressures above 200 bar.
Steam boiler approval	The FMP45 is approved as a limiting device for high water (HW) and low water (LW) for liquids in containers which are subject to the requirements of EN 12952-11 and EN 12953-9 (certified by TÜV Nord). See "Ordering structure", → 🖹 6. Further information can be found in the safety instruction for steam boiler approval (SD00288F/00/EN).

10.1.9 Additional documentation

| Additional documentation | This additional documentation can be found on our product pages on www.endress.com
■ Technical Information (TI00386F/00/EN)
■ Certificate "Allgemeine bauaufsichtliche Zulassung" (ZE00256F/00/DE)
■ Safety instruction for steam boiler approval (SD00288F/00/EN)
■ Brief Operating Instructions (KA01046F/00/EN) |

11   Appendix

11.1   Operating menu FOUNDATION Fieldbus

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				free	→	probe length 033		too short
		tie down gnd.		modified						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

output 06	→

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

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

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

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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		brocken probe det 019
from blocking distance **default: 0.1m**	alarm **warning** self holding	**no** yes		**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
sim. off sim. level sim. volume

simulation value 066

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

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

distance unit 0C5	download mode 0C8

Return to Group Selection

L00-FMP4xxxx-19-00-02-en-022

11.2   Description of functions

✎ Note!
A detailed description of the function groups, functions and parameters is given in the documentation BA00245F/00/DE "Description of Instrument Functions" on the enclosed CD-ROM.

11.3   Block model of the Levelflex M

The Micropilot M contains the follwoing blocks:
- **Resource Block (RB2)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Sensor Block (TBGRL)**
  contains the parameters relevant to the measurement of the Levelflex M
- **Diagnostic Block (DIAG)**
  contains the diagnostic parameters of the Levelflex M
- **Display Block (DISP)**
  contains the configuration parameters for the display module VU331
- **Analog-Input-Block 1 bzw. 2 (AI)**
  scale the signal of the Transducer Block and transmit them to the PLCS
- **PID Block (PID)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Arithmetic Block (AR)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Input Selector Block (IS)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Signal Characterizer Block (SC)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Integrator Block (IT)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"

11.3.1   Default Block configuration

The input and output variables of the blocks can be interconnected by a network configuration tool (e.g. NI–Fieldbus configurator). The figure below shows, how these connections are set by default.
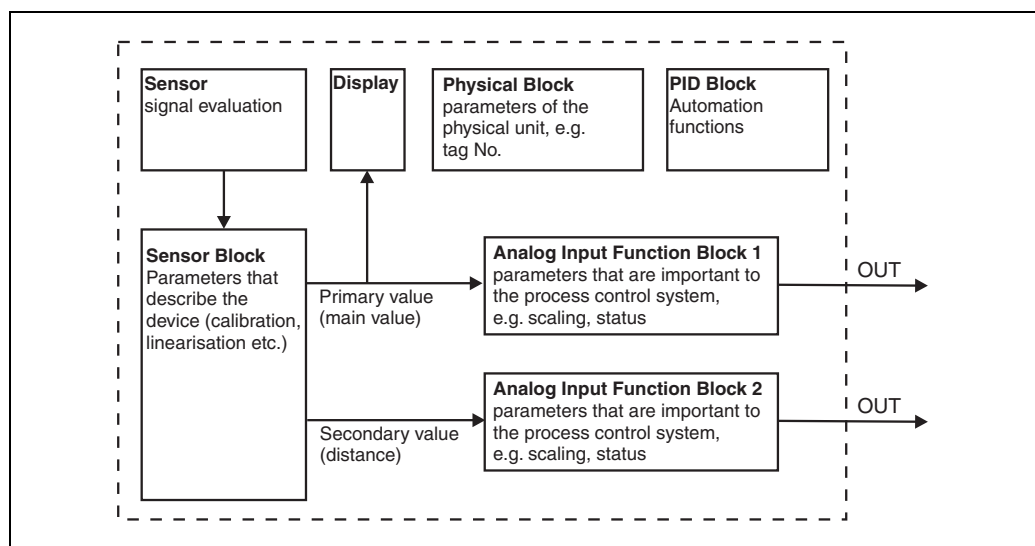
L00-FMxxxxxx-02-00-00-en-002

11.4   Resource block

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

11.4.1   Operation

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

11.4.2   Parameters

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

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

11.5   Sensor Block

The Sensor Block contains the parameters required to calibrate the device. These parameters can also be addressed by using the VU331 display module. The calibration of the device is described in Chapter 6.

11.5.1   Operation

Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. In order to resume operation, change MODE–BLK to AUTO [3].

11.5.2   Block administration parameters

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

11.5.3   Output values

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

11.5.4   Configuration parameters

The Sensor block also contains the configuration parameters, which are used to commission and calibrate the device. They are identical to the functions of the operating menu, except for the service parameters which are not accessible on the bus. Thus, the calibration procedure via the display module (→ 📄 44) is equally valid for a calibration via a network configuration tool.
A complete list of the configuration parameters can be found in the BA00245F/00/EN "Description of Instrument Functions".

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

11.5.5 Methods

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

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

Most of these methods are identical to the respective function group in the operating menu.
A detailed description of them can be found in the BA00245F/00/EN "Description of Instrument Functions".

11.5.6 Parameter list of the Levelflex M Sensor Block

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
measured value	000	18	PARMEASUREDVALUE	4	FloatingPoint	RO	dynamic	Auto, OOS
tank properties	002	19	PARTANKPROPERTIES	1	Unsigned8	RW	static	OOS
medium property	003	20	PARMEDIUMCONDITION	1	Unsigned8	RW	static	OOS
process propert.	004	21	PARPROCESSPROPERTIES	1	Unsigned8	RW	static	OOS
end of probe	030	22	PARENDOFPROBE	1	Unsigned8	RW	static	OOS
probe length	031	23	PARPROBESHORTEND	1	Unsigned8	RW	dynamic	OOS
probe	032	24	PARPROBEFREE	1	Unsigned8	RW	dynamic	OOS
probe length	033	25	PARPROBELENGTH	4	FloatingPoint	RW	static	OOS
determine length	034	26	PARPROBELENGTHSETUP	1	Unsigned8	RW	dynamic	OOS
empty calibr.	005	27	PAREMPTYCALIBRATION	4	FloatingPoint	RW	static	OOS
full calibr.	006	28	PARFULLCALIBRATION	4	FloatingPoint	RW	static	OOS
echo quality	056	29	PARECHOQUALITY	2	Integer16	RO	dynamic	Auto, OOS
check distance	051	30	PARCHECKDISTANCE	1	Unsigned8	RW	dynamic	OOS
range of mapping	052	31	PARSUPPRESSIONDISTANCE	4	FloatingPoint	RW	dynamic	OOS
start mapping	053	32	PARSTARTMAPPINGRECORD	1	Unsigned8	RW	dynamic	OOS
pres. map dist.	054	33	PARPRESMAPRANGE	4	FloatingPoint	RO	dynamic	Auto, OOS
delete mapping	055	34	PARDELETEMAPPING	1	Unsigned8	RW	dynamic	OOS
offset	057	35	PAROFFSETOFMEASUREDDISTANCE	4	FloatingPoint	RW	static	OOS
output damping	058	36	PAROUTPUTDAMPING	4	FloatingPoint	RW	static	Auto, OOS
upper block.dist	059	37	PARHIGHBLOCKINGDISTANCE	4	FloatingPoint	RW	static	OOS
output on alarm	010	38	PAROUTPUTONALARM	1	Unsigned8	RW	static	OOS
outp. echo loss	012	39	PARREACTIONLOSTECHO	1	Unsigned8	RW	static	OOS
ramp %span/min	013	40	PARRAMPINPERCENTPERMIN	4	FloatingPoint	RW	static	OOS
delay time	014	41	PARDELAYTIMEONLOSTECHO	2	Unsigned16	RW	static	OOS
safety distance	015	42	PARLEVELWITHINSAFETYDISTANCE	4	FloatingPoint	RW	static	OOS
in safety dist.	016	43	PARINSAFETYDISTANCE	1	Unsigned8	RW	static	OOS

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
ackn. alarm	017	44	PARACKNOWLEDGEALARM	1	Unsigned8	RW	dynamic	Auto, OOS
broken probe det	019	45	PARBROKENPROBEDETECTION	1	Unsigned8	RW	static	OOS
level/ullage	040	46	PARLEVELULLAGEMODE	1	Unsigned8	RW	static	OOS
linearisation	041	47	PARLINEARISATION	1	Unsigned8	RW	static	OOS
customer unit	042	48	PARCUSTOMERUNIT	2	Unsigned16	RW	static	OOS
table no.	043	49	PARTABLENUMBER	1	Unsigned8	RW	non-vol.	Auto, OOS
input level	044	50	PARINPUTLEVELHALFAUTOMATIC	4	FloatingPoint	RO	dynamic	Auto, OOS
input level	044	51	PARINPUTLEVELMANUAL	4	FloatingPoint	RW	dynamic	OOS
input volume	045	52	PARINPUTVOLUME	4	FloatingPoint	RW	dynamic	OOS
max. scale	046	53	PARMAXVOLUME	4	FloatingPoint	RW	static	OOS
diameter vessel	047	54	PARCYLINDERVESSEL	4	FloatingPoint	RW	static	OOS
simulation	065	55	PARSIMULATION	1	Unsigned8	RW	dynamic	OOS
simulation value	066	56	PARSIMULATIONVALUELEVEL	4	FloatingPoint	RW	dynamic	Auto, OOS
simulation value	066	57	PARSIMULATIONVALUEVOLUME	4	FloatingPoint	RW	dynamic	Auto, OOS
unlock parameter	0A4	58	PAROPERATIONCODE	2	Unsigned16	RW	non-vol.	OOS
measured dist.	0A5	59	PARMEASUREDDISTANCE	4	FloatingPoint	RO	dynamic	Auto, OOS
measured level	0A6	60	PARMEASUREDLEVEL	4	FloatingPoint	RO	dynamic	Auto, OOS
detection window	0A7	61	PARDETECTIONWINDOW	1	Unsigned8	RW	dynamic	OOS
application par.	0A8	62	PARAPPLICATIONPARAMETER	1	Unsigned8	RO	dynamic	Auto, OOS
distance unit	0C5	63	PARDISTANCEUNIT	2	Unsigned16	RW	static	OOS
download mode	0C8	64	PARDOWNLOADMODE	1	Unsigned8	RW	static	OOS
max meas dist	0D84	65	PARABSMAXMESSDIST	4	FloatingPoint	RO	dynamic	Auto, OOS
max sample dist.	0D88	66	PAREDITRANGEMAXSAMPLEDIST	4	FloatingPoint	RO	dynamic	Auto, OOS
present error	0A0	67	PARACTUALERROR	2	Unsigned16	RO	dynamic	Auto, OOS

11.6   Diagnostic Block

11.6.1   Operation

The diagnostic block contains the error messages of the device. These parameters can also be addressed by using the VU331 display module. The diagnostic block is opened by clicking on the "diagnostic" line. Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. In order to resume operation, change MODE_BLK to AUTO [4].

11.6.2   Block administration parameters

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

11.6.3   Methods

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

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

Most of these methods are identical to the respective function group in the operating menu.
A detailed description of them can be found in the BA00245F/00/EN "Description of Instrument Functions".

11.6.4   Device specific parameters

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
present error	0A0	13	PARACTUALERROR	2	Unsigned16	RO	dynamic	Auto, OOS
previous error	0A1	14	PARLASTERROR	2	Unsigned16	RO	non-vol.	Auto, OOS
clear last error	0A2	15	PARCLEARLASTERROR	1	Unsigned8	RW	dynamic	Auto, OOS
reset	0A3	16	PARRESET	2	Unsigned16	RW	dynamic	OOS
unlock parameter	0A4	17	PAROPERATIONCODE	2	Unsigned16	RW	non-vol.	OOS
protocol+sw-no.	0C2	18	PARPROTSOFTVERSIONSTRING	16	VisibleString	RO	const	Auto, OOS

---

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

11.7 Display Block

11.7.1 Operation

The display block contains the parameters required to parametrise the display module VU331 (which is contained in the remote display and operating unit FHX40). These parameters can also be addressed by using the VU331 display module. The display block is opened by clicking on the "display" line. Parameter changes from the tool are made off–line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. In order to resume operation, change MODE_BLK to AUTO [5].

11.7.2 Block administration parameters

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

11.7.3 Methods

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

The Levelflex M has got the following methods:
- Display

Most of these methods are identical to the respective function group in the operating menu. A detailed description of them can be found in the BA00245F/00/EN "Description of Instrument functions".

11.7.4 Device specific parameters

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
language	092	13	PARLANGUAGE	1	Unsigned8	RW	non-vol.	Auto, OOS
back to home	093	14	PARBACKTOHOME	2	Integer16	RW	non-vol.	Auto, OOS
format display	094	15	PARFORMATDISPLAY_FT	1	Unsigned8	RW	non-vol.	Auto, OOS
no.of decimals	095	16	PARNOOFDECIMALS	1	Unsigned8	RW	non-vol.	Auto, OOS
sep. character	096	17	PARSEPARATIONCHARACTER	1	Unsigned8	RW	non-vol.	Auto, OOS
unlock parameter	0A4	18	PAROPERATIONCODE	2	Unsigned16	RW	non-vol.	OOS

---

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

11.8   Analog input block

The analog input block conditons the signal output by the Sensor block and outputs signal to the PCL or other function blocks.
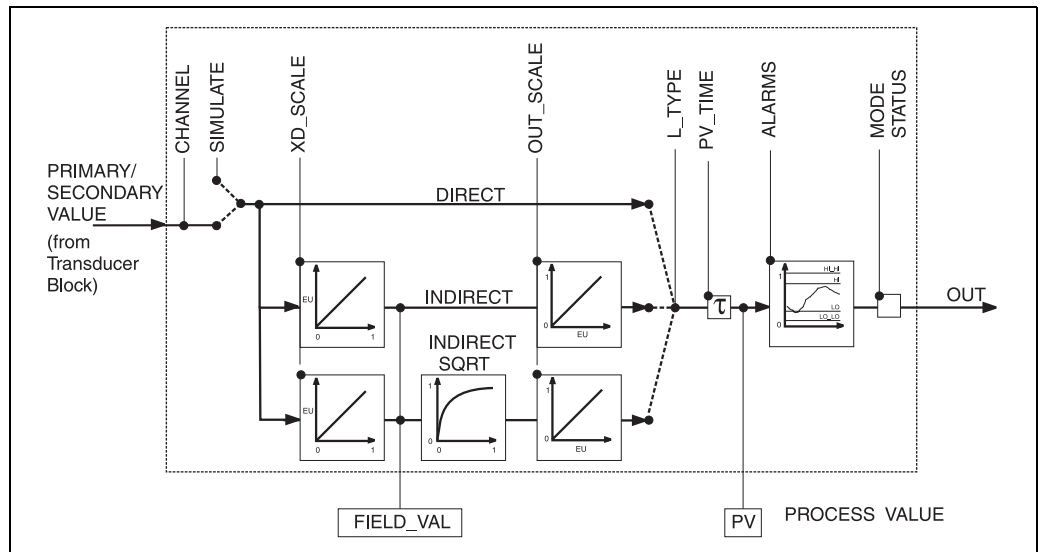
L00-FMR2xxxx-05-00-00-en-008

11.8.1   Operation

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

11.8.2   Block administration parameters

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

11.8.3   Output values

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

11.8.4   Scaling parameters

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

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

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

The L_TYPE parameter influences the signal conversion:
■ Direct:

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

■ Indirect:

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

■ Indirect square root:

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

11.8.5   Output response parameters

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

11.8.6   Alarm parameters

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

11.8.7   Alarm priorities

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

11.8.8   Alarm status

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

11.8.9   Simulation

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

A simulation is also possible by switching MODE_BLK to "MAN" and entering a value for OUT.

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

11.9   Checklist for commissioning

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

1. Configure the network and integrate the device.
    – Identify the device by means of the device ID and serial number.
    – If appropriate, assign a new PD_TAG.

2. Configure the resource block.
    – Check the position of the hardware switch in WRITE_LOCK
    – If "locked" is displayed, change the position of the DIP-switch.
    – If appropriate, change the block tag (right-hand click on tree).
    – Set MODE_BLK_TARGET to Out-of-Service.
    – Reset the device to factory values by using the function RESTART => Defaults
      (this function may also be available with a right-hand click on the device name)
    – If appropriate, assign a tag description (TAG_DESC).
    – Set MODE_BLK_TARGET to Auto.

3. Configure the Sensor block.
    – If appropriate, change the block tag (right-hand click on tree).
    – Set MODE_BLK_TARGET to Out-of-Service.
    – If appropriate, assign a tag description (TAG_DESC)
    – Configure the device as described in Chapter 6.4.
    – Set MODE_BLK_TARGET to Auto.

4. Configure the analog input block.
    – If appropriate, change the block tag (right-hand click on tree).
    – Set MODE_BLK_TARGET to Out-of-Service.
    – If appropriate, assign a tag description (TAG_DESC).
    – Set Channel to measured value or distance.
    – Set L_TYPE to "DIRECT" if the OUT value is to be in technical units e.g. ft to "INDIRECT"
      if the OUT value is to be scaled.
    – Set the desired output damping in PV_TIME.
    – If appropriate, set the advisory and critical alarms.
    – Set MODE_BLK_TARGET to Auto.

5. Link the function blocks in the function block editor.

6. Download the configuration (menu configure).

7. If appropriate, check the configuration by using the SIMULATE function.

11.10   List of start indices

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

Object	Start Index
Object Dictionary	298

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

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

11.11   Patents

This product may be 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 0 928 974

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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.
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Type of instrument / sensor   **Serial number**
Geräte-/Sensortyp _____   *Seriennummer* _____

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

Process data/ *Prozessdaten*   Temperature / *Temperatur* _____ [°F] _____ [°C]   Pressure / *Druck* _____ [psi] _____ [Pa]
                                     Conductivity / *Leitfähigkeit* _____ [μS/cm]   Viscosity / *Viskosität* _____ [cp] _____ [mm^2/s]

Medium and warnings
Warnhinweise zum Medium

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

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

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

Description of failure / *Fehlerbeschreibung* _____
_____
_____

Company data / *Angaben zum Absender*

Company / *Firma* _____   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 gefahrbringen- der Menge sind."

P/SF/Konta XV

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

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