



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

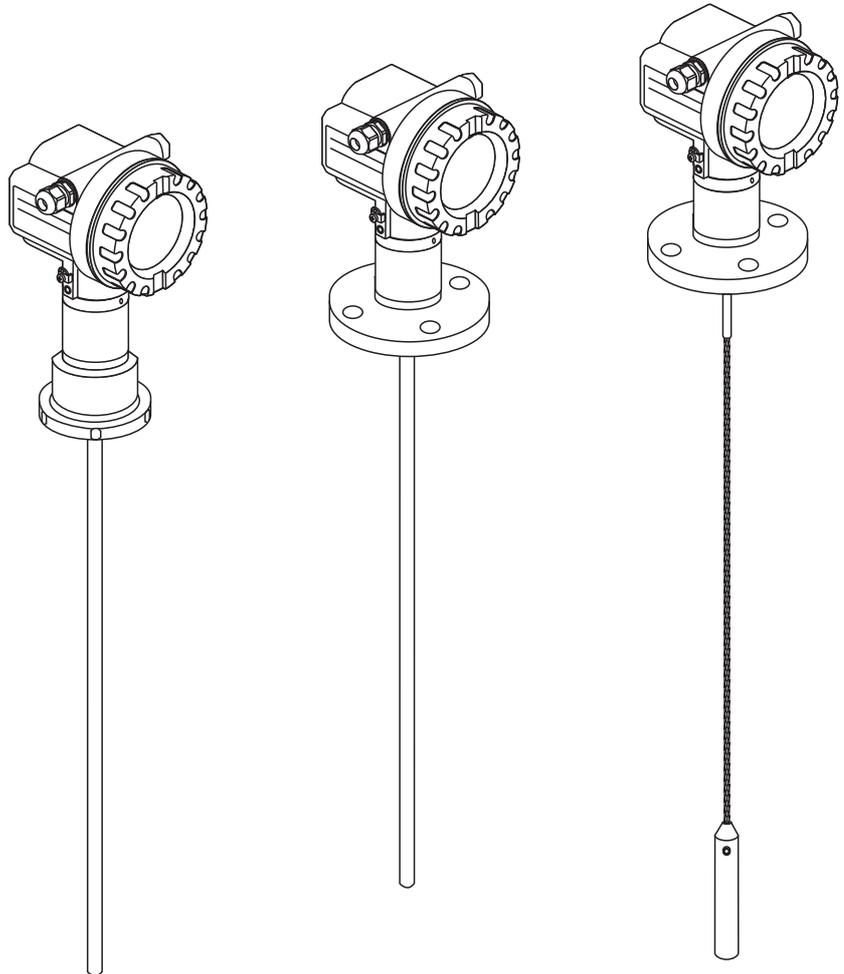


Solutions

Operating Instructions

Levelflex M FMP41C

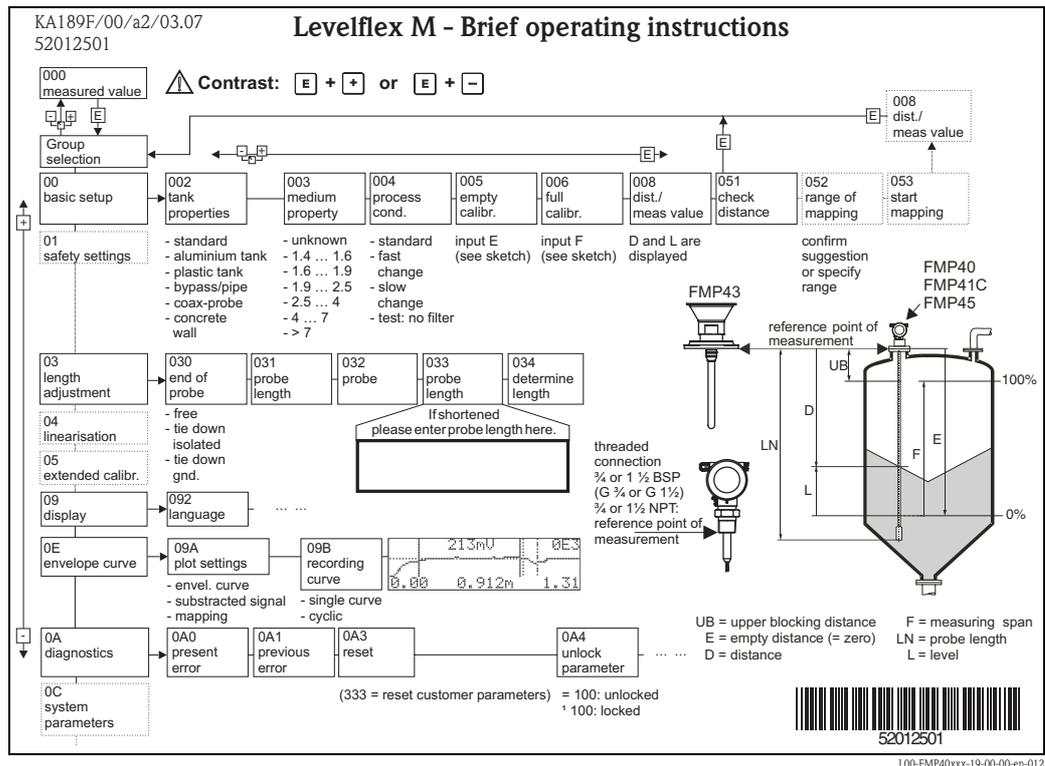
Guided Level-Radar



BA00277F/00/EN/13.10
71120288

Valid as of software version:
01.04.zz

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 converting measured values. These functions are not included in these Operating Instructions.

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

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

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1 Safety instructions

1.1 Designated use

The Levelflex M is a compact level transmitter for the continuous measurement of solids and liquids, measuring principle: 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 work on the device.

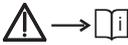
Hazardous areas

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

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

1.4 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	
	<p>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.</p>
	<p>Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the device.</p>
	<p>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.</p>
Explosion protection	
	<p>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.</p>
	<p>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.</p>
	<p>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.</p>
Electrical symbols	
	<p>Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied.</p>
	<p>Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.</p>
	<p>Grounded terminal A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.</p>
	<p>Protective grounding (earth) terminal A terminal which must be connected to earth ground prior to making any other connection to the equipment.</p>
	<p>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.</p>
	<p>Temperature resistance of the connection cables States, that the connection cables must be resistant to a temperature of at least 85 °C.</p>
	<p>Safety instruction For safety instructions refer to the manual for the appropriate device version.</p>

20	Probe:		
	A mm, rope PFA>316, 150mm, Center rod, nozzle height max 150mm	
	B mm, rope PFA>316, 300mm, Center rod, nozzle height max 300mm	
	C mm, rope PFA>316, 450mm, Center rod, nozzle height max 450mm	
	D inch, rope PFA>316, 6inch, Center rod, nozzle height max 6inch	
	E inch, rope PFA>316, 12inch, Center rod, nozzle height max 12inch	
	G inch, rope PFA>316, 18inch, Center rod, nozzle height max 18inch	
	K mm, rod PFA>316L	
	M inch, rod PFA>316L	
	Y	Special version, TSP-No. to be spec.	
30	Process connection:		
	AEK	1-1/2" 150lbs, PTFE >316/316L flange ANSI B16.5	
	AFK	2" 150lbs, PTFE >316/316L flange ANSI B16.5	
	AGK	3" 150lbs, PTFE >316/316L flange ANSI B16.5	
	AHK	4" 150lbs, PTFE >316/316L flange ANSI B16.5	
	AJK	6" 150lbs, PTFE >316/316L flange ANSI B16.5	
	AQK	1-1/2" 300lbs, PTFE >316/316L flange ANSI B16.5	
	ARK	2" 300lbs, PTFE >316/316L flange ANSI B16.5	
	ASK	3" 300lbs, PTFE >316/316L flange ANSI B16.5	
	ATK	4" 300lbs, PTFE >316/316L flange ANSI B16.5	
	CEK	DN40 PN16-40, PTFE >316L flange EN1092-1 (DIN2527 C)	
	CFK	DN50 PN10-40, PTFE >316L flange EN1092-1 (DIN2527 C)	
	CGK	DN80 PN10/16, PTFE >316L flange EN1092-1 (DIN2527 C)	
	CHK	DN100 PN10/16, PTFE >316L flange EN1092-1 (DIN2527 C)	
	CJK	DN150 PN10/16, PTFE >316L flange EN1092-1 (DIN2527 C)	
	CSK	DN80 PN25/40, PTFE >316L flange EN1092-1 (DIN2527 C)	
	CTK	DN100 PN25/40, PTFE >316L flange EN1092-1 (DIN2527 C)	
	KEK	10K 40A, PTFE >316L flange JIS B2220	
	KFK	10K 50A, PTFE >316L flange JIS B2220	
	KGK	10K 80A, PTFE >316L flange JIS B2220	
	KHK	10K 100A, PTFE >316L flange JIS B2220	
	MRK	DIN11851 DN50 PN40 slotted-nut, PTFE >316L	
	TCK	Tri-Clamp ISO2852 1-1/2", PTFE >316L	
	TDK	Tri-Clamp ISO2852 2", PTFE >316L	
	TFK	Tri-Clamp ISO2852 3", PTFE >316L	
	TJK	Tri-Clamp ISO2852 1-1/2", PTFE >316L, 3A EHEDG	
	TLK	Tri-Clamp ISO2852 2", PTFE >316L, 3A EHEDG	
	TNK	Tri-Clamp ISO2852 3", PTFE >316L, 3A EHEDG	
	YY9	Special version, TSP-No. to be spec.	
40	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.	
50	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.	
60	Type of probe:		
	1	Compact, basic version	
	3	Remote, cable 3m, top entry	
	4	Remote, cable 3m, side entry	
	9	Special version, TSP-No. to be spec.	

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", → 10!

The scope of delivery consists of:

- Assembled device
- Accessories (→ 72)
- Endress+Hauser operating program on the enclosed CD-ROM
- Brief operating instructions KA00189F/00/A2 (basic setup/troubleshooting), housed in the device
- Brief operating instructions KA01042F/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

PROFIBUS[®]

Registered trademark of the PROFIBUS Trade Organisation, Karlsruhe, Germany

3 Installation

3.1 Incoming acceptance, transport, storage

3.1.1 Incoming acceptance

Check the packing and contents for any signs of damage.

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

3.1.2 Transport



Caution!

Follow the safety instructions and transport conditions for devices of more than 18 kg.

Do not lift the measuring device by its probe rod in order to transport it.

3.1.3 Storage

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

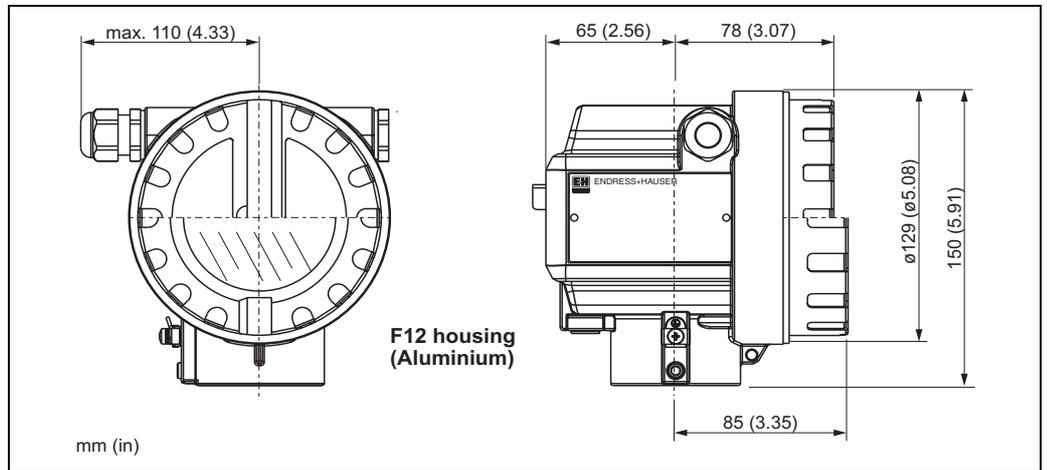
The original packing material provides the optimum protection for this.

The permissible storage temperature is -40 °C to +80 °C.

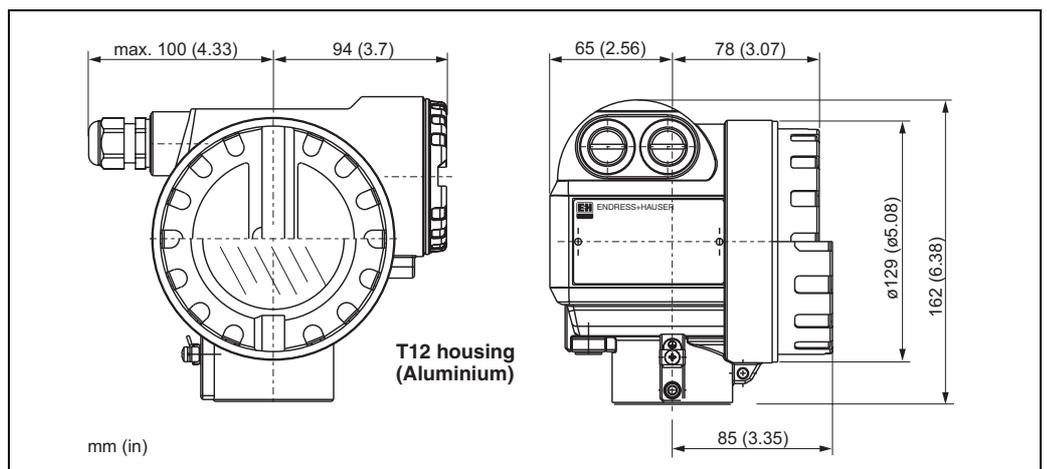
3.2 Installation conditions

3.2.1 Dimensions

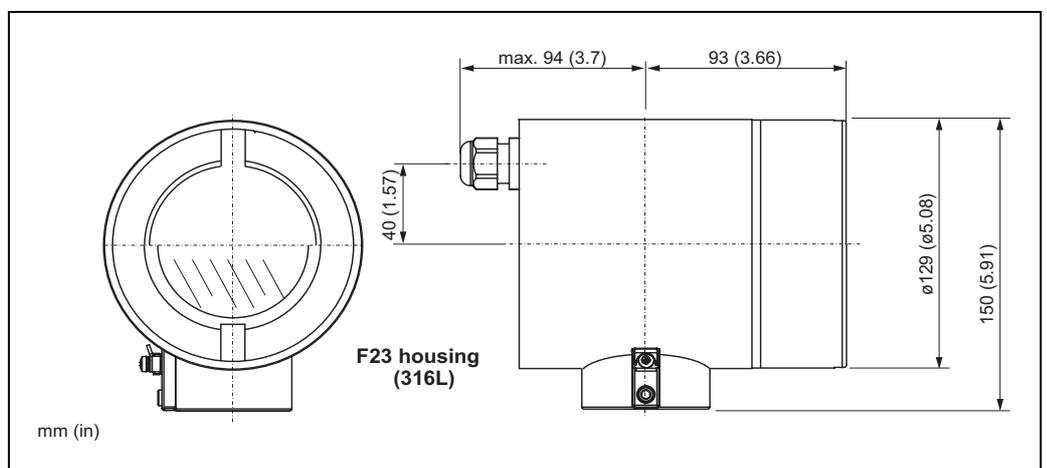
Housing dimensions



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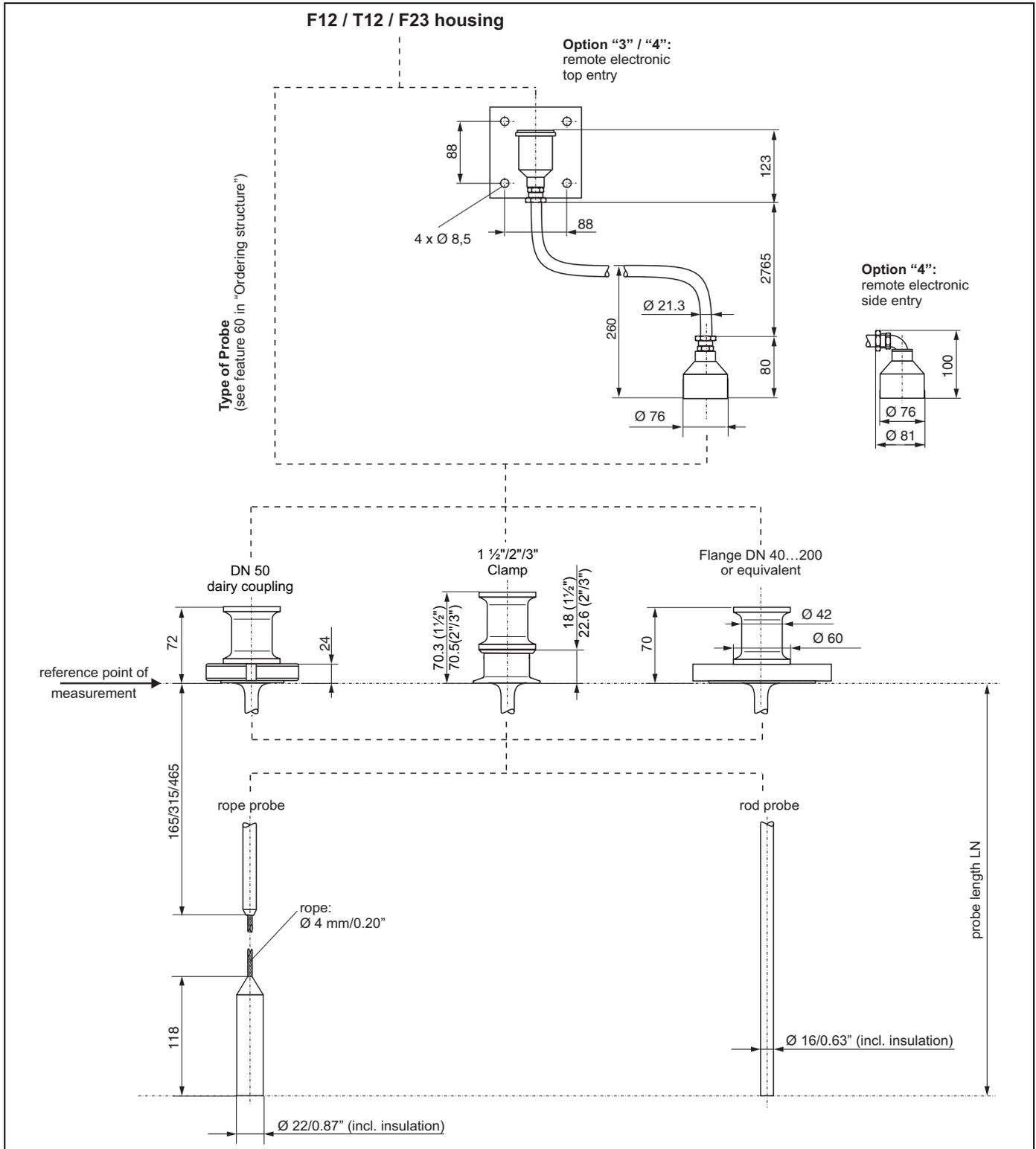


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L00-F23xxxx-06-00-00-en-001

Process connection, probe type



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3.3 Installation

3.3.1 Mounting kit

For the mounting, you will require the following tool:

- The tool for flange mounting
- 4 mm (0.1") Allen wrench for turning the housing

3.3.2 Mounting probes



Caution!

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

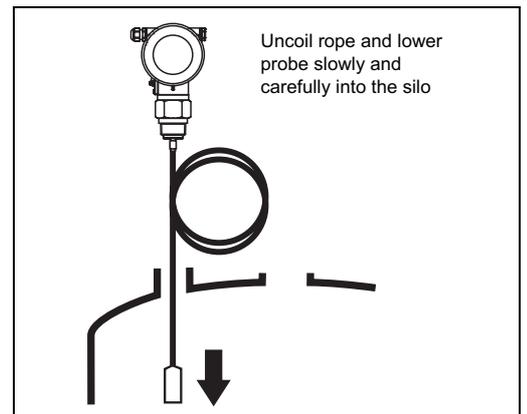
Insert probe

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



Note!

Be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.



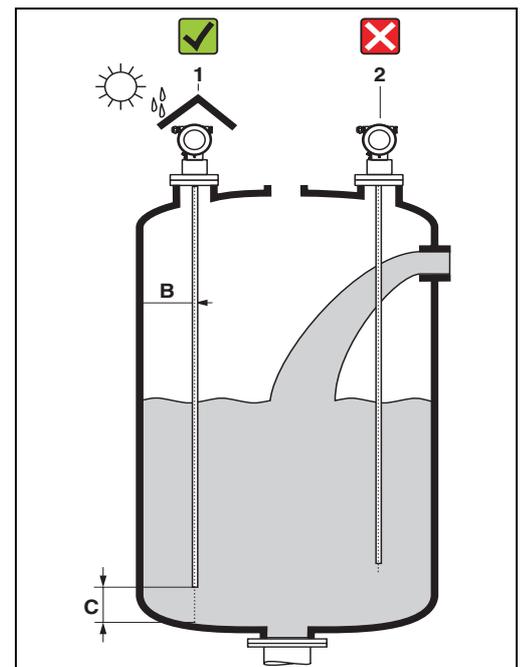
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3.3.3 General instructions

Normally use rod or coax probes for liquids. 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.

Mounting location

- Do not mount rod or rope probes in the filling curtain (3).
- 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: 50 mm
- When installing outdoors, it is recommended that you use a protective cover (1) ("Accessories", → 72).



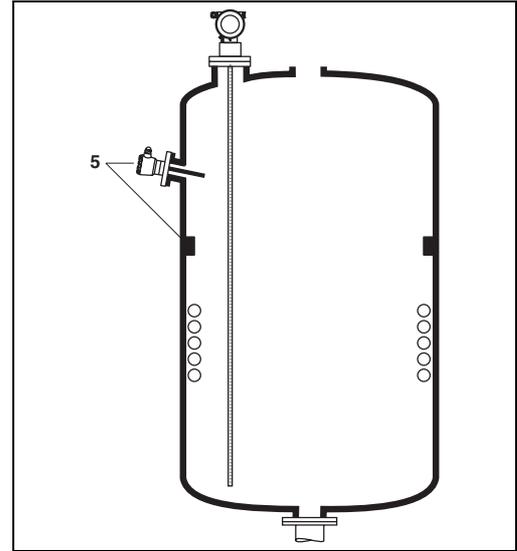
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Other installations

- 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.



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Minimum distance B of the probe 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 be no metallic parts or persons moving when installation is made in plastic tanks, also on the outside of the tank at a distance of 300 mm to the probe.
- There should no bridges to the wall created by build up or highly viscous media.

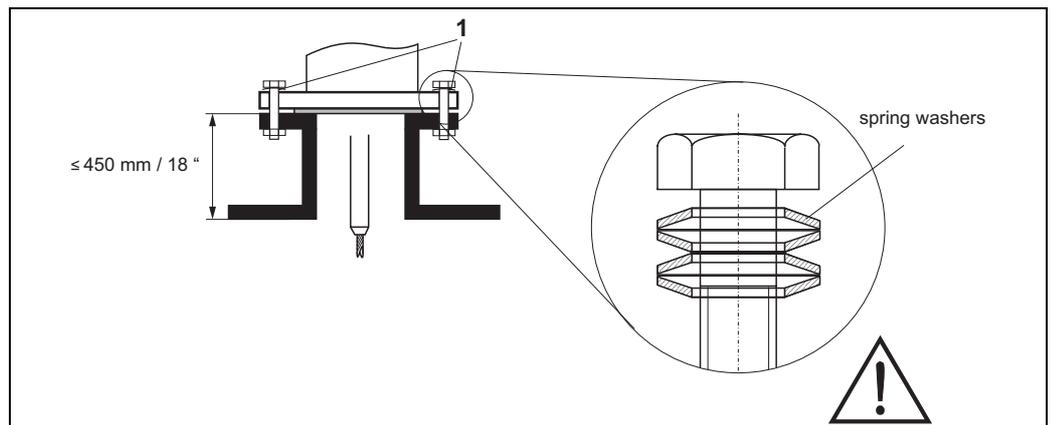
Type of probe mounting

- When installing in plastic tanks, the nozzle must have at least DN50 (2"). The appropriate flange must be used as the process connection.
- For nozzles up to 450 mm high, select the length of the centering rod appropriate for the nozzle height when using rope probes.
- Use spring washers (1) (see Figure below).

 **Note!**

It is recommended to retighten the flange bolts periodically, depending on process temperature and pressure. Recommended torque: 60 to 100 Nm.

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



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Note!

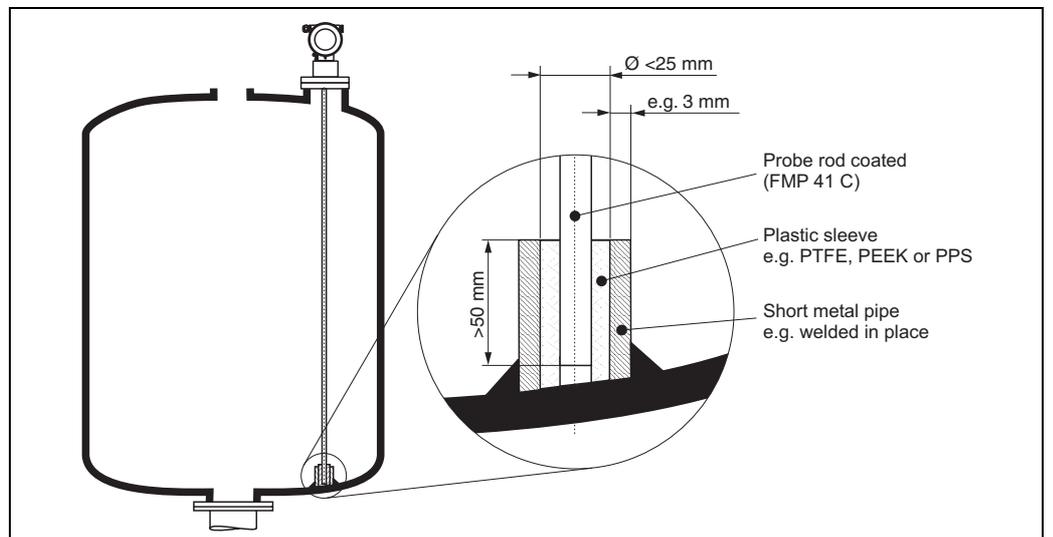
The PTFE plating of the FMP41C is used for sealing to the process. Usually no other sealing is necessary.

The coupling nut must be tightened using a torque of 5 up to a maximum of 10 Nm when installing the FMP41C in the universal adapter ("Welding boss for adapter 43 mm", →  72).

Supporting probes against warping

For WHG approval:

For probe lengths $\geq 3 \text{ m}$ a support is required (see figure).



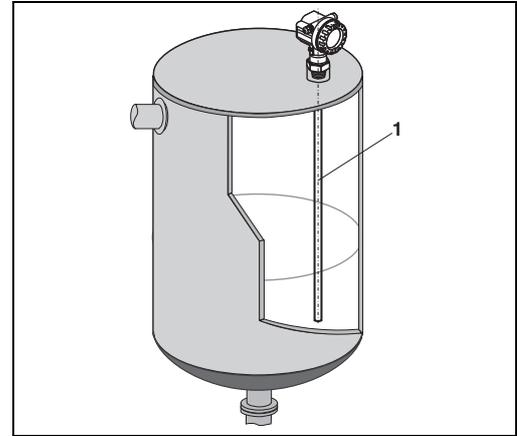
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3.3.4 Special instructions

When installing in stirring tanks, observe lateral load of probes. Possibly check whether a non-contact process, ultrasound or 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

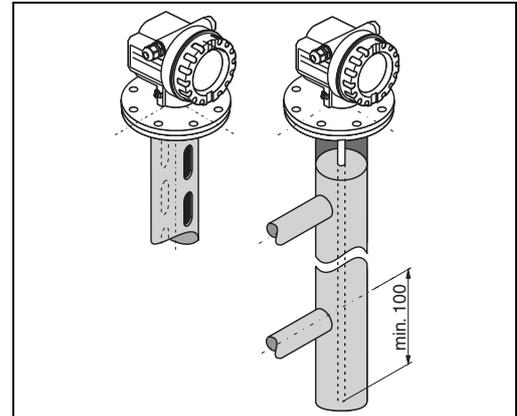
- Use a rod probe for measuring ranges up to 4 m. For anything over this or if there is too free cover space use a rope probe.
- Any distance from wall, as long as occasional contact is prevented.



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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 DC 1.4 can be measured.
- If a rod probe is used the probe length must be 100 mm longer than the lower disposal.
- Welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence measurement.

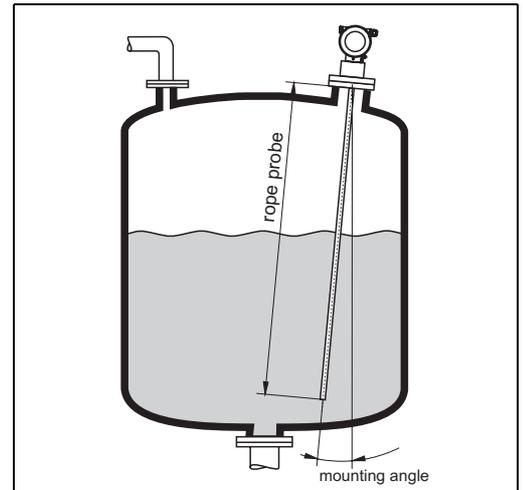


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3.3.5 Notes on special installation situations

Installation at an angle

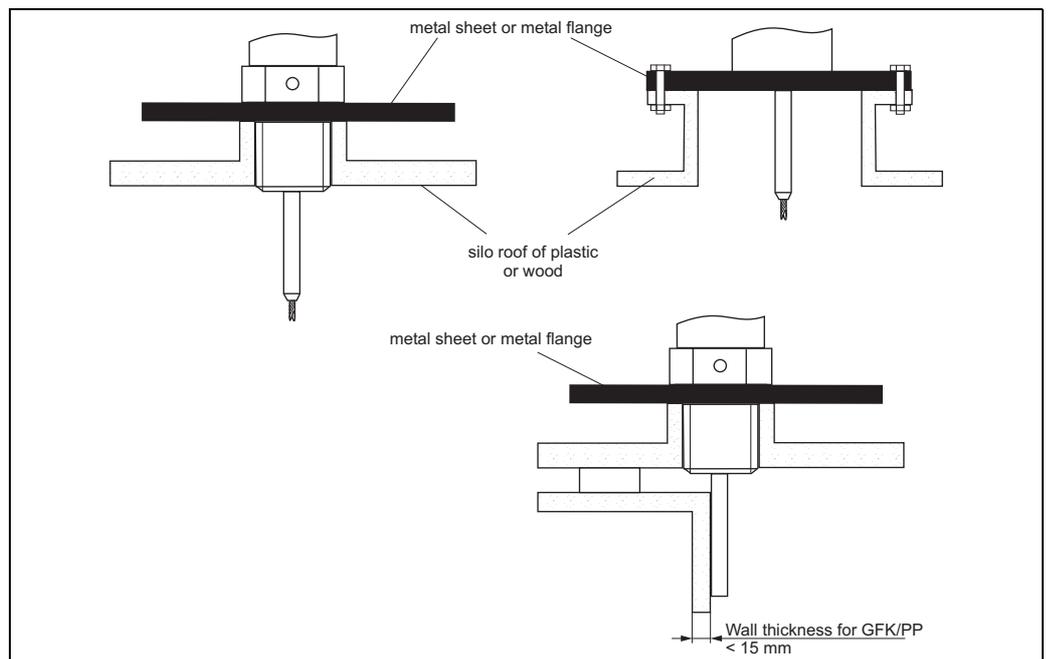
- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
 - up to 1 m = 30°
 - up to 2 m = 10°
 - up to 4 m = 5°.



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Installation in plastic containers

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

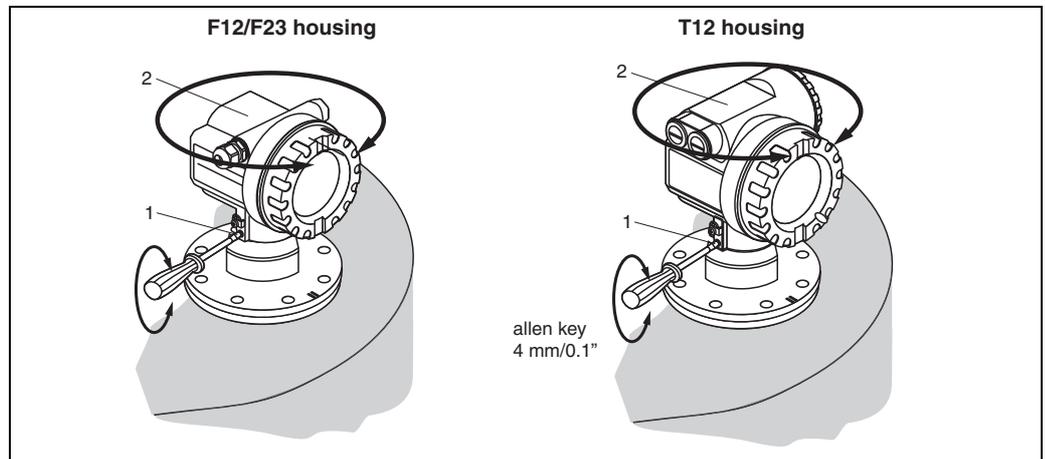


L00-FMP41xxx-17-00-00-en-018

3.3.7 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-FMP41 Ccx-17-00-00-de-002

3.4 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 (→ 72)?

4 Wiring

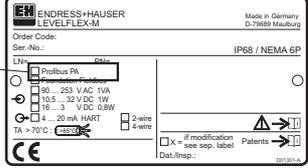
Notes on PROFIBUS PA installation can be found in Operating manual BA034S/04/EN.

4.1 Quick wiring guide

Wiring in F12/F23 housing

Caution!

- Before connection please note the following:
- PROFIBUS devices are marked on the nameplate (1). The voltage is determined by the PROFIBUS standard and the desired safety concept. (see chapter 4.3).
- Connect potential matching line to transmitter ground terminal (7) before connecting up the device.
- Tighten the locking screw (8): It forms the connection between the antenna and the housing earth potential.



1

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.

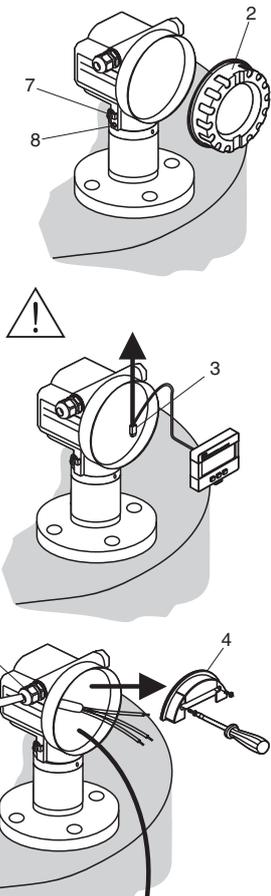
Connect up the Levelflex M as follows:

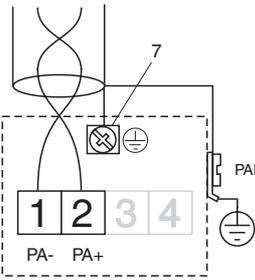
- Unscrew housing cover (2).
- Remove any display (3) if fitted.
- Remove cover plate from terminal compartment (4).
- Pull out terminal module slightly using pulling loop.
- Insert cable (5) through gland (6).
- Use screened, twisted wire pair.

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).

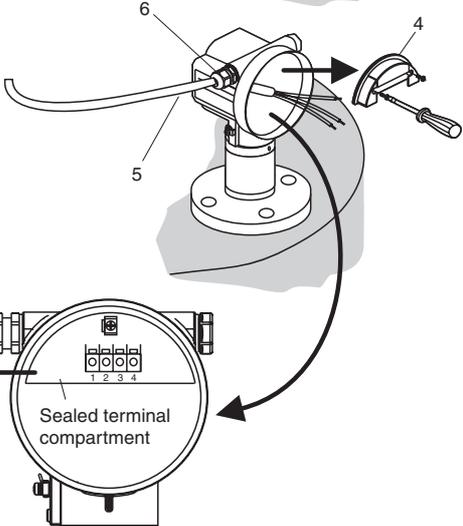




7

PA- PA+

PAL



6

5

4

Sealed terminal compartment

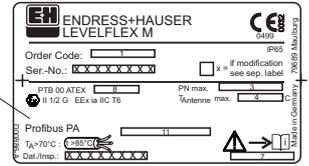
L00-FMP41 Ccx-04-00-00-ens-003

Wiring in T12 housing



Before connection please note the following:

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

Connect up the Levelflex M as follows:



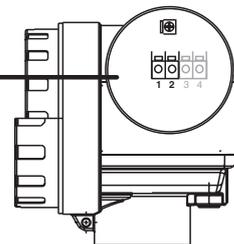
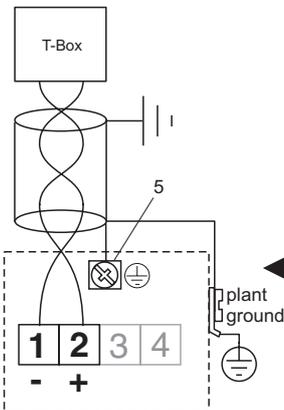
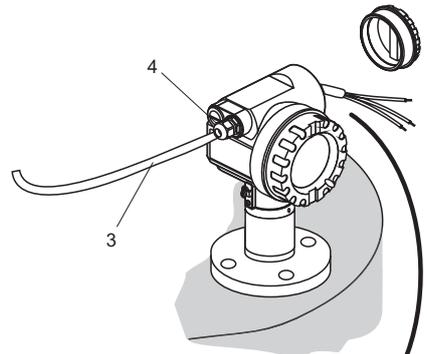
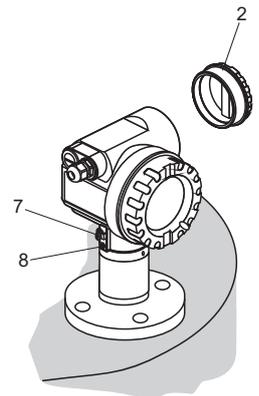
Before unscrew housing cover (2) at separate connection room turn off the power supply!

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



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

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



Wiring with M12 connector

Caution!

Before connection please note the following:

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

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

EX

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

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

The Levelflex M is connected as follows:

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

L00-FMP40zxx-04-00-00-es-007

Cable specification PROFIBUS

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

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

The following cable types can be used, for example

Non-Ex-area:

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

Ex-area:

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

Connectors

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

PIN assignment for M12 connector

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

A0011175

4.2 Connecting the measuring unit

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 mm²

Cable entry

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

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

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).

Connection with M12 plug

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

4.3 Recommended connection

For maximum EMC protection please observe the following points:

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



Caution!

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

4.4 Degree of protection

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



Caution!

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

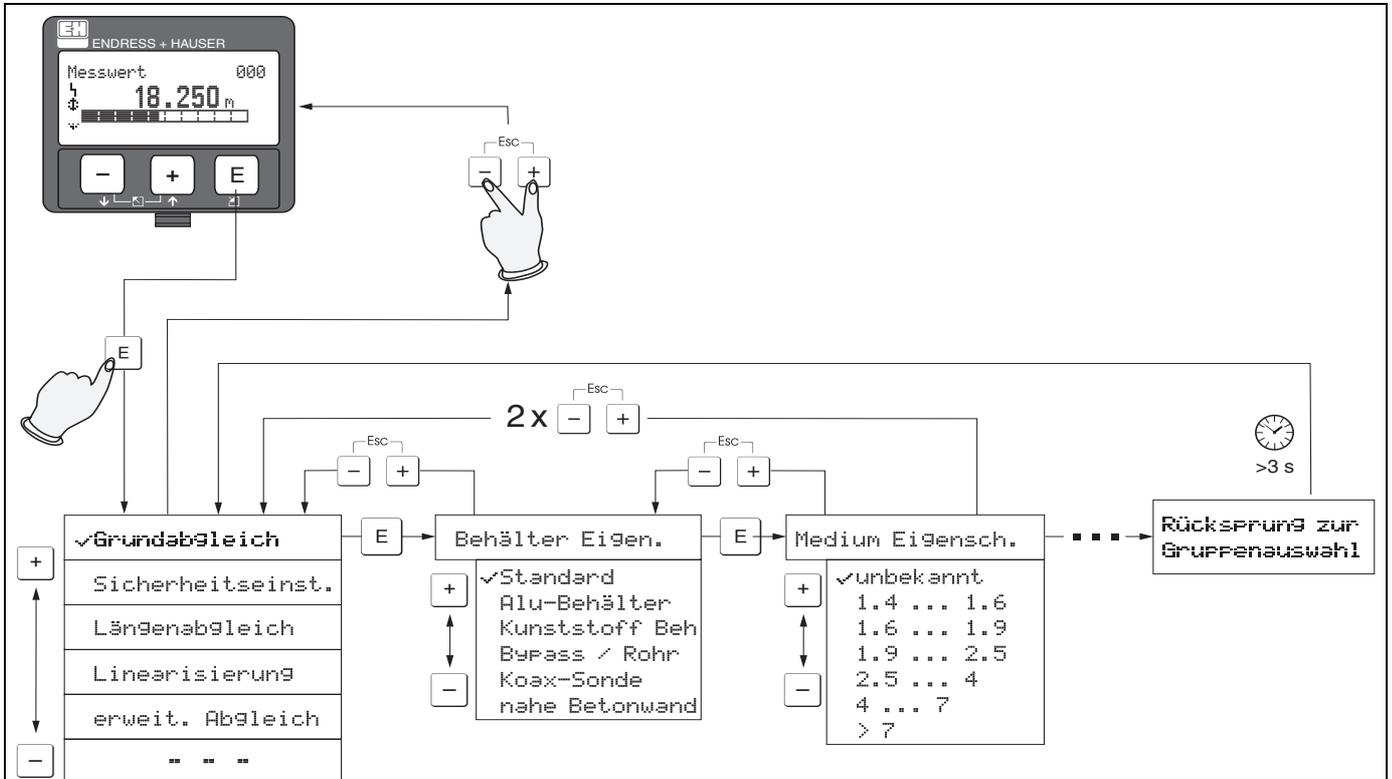
4.5 Post-connection check

After wiring the measuring device, perform the following checks:

- Is the terminal allocation correct (→  20, 21)?
- 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

5.1 Quick operation guide



Auswahl und Konfiguration im Bedienmenü:

- 1.) Aus der Messwertdarstellung mit **E** in die **Gruppenauswahl** wechseln
- 2.) Mit **-** oder **+** die gewünschte **Funktionsgruppe** (z.B. "Grundabgleich (00)") auswählen und mit **E** bestätigen → erste **Funktion** (z.B. "Behälter Eigen. (002)") wird angewählt.

Hinweis!

Die aktive Wahl ist durch ein ✓ vor dem Menütext gekennzeichnet!

- 3.) mit **+** oder **-** wird der Editiermodus aktiviert.

Auswahlmenüs:

- a) in der ausgewählten **Funktion** (z.B. "Behälter Eigen. (002)") kann mit **-** oder **+** der gewünschte **Parameter** gewählt werden.
- b) **E** bestätigt die Wahl → ✓ erscheint vor dem gewählten Parameter
- c) **E** bestätigt den editierten Wert → Editiermodus wird verlassen
- d) **+** + **-** (= **Esc**) bricht die Auswahl ab → Editiermodus wird verlassen

Zahlen- / Texteingabe:

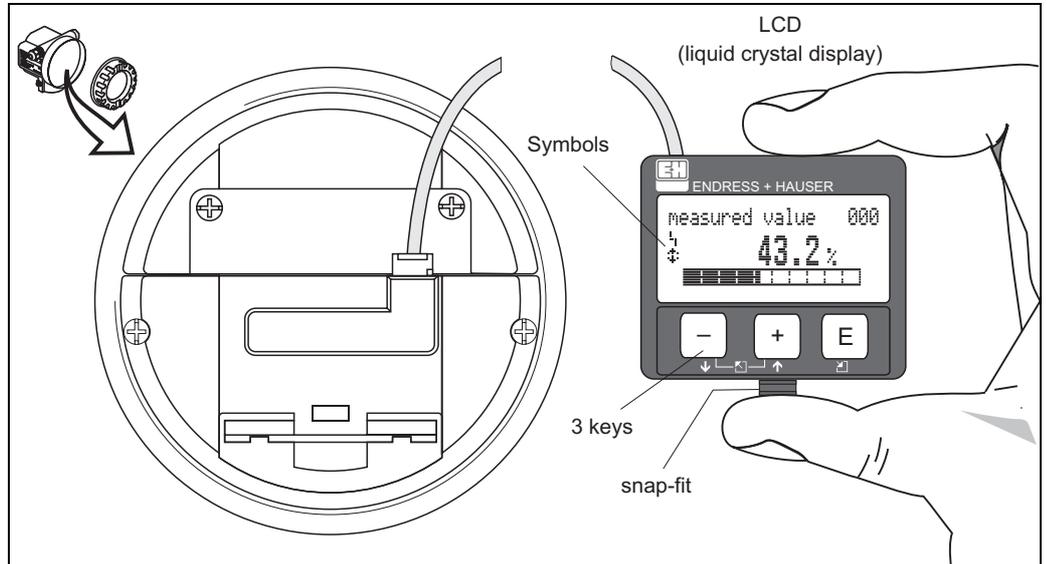
- a) durch **+** oder **-** kann die erste Stelle der **Zahl / Text** (z.B. "Abgleich leer (005)") editiert werden
- b) **E** setzt die Eingabemarke an die nächste Stelle → weiter mit (a) bis der Wert komplett eingegeben ist
- c) wenn ein **←** Symbol an der Eingabemarke erscheint wird mit **E** der eingegebene Wert übernommen → Editiermodus wird verlassen
- d) **+** + **-** (= **Esc**) bricht die Eingabe ab, Editiermodus wird verlassen

- 4) mit **E** wird die nächste **Funktion** (z.B. "Medium Eigensch. (003)") angewählt
- 5) 1 x Eingabe von **+** + **-** (= **Esc**) → zurück zur letzten **Funktion** (z.B. "Behälter Eigen. (002)")
2 x Eingabe von **+** + **-** (= **Esc**) → zurück zur **Gruppenauswahl**
- 6) mit **+** + **-** (= **Esc**) zurück zur **Messwertdarstellung**

5.2 Display and operating elements

5.2.1 Liquid crystal display (LCD)

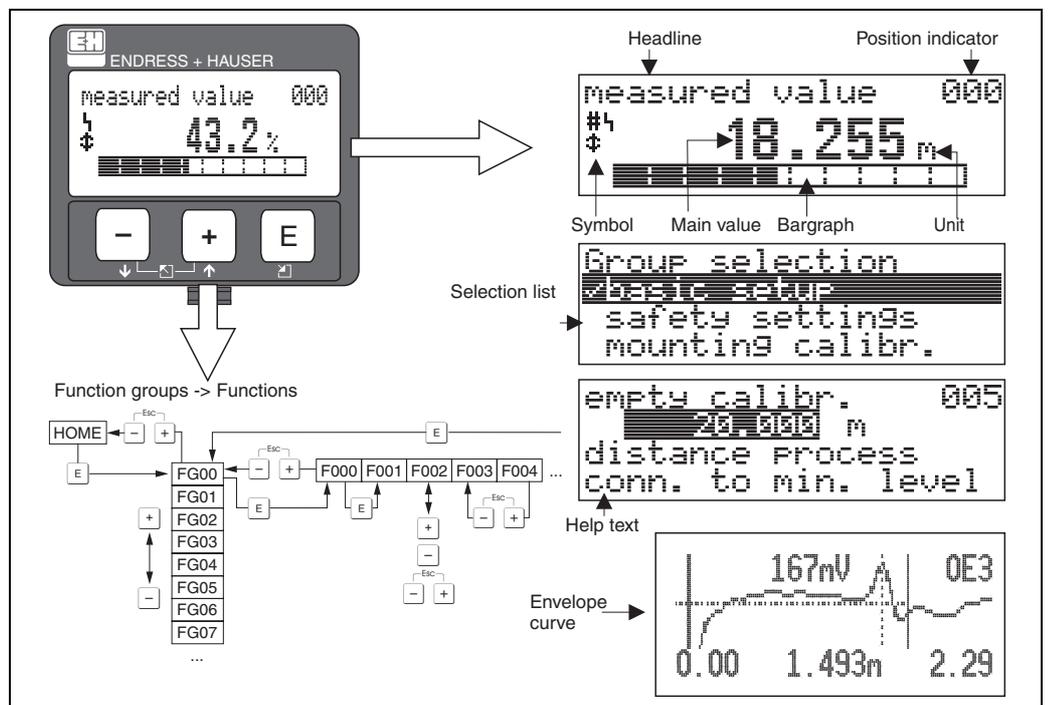
Four lines with 20 characters each. Display contrast adjustable through key combination.



L00-FMxxxxx-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-FMRxxxx-07-00-00-en-007

5.2.3 Display symbols

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

Symbol	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.

5.2.4 Key assignment

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

Function of the keys

Key(s)	Meaning
 or 	Navigate upwards in the selection list. Edit numeric value within a function.
 or 	Navigate downwards in the selection list. Edit numeric value within a function.
 or 	Navigate to the left within a function group.
	Navigate to the right within a function group, confirmation.
 and  or  and 	Contrast settings of the LCD.
 and  and 	Hardware lock / unlock After a hardware lock, an operation of the 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.

5.3 Local operation

5.3.1 Locking of the configuration mode

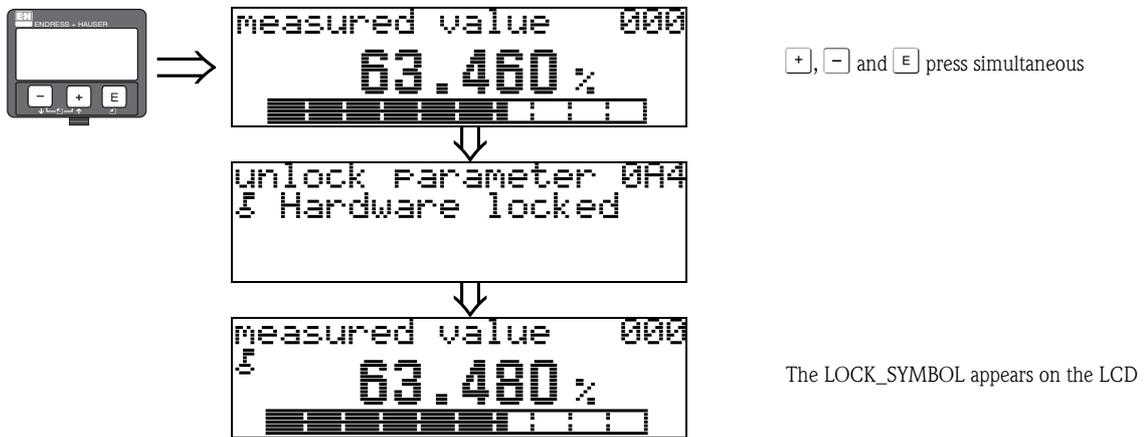
The Levelflex can be protected in two ways against unauthorised changing of device data, numerical values or factory settings:

Function "unlock parameter" (0A4):

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

Hardware lock:

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



5.3.2 Unlocking of configuration mode

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

Function "unlock parameter" (0A4):

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

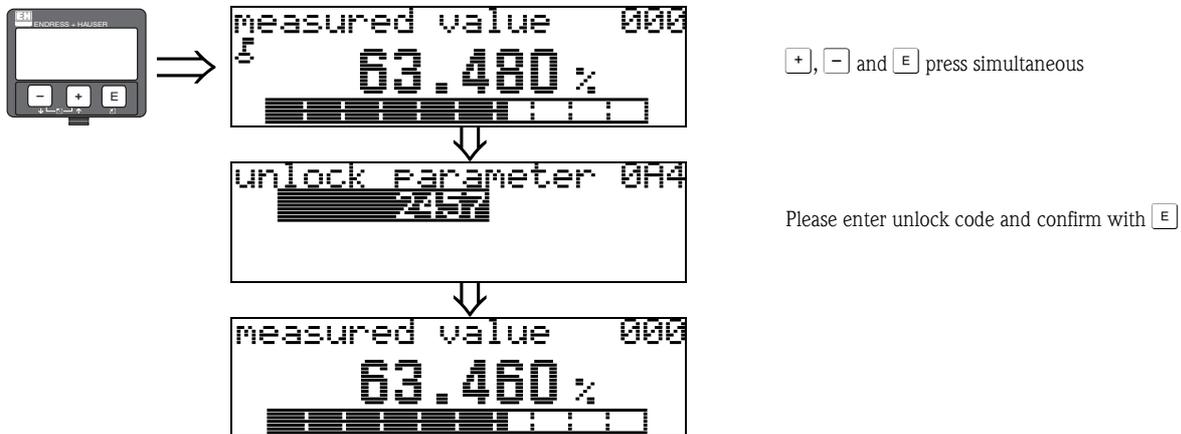
2457 = for PROFIBUS PA devices

the Levelflex is released for operation.

Hardware unlock:

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

2457 = for PROFIBUS PA devices



Caution!

Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.

5.3.3 Factory settings (Reset)

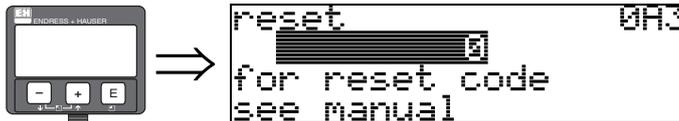


Caution!

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

A reset is only necessary if the device...

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



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

- 33 333 = customer parameters (PROFIBUS PA)

333 = reset customer parameters

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

- The Levelflex is reset to the default values.
- **The customer specific tank map is not deleted.**
- The mapping can also be deleted in the "cust. tank map" (055) function of the "extended calibr" (05) function group.
- A linearisation is switched to "linear" although the table values are retained. The table can be reactivated in the "linearisation" (04) function group.

List of functions that are affected by a reset:

- | | |
|------------------------------|---------------------------|
| ■ tank properties (002) | ■ max. scale (046) |
| ■ medium cond. (003) | ■ diameter vessel (047) |
| ■ process proper. (004) | ■ check distance (051) |
| ■ empty calibr. (005) | ■ range of mapping (052) |
| ■ full calibr. (006) | ■ start mapping (053) |
| ■ output on alarm (010) | ■ offset (057) |
| ■ outp. echo loss (012) | ■ output damping (058) |
| ■ ramp %span/min (013) | ■ language (092) |
| ■ delay time (014) | ■ back to home (093) |
| ■ safety distance. (015) | ■ format display (094) |
| ■ in safety dist. (016) | ■ no of decimals (095) |
| ■ overspill protection (018) | ■ sep. character (096) |
| ■ end of probe (030) | ■ unlock parameter (0A4) |
| ■ level/ullage (040) | ■ application par.. (0A8) |
| ■ linearisation (041) | ■ tag no.(0C0) |
| ■ customer unit (042) | |

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

5.4 Display and acknowledging error messages

Type of error

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

The measuring system distinguishes between two types of error:

- **A (Alarm):**
Device goes into a defined state (e.g. max 22 mA)
Indicated by a constant  symbol.
(For a description of the codes, →  76)
- **W (Warning):**
Device continue measuring, error message is displayed.
Indicated by a flashing  symbol.
(For a description of the codes, →  76)
- **E (Alarm / Warning):**
Configurable (e.g. loss of echo, level within the safety distance)
Indicated by a constant/flashing  symbol.
(For a description of the codes, →  76)



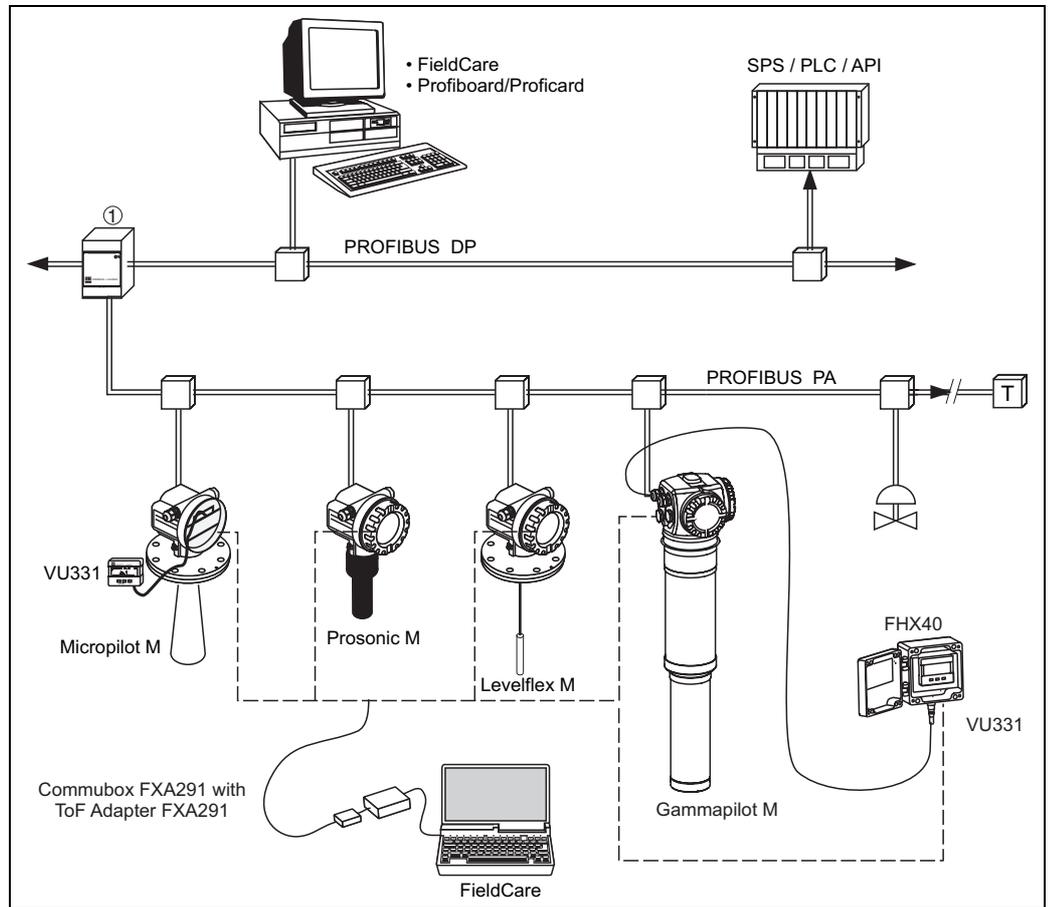
Error messages

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

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

5.5 PROFIBUS PA communication

5.5.1 Synopsis



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

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

5.5.2 Device address

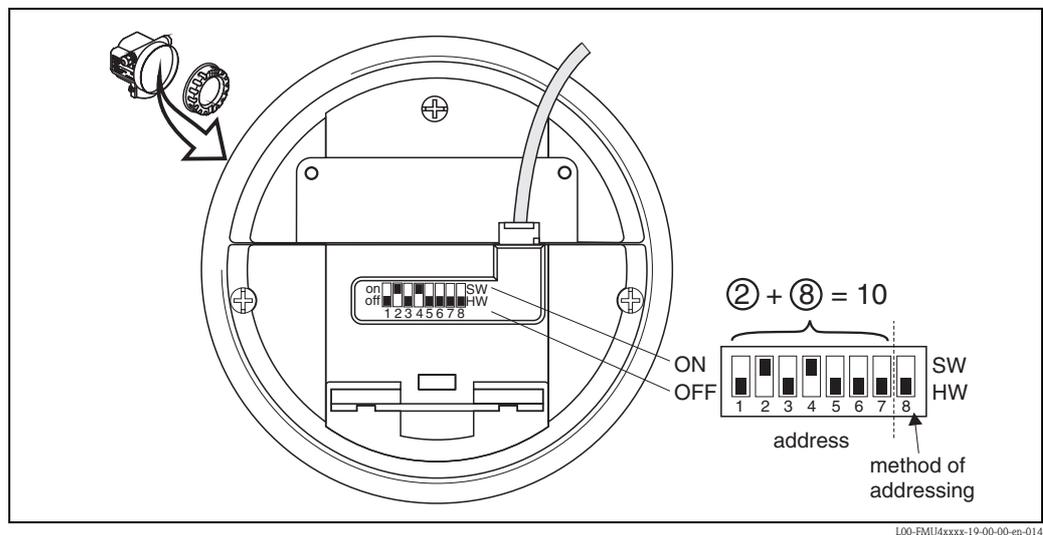
Selecting the device address

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

Software addressing

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

Hardware addressing



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

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

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

5.5.3 Device database and type files (GSD)

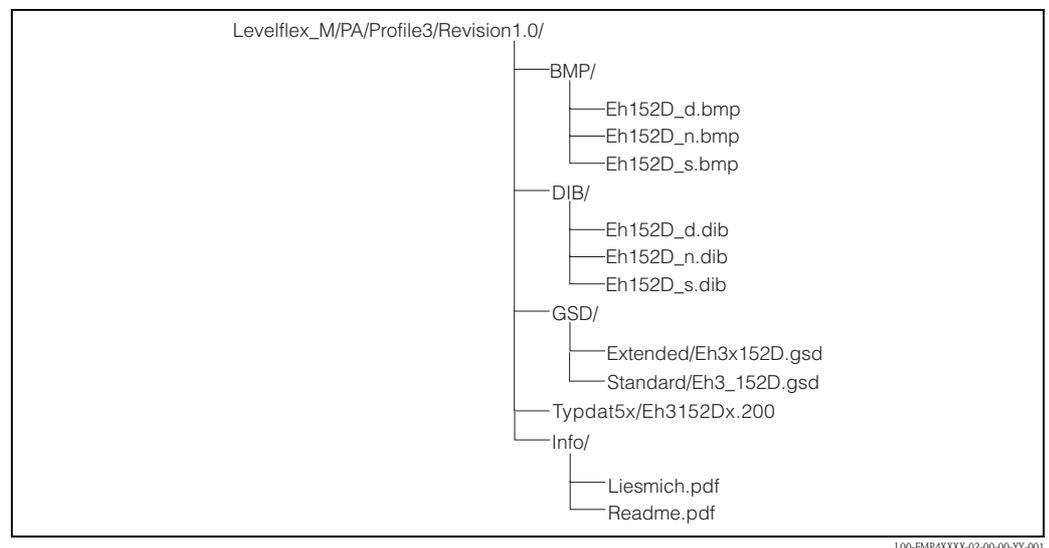
A device database file (GSD) contains a description of the properties of the PROFIBUS-PA device, e.g. the supported transmission rates and the type and format of the digital information output to the PLC. Additional bitmap files are required in order to represent the device by an icon in the network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

Source of supply

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

Directory structure

The files are organized in the following structure:



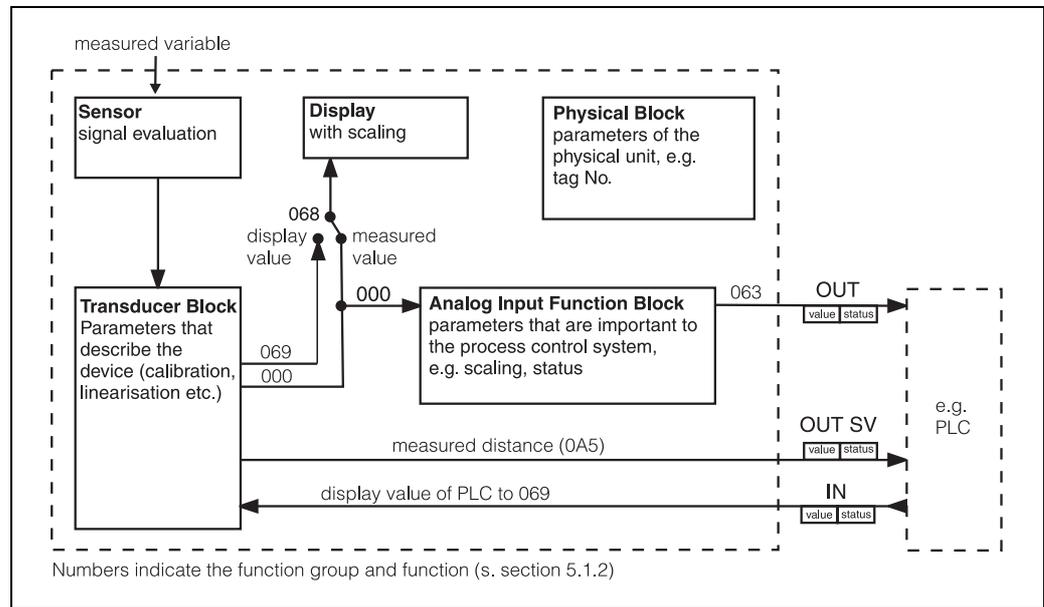
- The GSD files in the directory "Extended" are needed for the network design software STEP 7 of the S7-300/400 PLC family.
- The GSD files in the directory "Standard" are used for PLCs, which do not support an identifier format but only an identifier byte (e.g. PLC5 of Allen-Bradley)
- For the network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

Universal Database File

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

5.5.4 Cyclic data exchange

Block model of the Levellflex M



L00-FMR230xx-02-00-00-es-001

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

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

Modules for the cyclic data telegram

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

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

Configuration of the cyclic data telegram

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

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

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

Structure of the input data (Levelflex M → PLC)

The input data are transmitted according to the following structure:

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

Structure of the output data (PLC → Levelflex M)

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

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

IEEE-745 Floating Point Number

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

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

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

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

Example:

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

Status codes

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

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

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

5.5.5 Acyclic data exchange

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

Acyclic data exchange is used

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

There are two types of acyclic data exchange:

Acyclic communication with a Class 2 master (MS2AC)

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

- FieldCare
- PDM

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

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



Note!

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

Acyclic communication with a Class 1 master (MS1AC)

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



Note!

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



Caution!

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

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

The Levelflex M supports MS2AC communication with two SAP's.

The Levelflex M does not support MS1AC communication.

5.5.6 Slot/index tables

Device Management

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

Analog-Input-Block

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

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

Physical Block

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		0	16	20	DS-32*	X		constant
Static revision		0	17	2	UNSIGNED16	X		non-vol.
Device tag		0	18	32	OSTRING	X	X	static
Strategy		0	19	2	UNSIGNED16	X	X	static
Alert key		0	20	1	UNSIGNED8	X	X	static
Target mode		0	21	1	UNSIGNED8	X	X	static
Mode		0	22	3	DS-37*	X		dynamic non-vol. constant
Alarm summary		0	23	8	DS-42*	X		dynamic
Block parameters								
Software revision		0	24	16	OSTRING	X		constant
Hardware revision		0	25	16	OSTRING	X		constant
Device manufacturer ID		0	26	2	UNSIGNED16	X		constant
Device ID		0	27	16	OSTRING	X		constant
Device serial number		0	28	16	OSTRING	X		constant
Diagnosis		0	29	4	OSTRING	X		dynamic
Diagnosis extension		0	30	6	OSTRING	X		dynamic
Diagnosis mask		0	31	4	OSTRING	X		constant
Diagnosis mask ext.		0	32	6	OSTRING	X		constant
Device certification		0	33	32	OSTRING	X	X	constant
Security locking	V9H9	0	34	2	UNSIGNED16	X	X	non-vol.
Factory reset	V9H5	0	35	2	UNSIGNED16		X	non-vol.
Descriptor		0	36	32	OSTRING	X	X	static
Device message		0	37	32	OSTRING	X	X	static
Device instal. date		0	38	8	OSTRING	X	X	static
Gap reserved		0	39					
Ident number select	V6H0	0	40	1	UNSIGNED8	X	X	static
HW write protection		0	41	1	UNSIGNED8	X	X	dynamic
Gap reserved		0	42-53					

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

Endress+Hauser specific level transducer block

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameter								
Block data		1	130	20	DS-32*	x		constant
Static revision		1	131	2	UNSIGNED16	x		non-vol.
Device tag		1	132	32	OSTRING	x	x	static
Strategy		1	133	2	UNSIGNED16	x	x	static
Alert key		1	134	1	UNSIGNED8	x	x	static
Target mode		1	135	1	UNSIGNED8	x	x	static
Mode		1	136	3	DS-37*	x		dynamic/ non-vol./ static
Alarm summary		1	137	8	DS-42*	x		dynamic
Endress+Hauser parameters								
Measured value	V0H0	1	138	4	FLOAT	x		dynamic
Gap			139					
Tank properties	V0H2	1	140	1	UNSIGNED8	x	x	static
Application parameter	V0H3	1	141	1	UNSIGNED8	x	x	static
Process properties	V0H4	1	142	1	UNSIGNED8	x	x	static
Empty calibration	V0H5	1	143	4	FLOAT	x	x	static
Full calibration	V0H6	1	144	4	FLOAT	x	x	static
Tube diameter	V0H7	1	145	4	FLOAT	x	x	static
Gap			146 - 147					
Output on alarm	V1H0	1	148	1	UNSIGNED8	x	x	static
Gap			149					
Outp. echo loss	V1H2	1	150	1	UNSIGNED8	x	x	static
Ramp %span/min	V1H3	1	151	4	FLOAT	x	x	static
Delay time	V1H4	1	152	2	UNSIGNED16	x	x	static
Safety distance	V1H5	1	153	4	FLOAT	x	x	static

Parameter	Endress+Hauser Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
In safety dist.	V1H6	1	154	1	UNSIGNED8	x	x	static
Reset self holding	V1H7	1	155	1	UNSIGNED8	x	x	static
Operating mode	V1H8	1	156	1	UNSIGNED8	x	x	static
Brocken probe det.	V1H9	1	157	1	UNSIGNED8	x	x	static
End of probe	V2H0	1	158	1	UNSIGNED8	x	x	static
Probe shortened	V2H1	1	159	1	UNSIGNED8	x	x	static
Probe free	V2H2	1	160	1	UNSIGNED8	x	x	static
Probe length	V2H3	1	161	4	FLOAT	x	x	static
Probe length setup	V2H4	1	162	1	UNSIGNED8	x	x	static
Gap		1	163-167					
Level/ullage	V3H0	1	168	1	UNSIGNED8	x	x	static
Linearisation mode	V3H1	1	169	1	UNSIGNED8	x	x	static
Customer unit	V3H2	1	170	1	UNSIGNED16	x	x	static
Table no.	V3H3	1	171	1	UNSIGNED8	x	x	static
Input level	V3H4	1	172	4	FLOAT	x	x	static
Input volume	V3H5	1	173	4	FLOAT	x	x	static
Max. volume	V3H6	1	174	4	FLOAT	x	x	static
Cylinder vessel	V3H7	1	175	4	FLOAT	x	x	static
Gap		1	176-177					
Selection	V4H0	1	178	1	UNSIGNED8	x	x	static
check distance	V4H1	1	179	1	UNSIGNED8	x	x	static
Range of mapping	V4H2	1	180	4	FLOAT	x	x	static
Mapping rec start	V4H3	1	181	1	UNSIGNED8	x	x	static
Pres. map. dist.	V4H4	1	182	4	FLOAT	x		dynamic
Delete mapping	V4H5	1	183	1	UNSIGNED8	x	x	static
Echo quality	V4H6	1	184	1	UNSIGNED8	x		dynamic
Offset meas dist	V4H7	1	185	4	FLOAT	x	x	static
Output damping	V4H8	1	186	4	FLOAT	x	x	static
High blocking dist.	V4H9	1	187	4	FLOAT	x	x	static
Bus address	V5H0	1	188	1	UNSIGNED8	x		dynamic
Ident nr sel	V5H1	1	189	1	UNSIGNED8	x	x	static
Set unit to bus	V5H2	1	190	1	UNSIGNED8	x	x	static
AI out value	V5H3	1	191	4	FLOAT	x		dynamic
AI out status	V5H4	1	192	1	UNSIGNED8	x		dynamic
Simulation type	V5H5	1	193	1	UNSIGNED8	x	x	static
Simulation value	V5H6	1	194	4	FLOAT	x	x	static
2nd cyclic value	V5H7	1	195	1	UNSIGNED8	x	x	static
Select Main Value	V5H8	1	196	1	UNSIGNED8	x	x	static
Input value	V5H9	1	197	4	FLOAT	x		dynamic
Gap		1	198					
Display contrast	V6H1	1	199	1	UNSIGNED8	x	x	static
Language	V6H2	1	200	1	UNSIGNED8	x	x	static
Back to home	V6H3	1	201	2	INT16	x	x	static

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

Data strings

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

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

5.5.7 Scaling of the output data

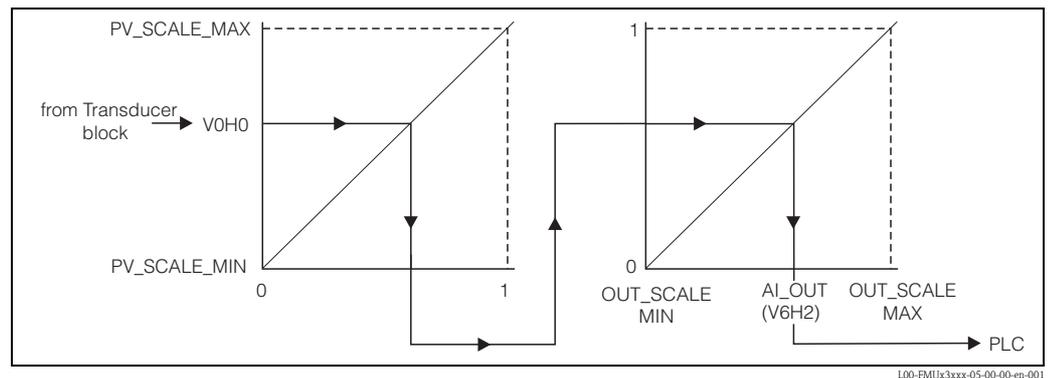
The on-site display and the digital output are working independently of each other.

On-site display

The on-site display always displays the main value VOHO directly from the Transducer Block.

Digital output

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



1. In a first step, the main value is mapped to the interval [0;1]. PV_SCALE_MIN and PV_SCALE_MAX determine the limits of this mapping.
2. In a second step, the interval [0,1] is mapped to the interval [OUT_SCALE_MIN, OUT_SCALE_MAX]. The value resulting from this mapping is transferred via V6H2 to the PLC.



Note!

The scaling of the output value is required by the Profibus profiles. It prevents uncontrolled jumps of the output value when one changes the unit of the measuring value in the Transducer Block. If units are changed, PV_SCALE_MIN and PV_SCALE_MAX automatically adapt themselves in such a way that the output value remains unchanged. Only after confirming the change by the **"Set unit to bus" (062)** function,

OUT_SCALE_MIN is set equal to PV_SCALE_MIN and
 OUT_SCALE_MAX equal to PV_SCALE_MAX.

Thereby the new unit also becomes effective at the output.



Caution!

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

5.5.8 Endress+Hauser operating program

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

www.endress.com → select your country → search: FieldCare → FieldCare → Technical Data.

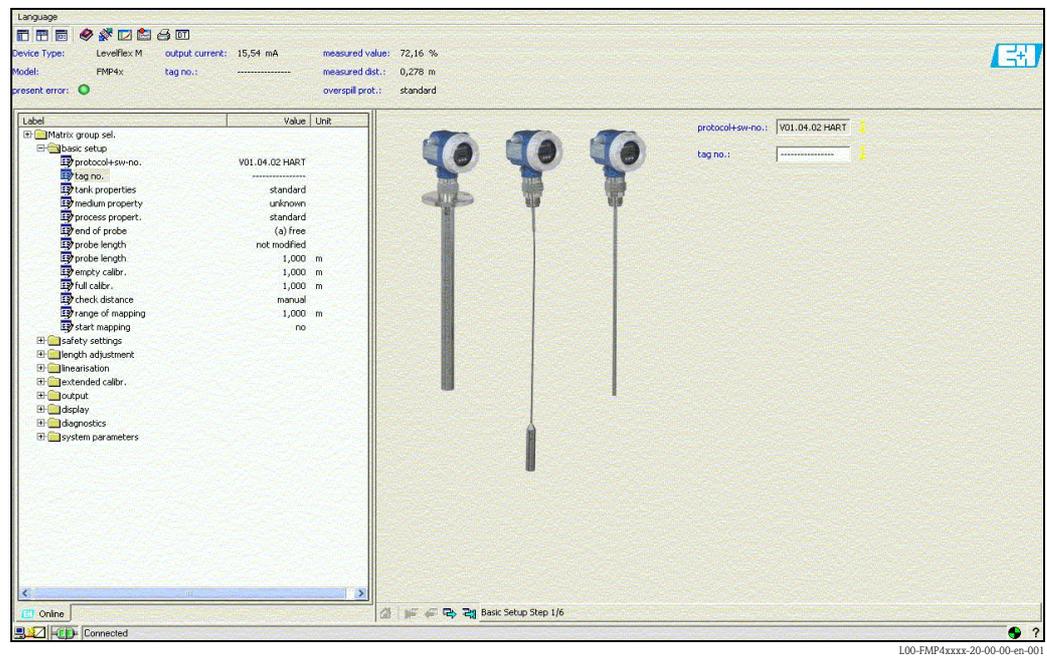
FieldCare supports the following functions:

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

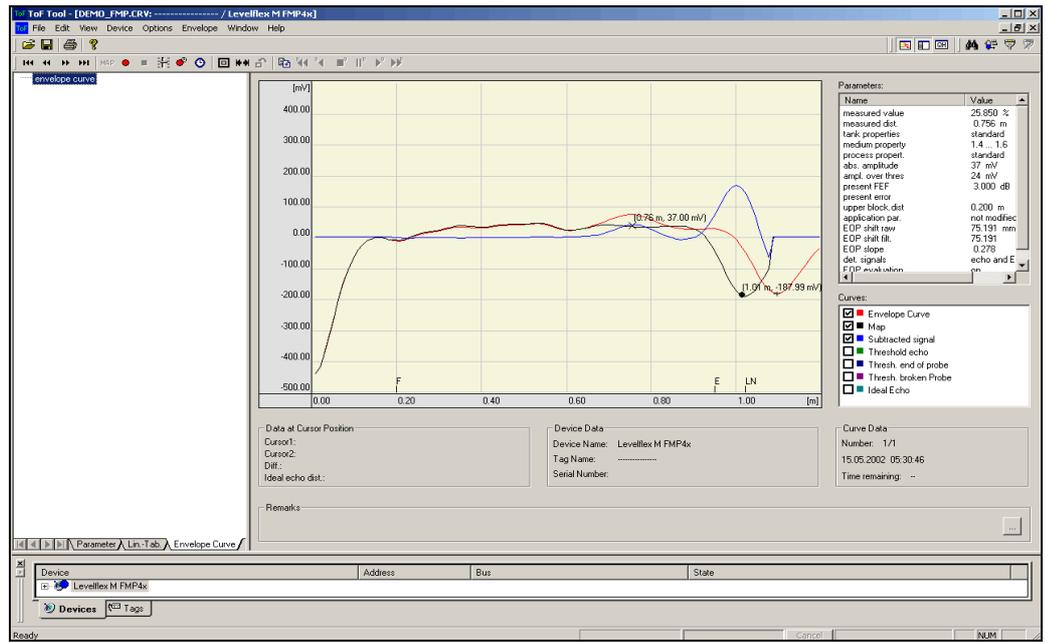
Connection options:

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

Menu-guided commissioning

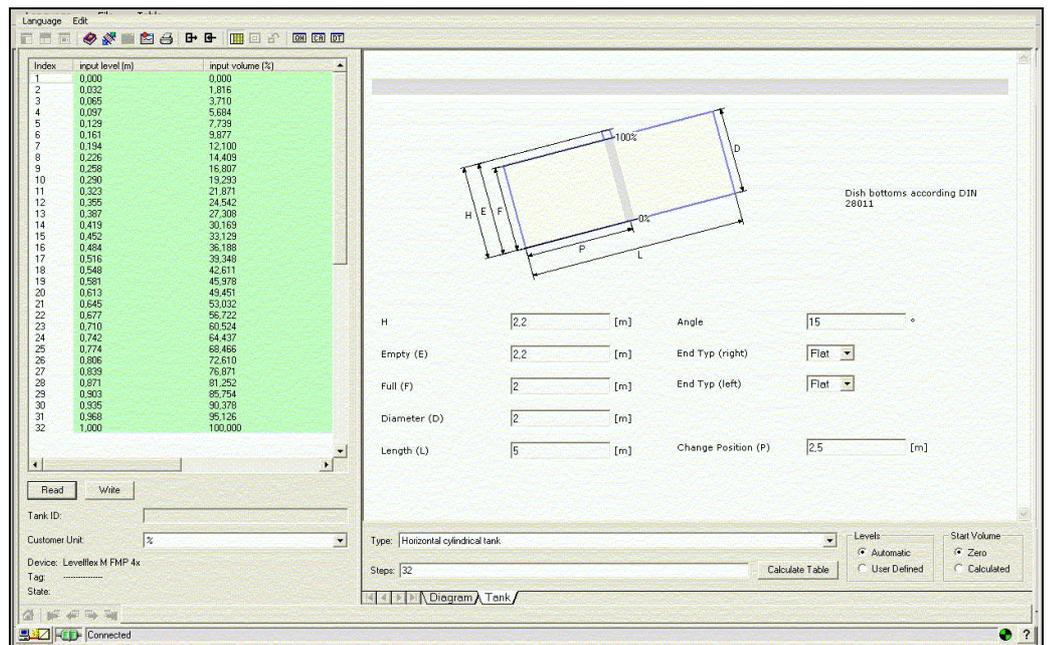


Signal analysis via envelope curve



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

Tank linearization



L00-fmp-xxxx-20-00-00-en-041

6 Commissioning

6.1 Function check

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

- Checklist "Post-installation check", → 19.
- Checklist "Post-connection check", → 24.

6.2 Switching on the measuring device

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



```

Language 092
English
Deutsch
Français
  
```

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



```

distance unit 005
m
ft
mm
  
```

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



```

measured value 000
63.460 %
  
```

The current measured value is displayed



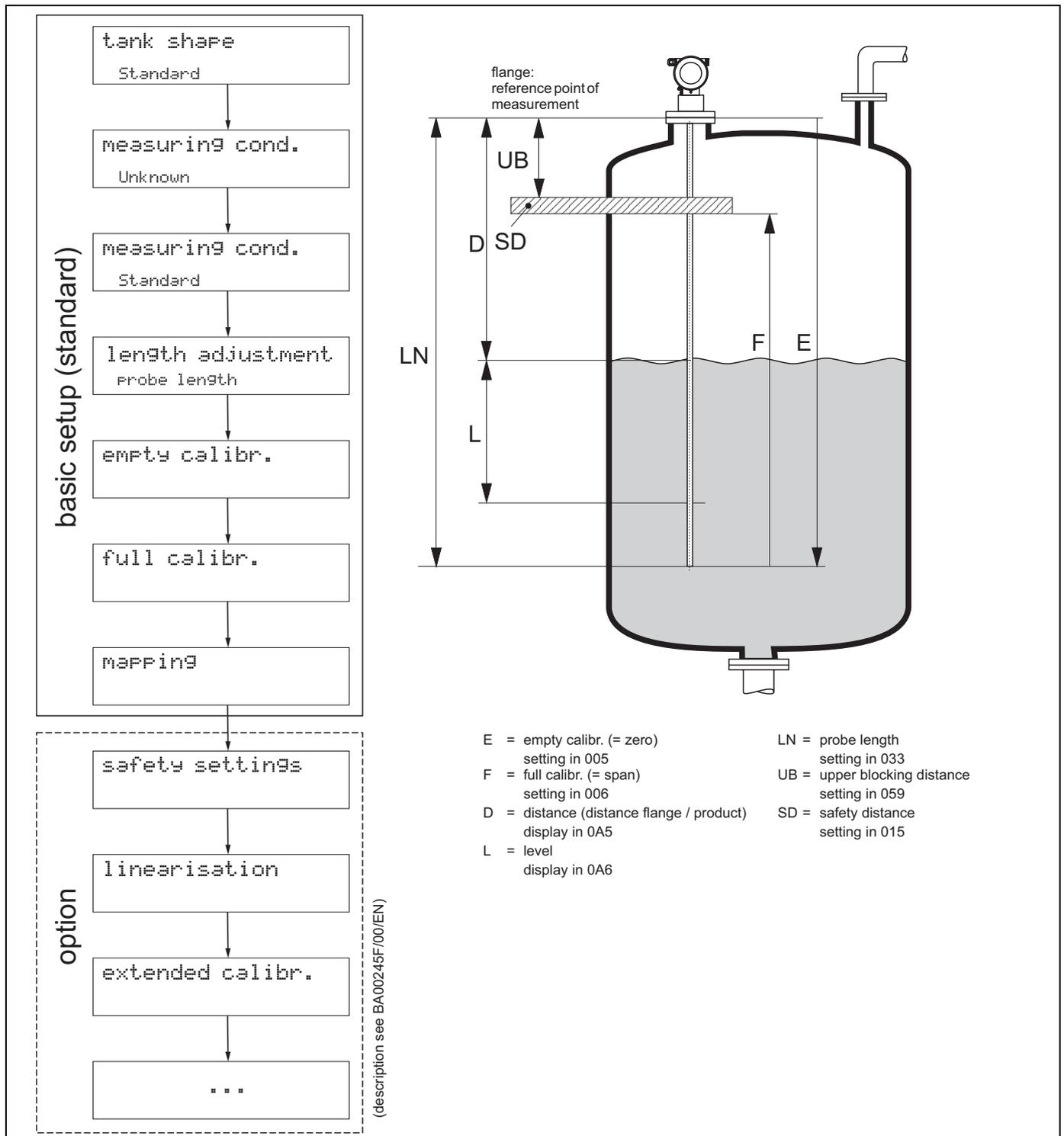
```

Group selection 00+
basic setup
safety settings
linearisation
  
```

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

This selection enables you to perform the basic setup

6.3 Basic Setup



**Caution!**

The basic setup is sufficient for successful commissioning in most applications.

The Levelflex is initially adjusted at the factory to the probe length ordered, so that in most cases only the application parameters, that automatically adapt the device to the measuring conditions, need to be entered. For digital outputs and the display module, the factory adjustment for zero point "E" and span "F" is 0 % and 100 %.

A linearization function with max. 32 points, that is based on a manually or semi-automatically input table, can be activated on-site or via remote operation. This function enables, for example, the conversion of the level into units of volume or weight.

**Note!**

The Levelflex M allows to check for broken probe. On delivery, this function is switched off, because otherwise shortening of the probe would be mistaken for a broken probe.

In order to activate this function, perform the following steps:

1. With the probe uncovered, perform a mapping ("**range of mapping**" (052) and "**start mapping**." (053)).
2. Activate the "**broken probe det**" (019) function in the "**safety settings**" (01) function group.

Complex measuring operations necessitate additional functions that the user can use to customise the Levelflex as necessary to suit his specific requirements. The functions available to do this are described in detail in the BA00245F/00/EN.

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

- Select the functions as described, → 25.
- Certain functions (e.g. starting an interference echo mapping (053)) prompt you to confirm your data entries. Press or to select "**YES**" and press to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group "**display** (09)"), an automatic return is made to the home position (measured value display).

**Note!**

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

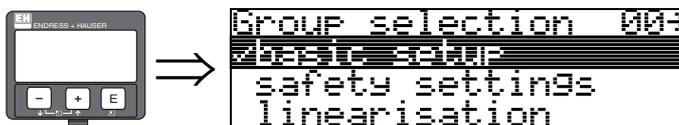
6.4 Basic Setup with the VU331

Function "measured value" (000)

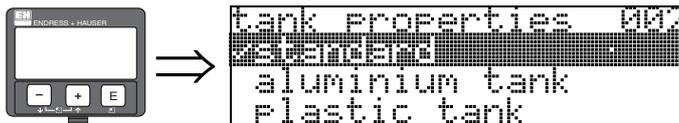


This function displays the current measured value in the selected unit (see "customer unit" (042)) function). The number of digits after decimal point can be selected in the "no.of decimals" (095) function.

6.4.1 Function group "basic setup" (00)



Function "tank properties" (002)



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" option is sufficient!



Note!

In principle the employment of a metallic surface area should be preferred at the process connection!

bypass / pipe

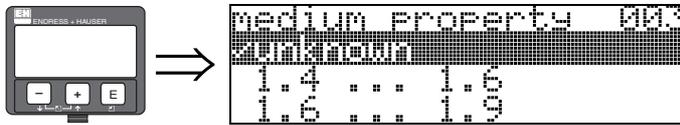
The "**bypass / pipe**" option is designed especially for the installation of probes in a bypass or a stilling well. If this option is selected, the upper blocking distance is preset to 100 mm.

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 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)

This function is used to select the dielectric constant.

Selection:

- **unknown**
- 1.4 ... 1.6 (use coaxial or Rod probe with installation in metallic pipes \leq DN150)
- 1.6 ... 1.9
- 1.9 ... 2.5
- 2.5 ... 4.0
- 4.0 ... 7.0
- > 7.0

Media group	DC (ϵ_r)	Typical liquids	Typ. 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 oils, fuels	12 m (472")
4	2.5 to 4	– Benzene, styrene, toluene – Furan – Naphthalene	16 m (629")
5	4 to 7	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline	25 m (984")
6	> 7	– Aqueous solutions – Alcohols – 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.

**Note!**

Due to the high diffusion rate of ammonia it is recommended to use the FMP45 with gas-tight bushing for measurements in this medium.

Function "process propert." (004)



Use this function to adapt the device reaction 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. caused by stirrer, primarily large tanks with slow to medium filling speed.	Shortest reaction time: <ul style="list-style-type: none"> ■ 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)



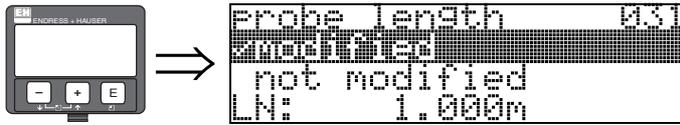
Use this function to select the polarity of the probe end signal. If the probe end is uncovered or in an insulated attachment, there is a negative probe end signal. The signal from the probe end is positive if the attachment is grounded. Only the setting "**free**" is permitted for the FMP41C.

Selection:

- free
- tie down isol.
- tie down gnd.¹⁾

1) These settings lead to a false output signal for empty tanks.

Function "probe length" (031)



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)

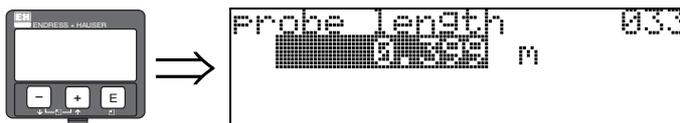


Use this function to select whether the probe is at the time of the commissioning uncovered or covered. If the probe is uncovered, the Levelflex can determine the probe length automatically "**determine length**" (034) function. If the probe is covered, a correct entry is required in the "**probe length**"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

Selection:

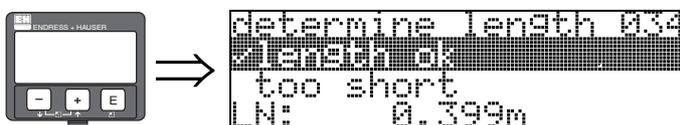
- free
- covered

Function "probe length" (033)



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

Function "determine length" (034)



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
- too short
- too long

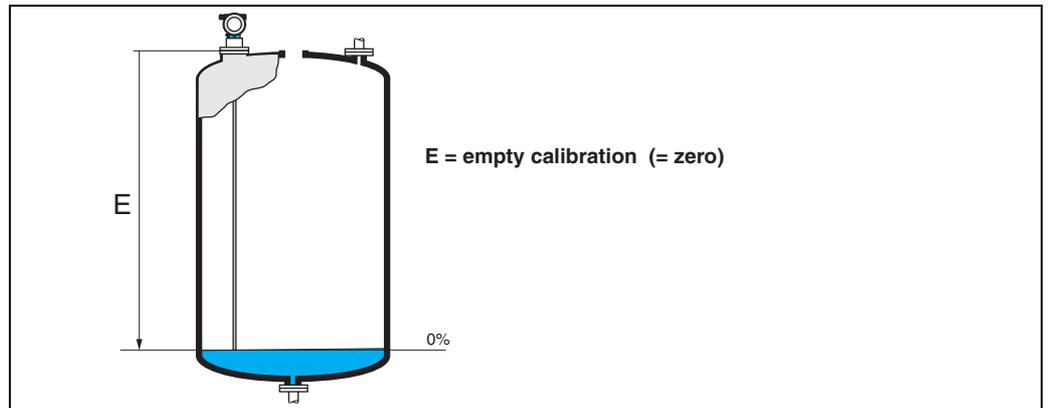
After selection "length too short" or "length too long", the calculation of the new value need approx. 10 s.

Function "empty calibr." (005)



```
empty calibr. 005
[blinking cursor] 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).



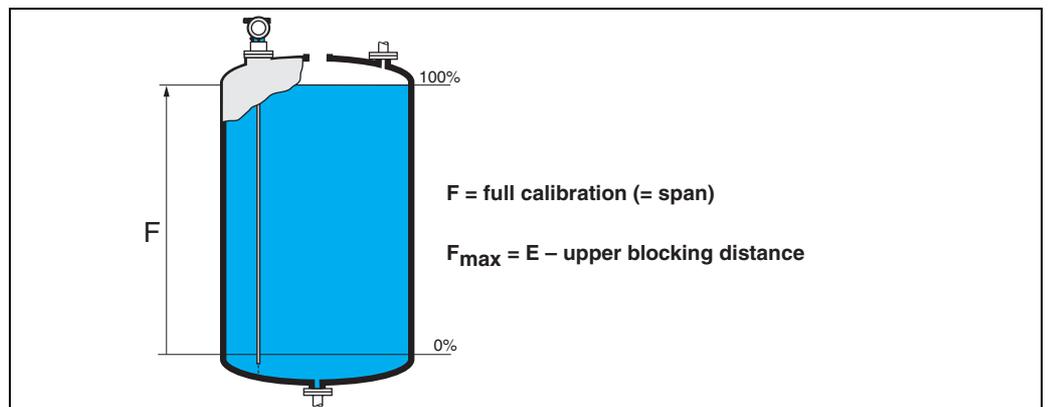
L00-FMP4xxxx-14-00-06-en-008

Function "full calibr." (006)



```
full calibr. 006
[blinking cursor] m
span
```

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



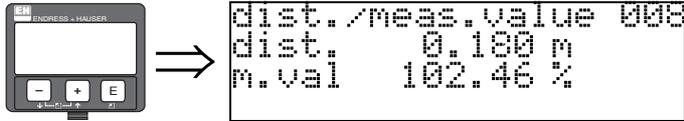
L00-FMP4xxxx-14-00-06-en-009



Note!

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

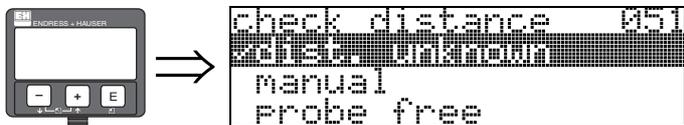
Function "dist./meas.value" (008)



The **distance** measured from the reference point to the product surface and the **meas. value** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual meas. 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).

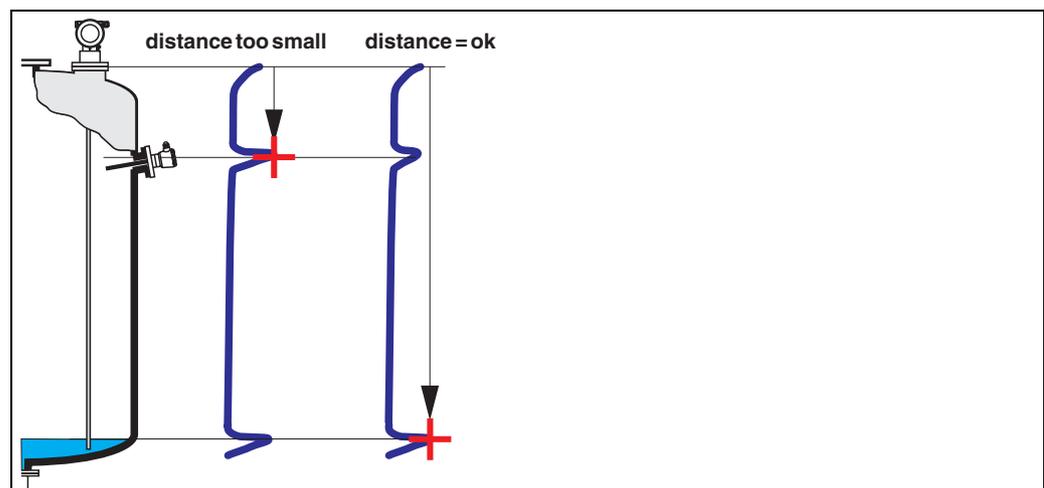
Function "check distance" (051)



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

Selection:

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



L00-FMP4xxxx-14-00-06-es-010

distance = ok

Use this function at part-covered probe. Choosing function "manual" or "probe free" at free probe.

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

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



Note!

At free probe, the mapping should be confirmed with the choice "probe free".

dist. too small

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

dist. too big

- This error cannot be remedied by interference echo mapping
- Check the application parameters (002), (003), (004) and "probe length." (031)

dist. unknown

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

manual

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



Caution!

The range of mapping must end 0.3 m (20") before the echo of the actual level. In case of empty vessel it is possible to make a map over the whole probe length.

probe free

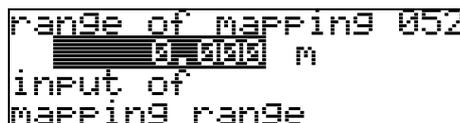
If the probe is uncovered, mapping is carried out along the whole probe length.



Caution!

Only begin mapping in this function if the probe is safely uncovered. Otherwise, the device will not make correct measurements!

Function "range of mapping" (052)



This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (→ 49). This value can be edited by the operator. For manual mapping, the default value is 0,3 m.

Function "start mapping" (053)



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

Selection:

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

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 meas. value calculated with the aid of the empty alignment 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 → a further interference echo mapping must be carried out "**check distance**" (051).
- Distance correct – meas. value incorrect → check "**empty calibr**" (005)



```

Return to
Group Selection
  
```

```

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

After 3 s, the following message appears



Note!

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("**envelope curve**" (0E) function group) is recommended (→ 62).

6.5 Blocking distance

Function "upper block. dist" (059)



For rod probes and for rope probes with lengths of up to 8 m, the upper blocking distance is preset to 0.2 m on delivery. 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", → 59.

FMP41C	LN [m] min	LN [m] max	UB [m] min
Rod probe	0,3	4	0,2 ¹⁾
Rope probe	1	30	0,2 ¹⁾

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.

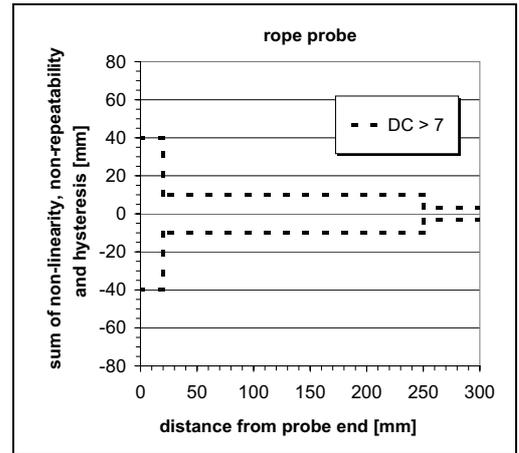
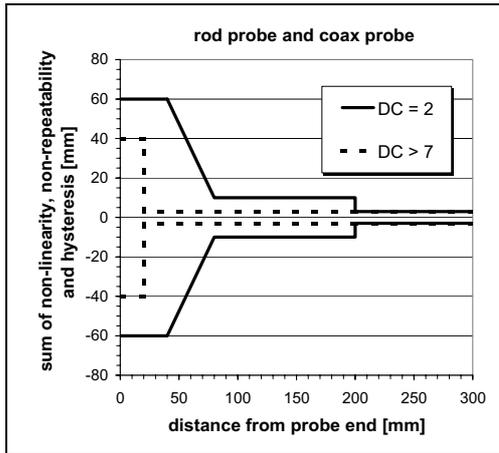
Maximum measured error

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

Output:	digital	analogue
sum of non-linearity, non-repeatability and hysteresis	measuring range: – up to 10 m: ±5 mm – > 10 m: ± 0.05 % for PA coated rope measuring range: – up to 5 m: ±5 mm – > 5 m: ± 0.1 %	± 0.06 %
Offset / Zero	±4 mm	± 0.03 %

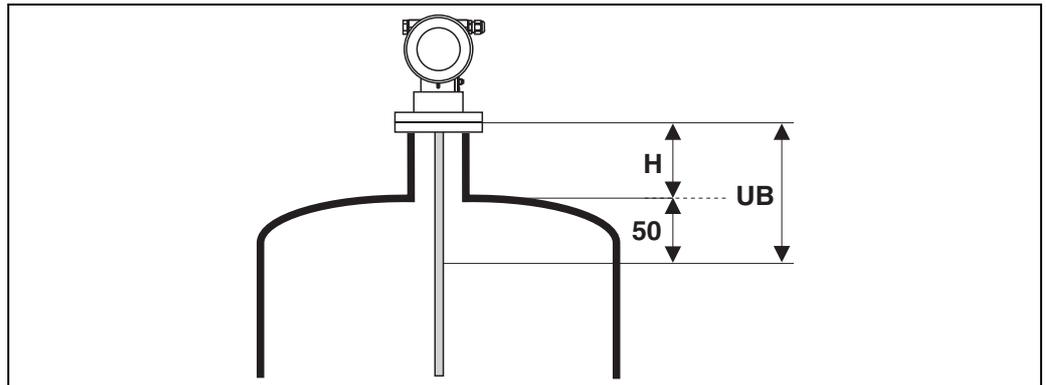
If the reference conditions are not met, the offset/zero arising from the mounting situation may be up to ±12 mm. This additional offset/zero can be compensated for by entering a correction (function "offset" (057)) during commissioning.

Differing from this, the following measuring error is present in the vicinity of the probe end:



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.



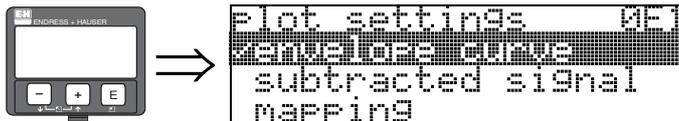
6.6 Envelope curve with VU331

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

6.6.1 Function "plot settings" (0E1)

Here you can select which information is shown on the display:

- envelope curve
- subtracted signal
- mapping



Note!

The interference echo suppression (map) are explained in BA00245F/00/EN "Description of Instrument Functions".

6.6.2 Function "recording curve" (0E2)

This function determines whether the envelope curve is read as

- single curve or
- cyclic

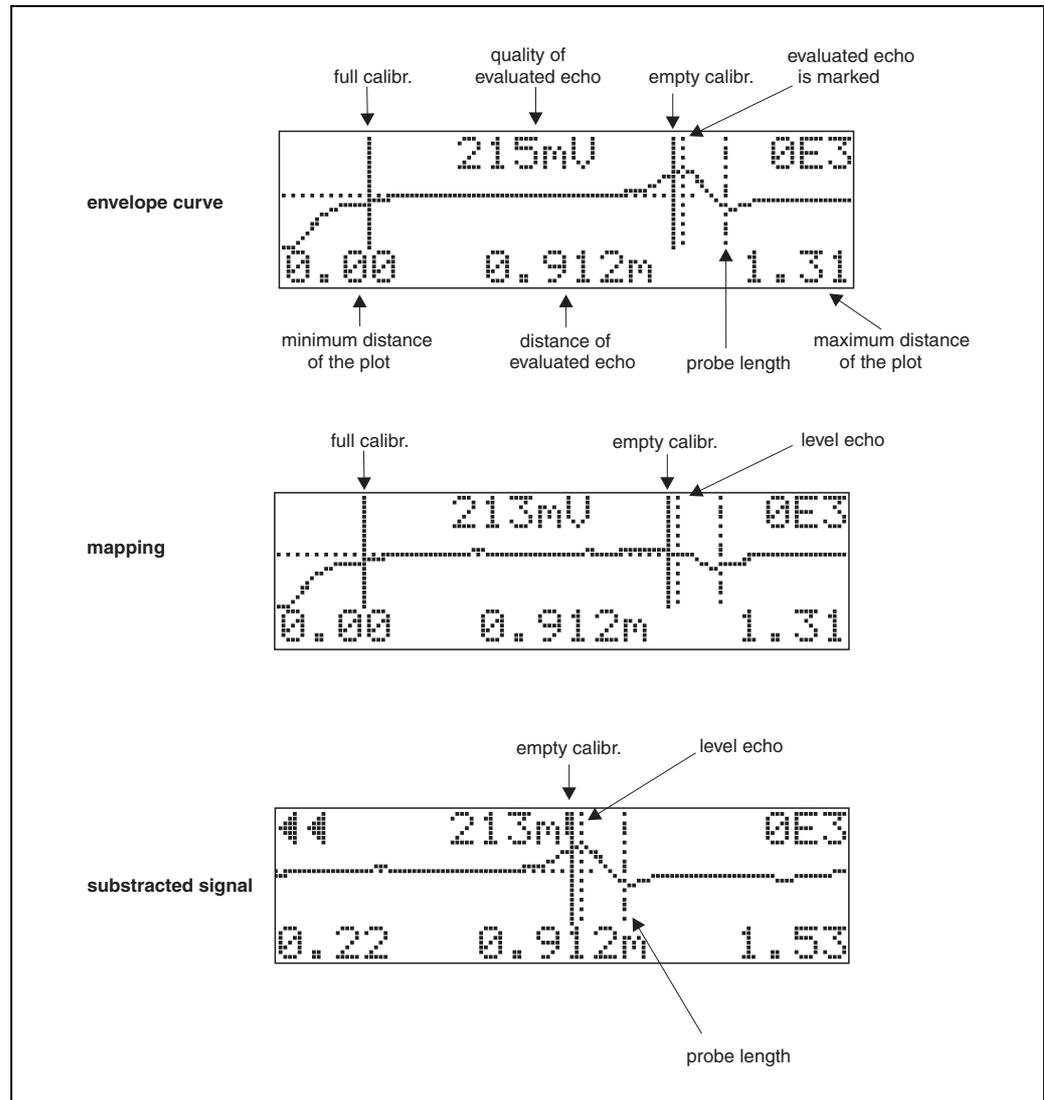


Note!

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 Function "envelope curve display" (0E3)

You can obtain the following information from the envelope curve display in this function:



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6.7.1 Envelope curve

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

6.7.2 Mapping (empty curve) and difference curve

To suppress interference signals, the envelope curve is not directly evaluated in the Levelflex.

The mapping (empty curve) is first subtracted from the envelope curve.

The system looks for level echoes in the resulting difference curve.

Difference curve = envelope curve - mapping (empty curve)

The mapping (empty curve) should be a good representation of the probe and the empty tank or silo. Ideally, only the signals from the medium being measured remain in the difference curve.

6.7.3 Mapping

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

6.7.4 Echo threshold

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

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.

Horizontal Zoom mode:
 ◀▶ - horizontal zoom in
 ▶▶ - horizontal zoom out

Move mode:
 ◀◀ - moved to the left
 ▶▶ - moved to the right

Vertical Zoom mode:
 ◊◊...◊◊ - vertical zoom (4 steps)

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Horizontal-Zoom-Modus

Press **[+]** or **[-]**, to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either ◀▶ or ▶▶ is displayed.

You now have the following options:

- **[+]** increases the horizontal scale.
- **[-]** decreases the horizontal scale.

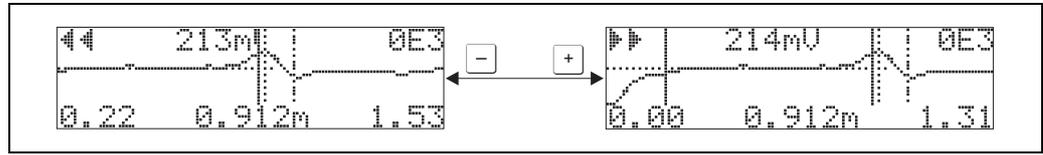
L00-FMPxxxxx-07-00-00-xx-001

Move-Modus

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

You now have the following options:

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



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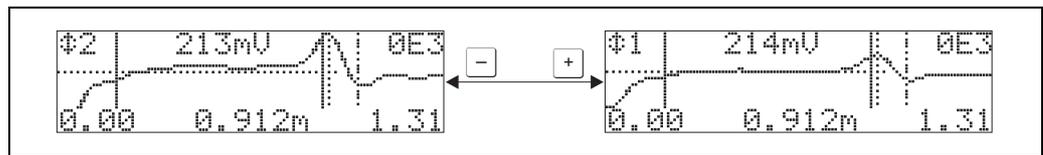
Vertical-Zoom-Modus

Press **[E]**, once more to switch to Vertical Zoom mode. **Φ1** is displayed.

You now have the following options:

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

The display icon shows the current zoom factor (**Φ0** to **Φ3**).



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Exiting the navigation

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



Return to
Group Selection

Group selection 0E3
 envelope curve
 display
 diagnostics

After 3 s, the following message appears

6.8 Basic setup with the Endress+Hauser operating program

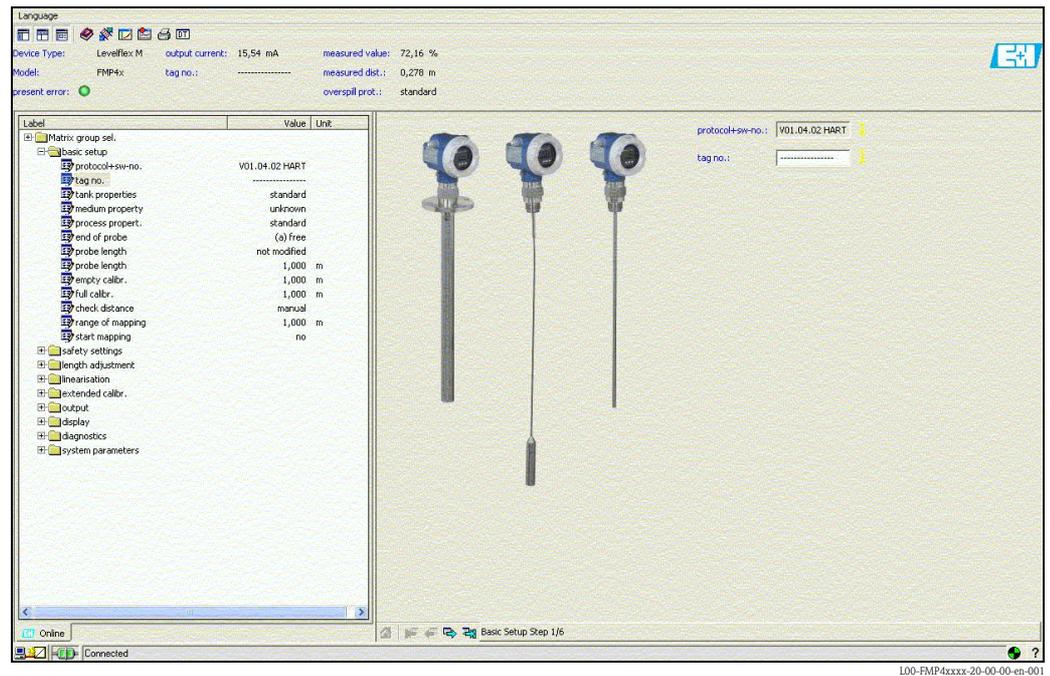
To carry out the basic setup with the operating program, proceed as follows:

- 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.

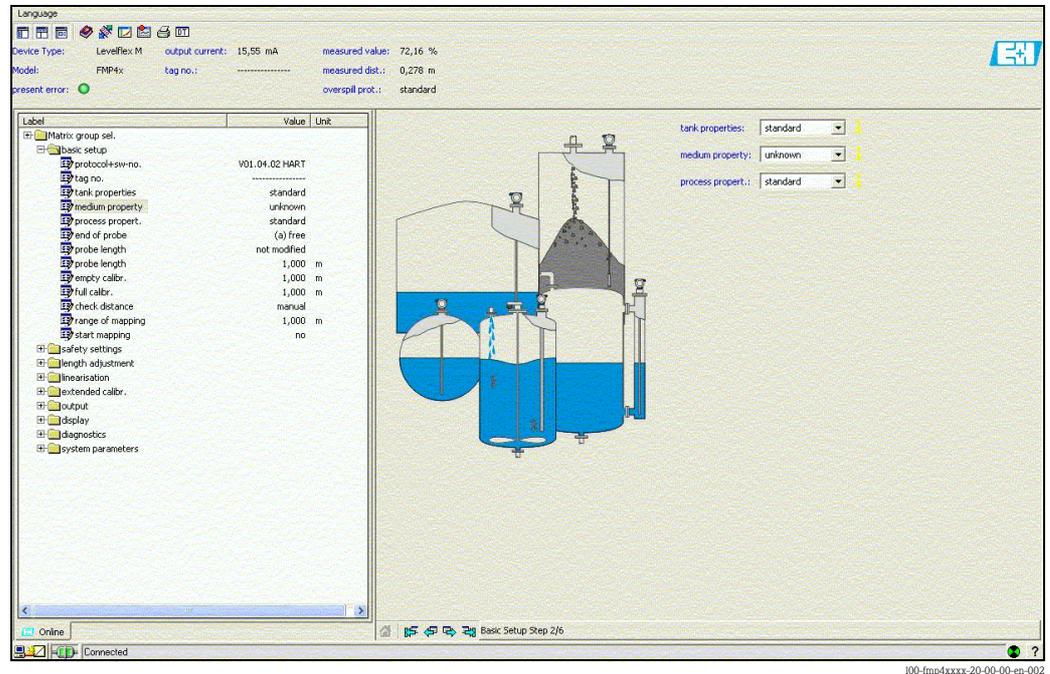


Note!

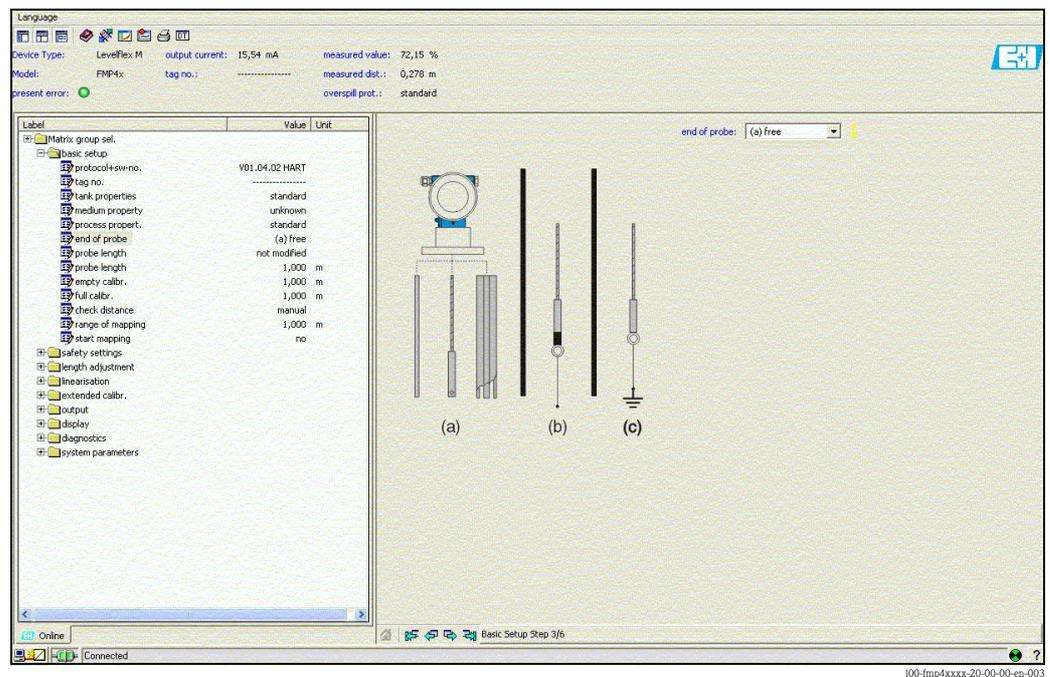
- Each parameter that is changed must be confirmed with the **RETURN** key!
- The "**Next**" button takes you to the next screen:

Basic setup step 2/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
 - Tank properties
 - Medium properties
 - Process properties

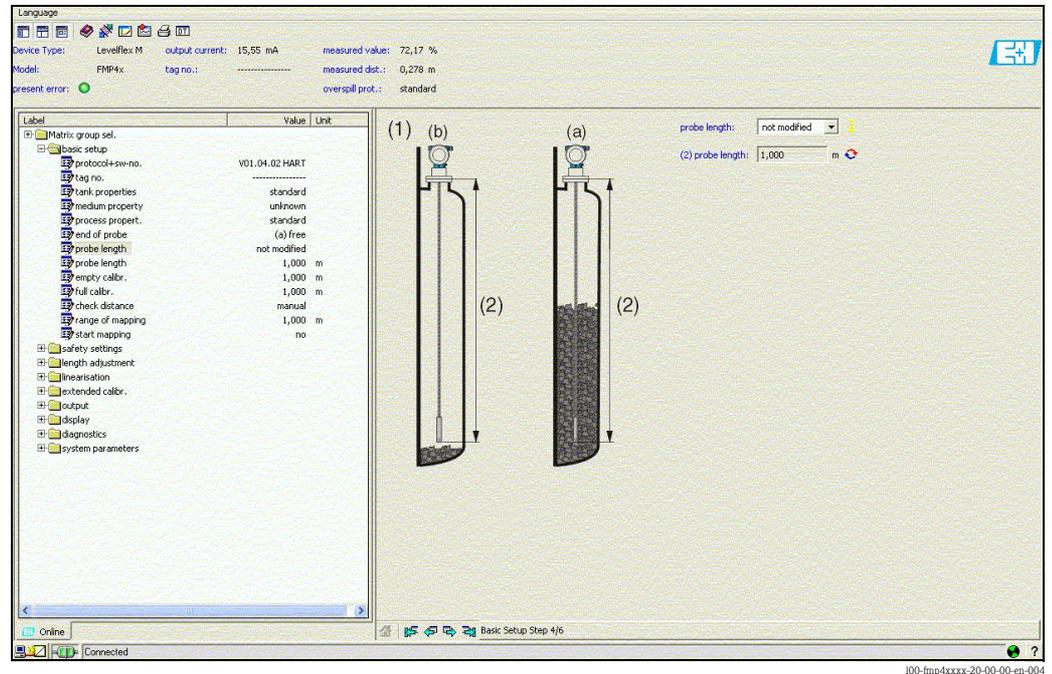
**Basic setup step 3/6:**

- Enter the application parameters (see chapter basic setup with "VU331"):
 - End of probe



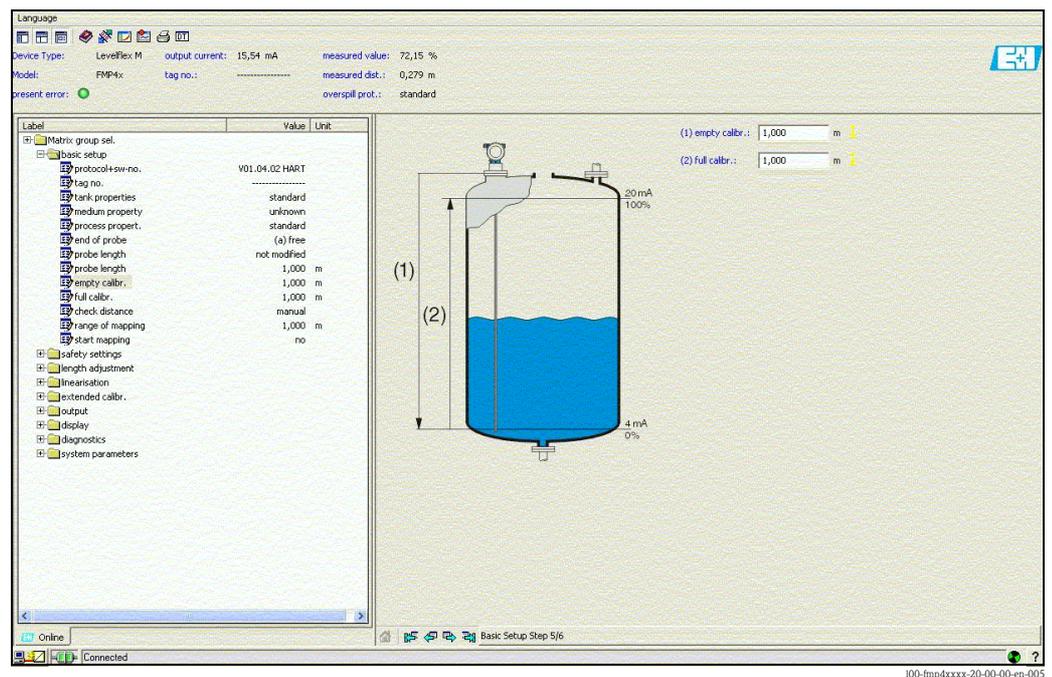
Basic setup step 4/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
 - Probe length
 - Probe
 - Probe length
 - Determine length



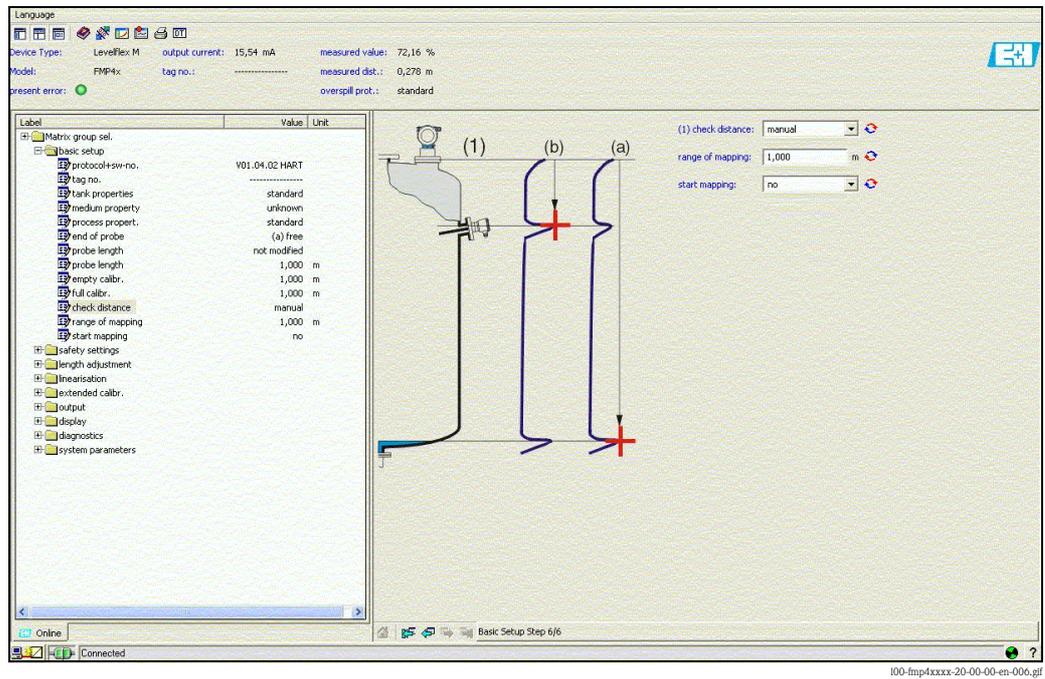
Basic setup step 5/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
 - Empty calibration
 - Full calibration



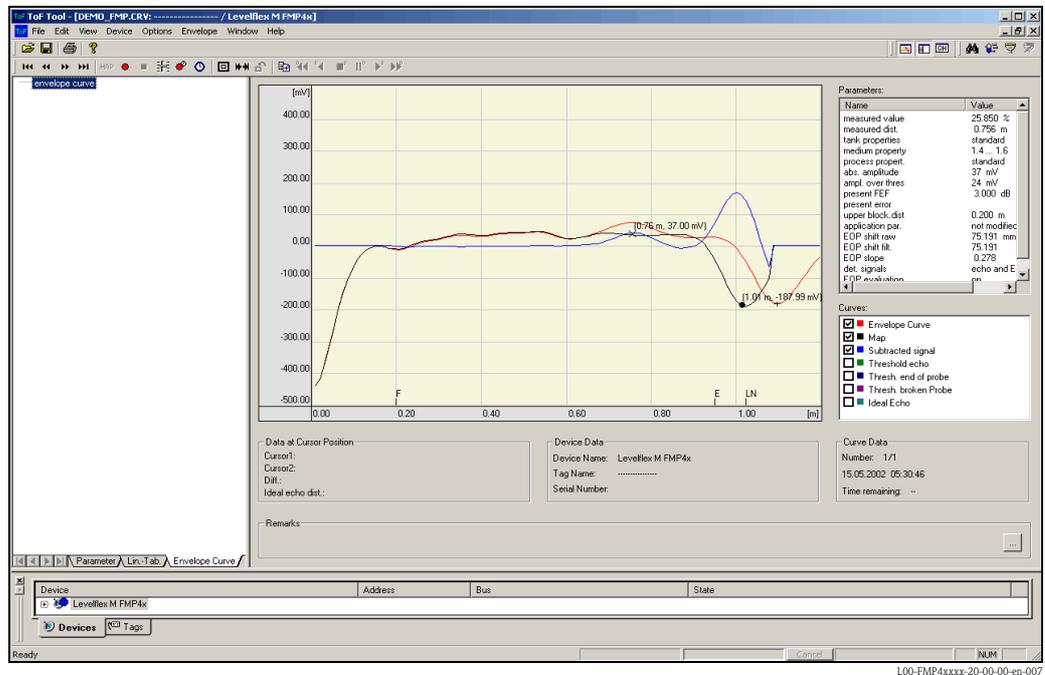
Basic setup step 6/6:

- Interference echo suppression takes place in this step
- The measured distance and the current measured value are always displayed in the header



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.

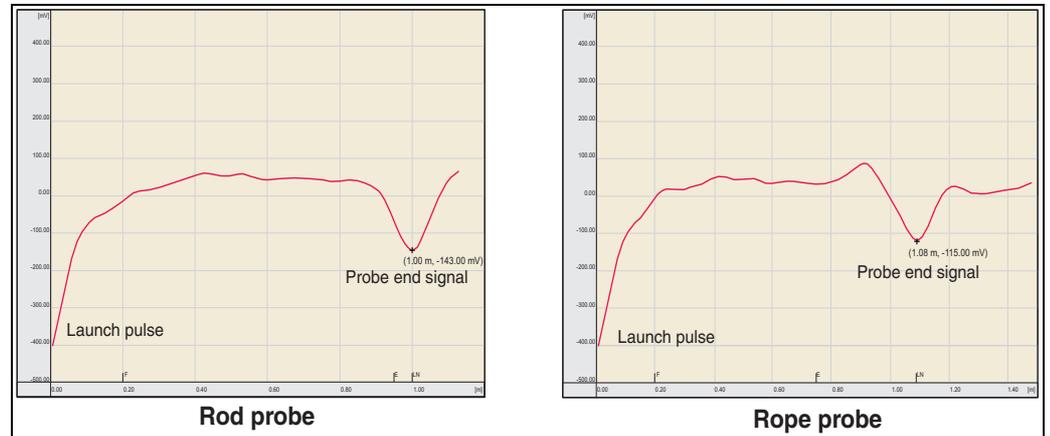


Note!
In the event of severe interference echoes, installing the Levelflex at another point can optimize the measurement routine.

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).

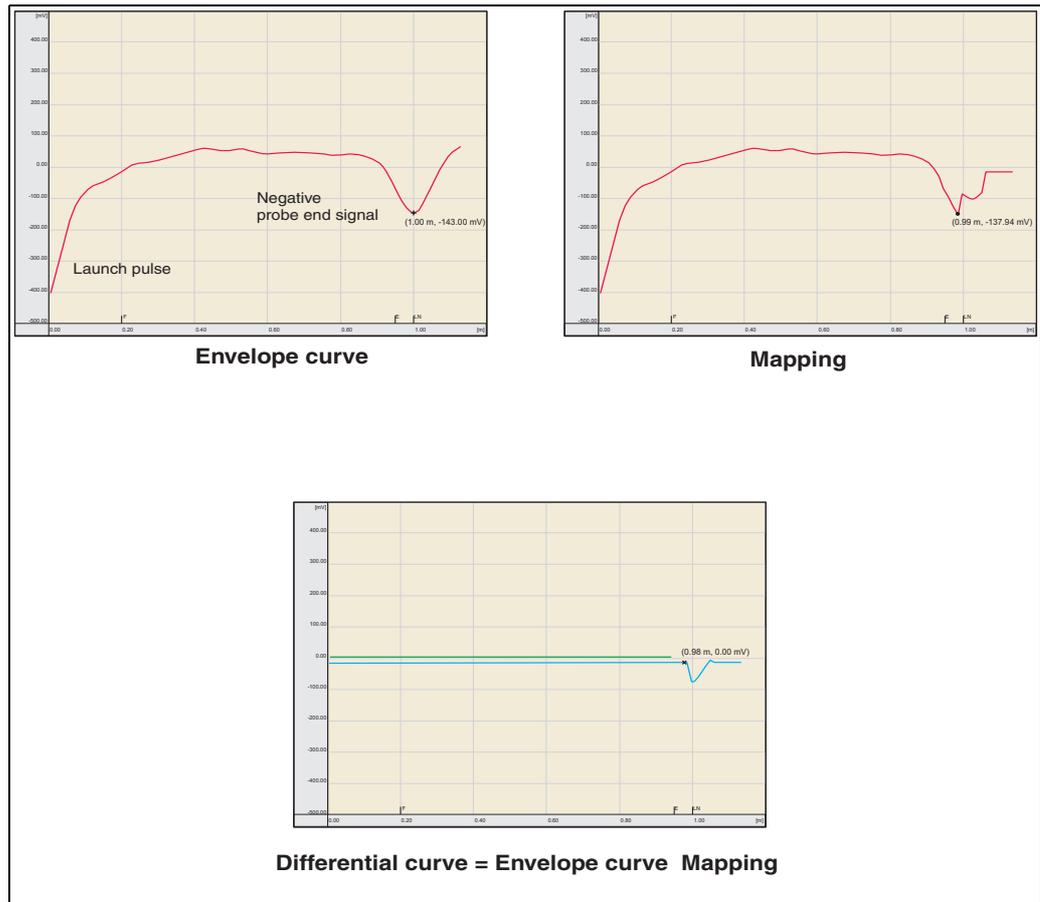


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Level echoes are indicated as positive signals in the envelope curve. Interference echoes can be both positive (e.g. reflections from internals) and negative (e.g. nozzles). The envelope curve, the map and the differential curve are used for the evaluation.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



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6.8.2 User-specific applications (operation)

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

7 Maintenance

The Levelflex M measuring device requires no special maintenance.

7.1 Exterior cleaning

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

7.2 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", →  80). 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 out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

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)

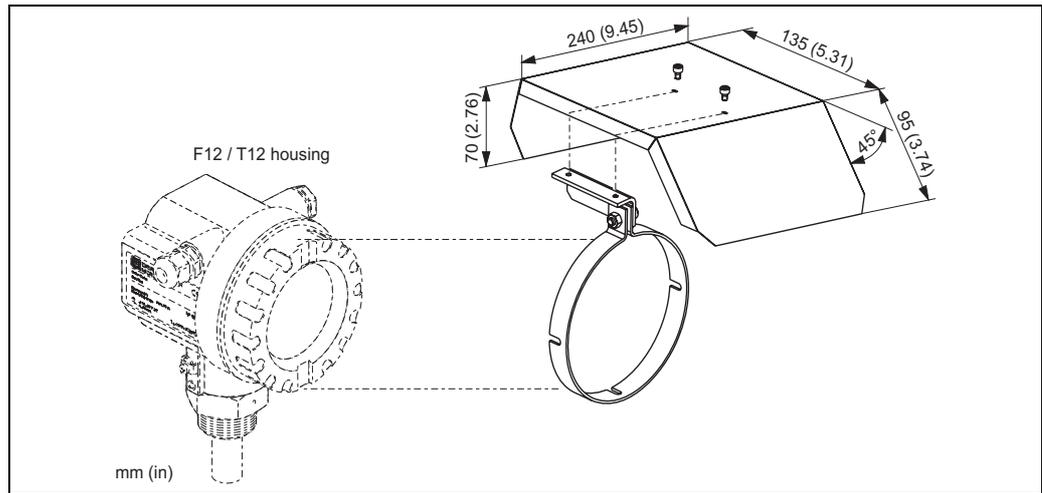
After an probe or electronic has been replaced, a new calibration must be carried out. This is described in the repair instructions.

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.

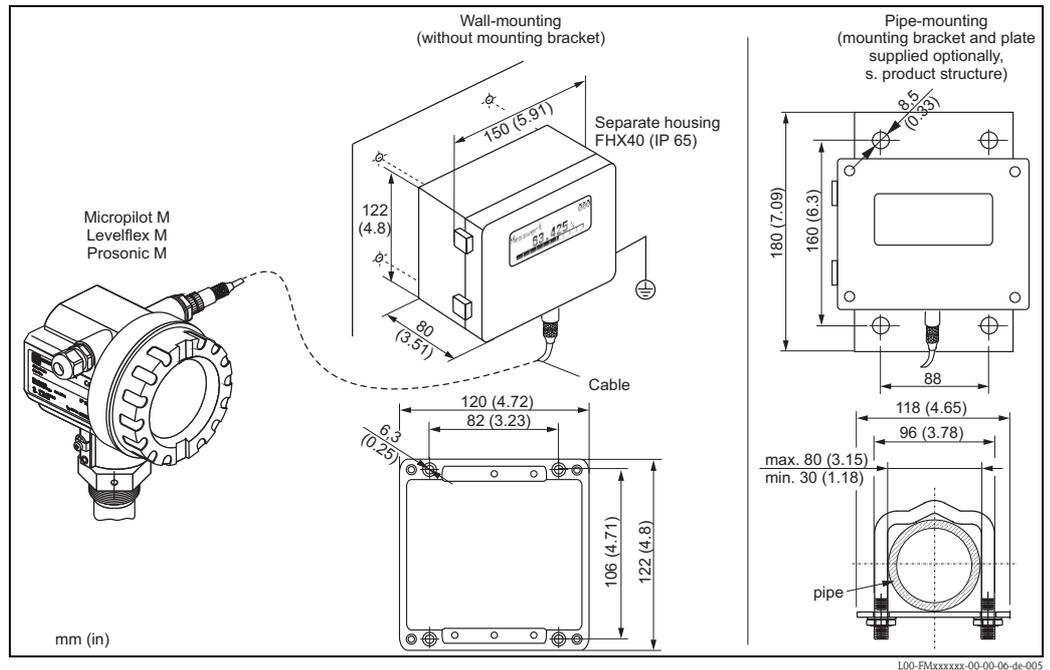


8.2 Welding boss for adapter 43 mm

Dimensions of the welding ring		Order
Diameter D	Height H	
85	12	52006262
65	8	214880-0002

Material: 316L (1.4435)

8.3 Remote display and operation FHX40



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: AISi12; 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 disk

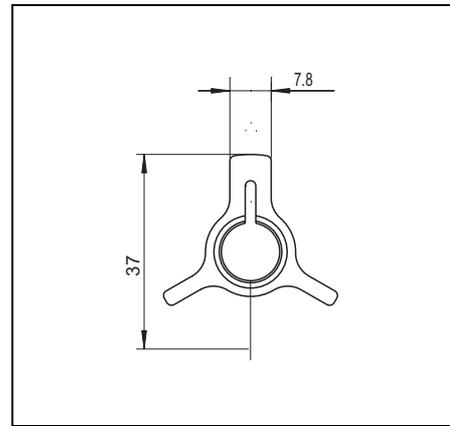
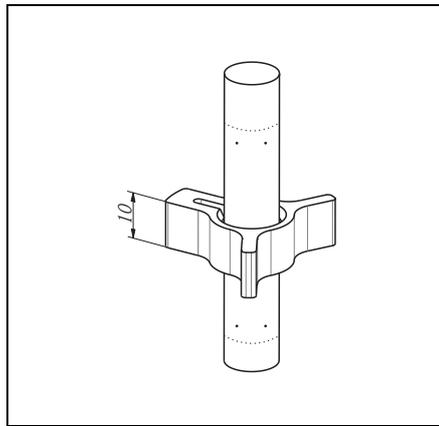
If the probes with rod version are used in stilling well or bypass, it must be ensured that the probe does not come into contact with the wall. The centering disk fixes the rod probe in the middle of the pipe.

8.4.1 Centering disk PFA Ø 1.46 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 Instructions BA00378F/00/EN.

- 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 Proficard

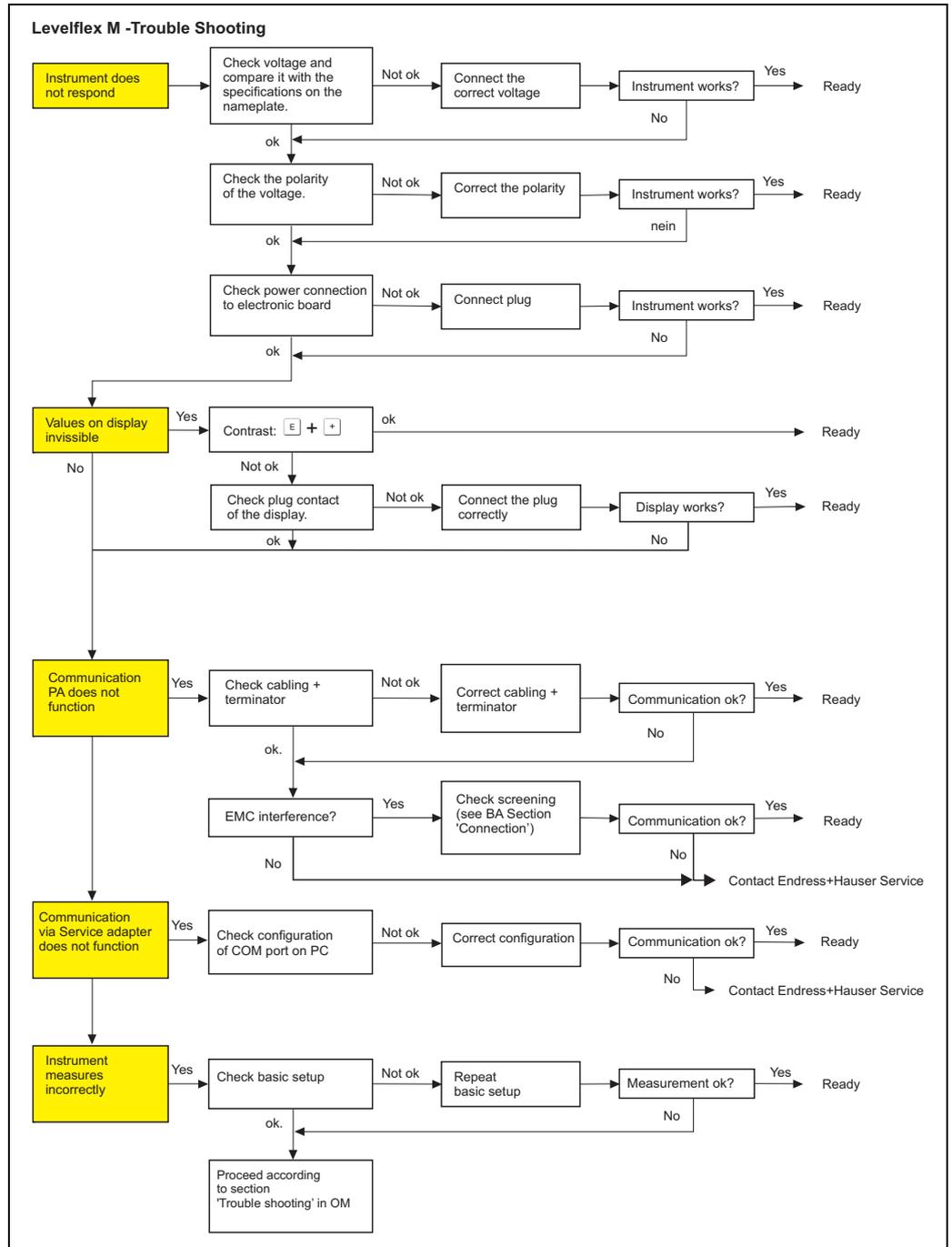
For the connection of a Laptop to PROFIBUS.

8.8 Profiboard

For the connection of a Personal Computer to PROFIBUS.

9 Trouble-shooting

9.1 Trouble-shooting instructions



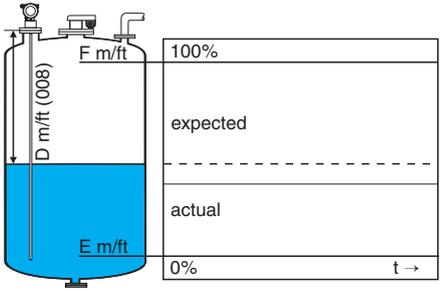
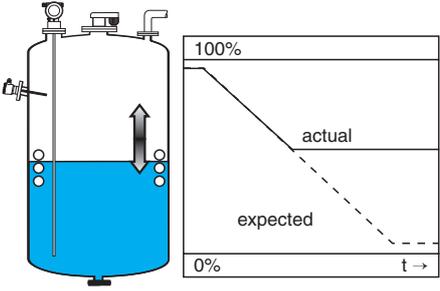
L00-FMP4xxxx-19-00-00-en-100

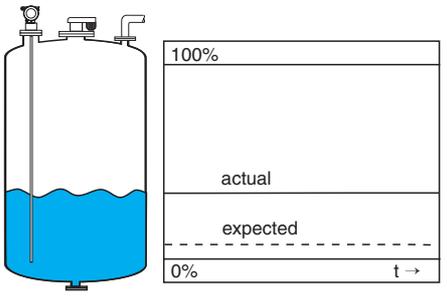
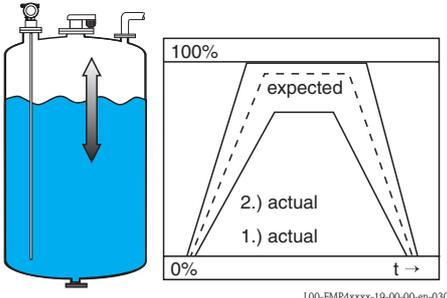
9.2 System error messages

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 or value 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 feedthrough
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 too 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
<p>A warning or alarm has occurred</p>	<p>Depending on the configuration</p>	<p>See table of error messages (→ 76)</p>	<p>1. See table of error messages (→ 76)</p>
<p>Measured value (00) is incorrect</p>		<p>Measured distance (008) OK?</p> <p>yes →</p> <p>no ↓</p> <p>An interference echo may have been evaluated.</p> <p>yes →</p>	<p>yes →</p> <ol style="list-style-type: none"> 1. Check empty calibr. (005) and full calibr. (006) 2. Check linearisation: <ul style="list-style-type: none"> → level/ullage (040) → max. scale (046) → diameter vessel (047) → Check table <p>yes →</p> <ol style="list-style-type: none"> 1. Carry out tank mapping → basic setup
<p>No change off measured value on filling/emptying</p>		<p>Interference echo from installations, nozzle or extension on the probe</p>	<ol style="list-style-type: none"> 1. Carry out tank mapping → basic setup 2. If necessary, clean probe 3. If necessary, select better mounting position
<p>E641 (loss of echo) after turn on the power supply</p>	<p>If the device is configured to Hold by loss of echo the output is set to any value/current.</p>	<p>noise level during the initialisation phase to high.</p>	<p>Repeat once more empty calibr. (005).</p> <p>Caution! Before conformation change with <input type="checkbox"/>+ or <input type="checkbox"/>- to the edit mode.</p>

Error	Output	Possible cause	Remedy
<p>Device displays a level when the tank is empty</p>	 <p>The diagram shows a tank with a probe. The graph plots level (%) on the y-axis (0% to 100%) against time (t) on the x-axis. A solid line labeled 'actual' is constant at 100%. A dashed line labeled 'expected' starts at 0% and rises to 100% as the tank fills. Reference: 100-FMP4xxxx-19-00-00-en-027</p>	<p>Incorrect probe length</p>	<ol style="list-style-type: none"> 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!).
<p>Measured value incorrect (slope error in the entire measuring range)</p>	 <p>The diagram shows a tank with a probe. The graph plots level (%) on the y-axis (0% to 100%) against time (t) on the x-axis. A solid line labeled 'expected' is a trapezoidal shape. Two dashed lines labeled '1.) actual' and '2.) actual' show deviations in slope from the expected curve. Reference: 100-FMP4xxxx-19-00-00-en-030</p>	<p>Tank properties incorrect.</p> <p>Medium properties incorrect.</p>	<p>LN < 4 m and "Aluminium tank" tank properties selected</p> <ul style="list-style-type: none"> → Calibration not possible. → Selection → Select standard → Thresholds too high <p>Select lower medium properties.</p>

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.

Endress+Hauser product search

Via product name
 Enter the product name

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

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

▶ Accessories
 ▼ All Spare parts
 ▶ Housing/housing accessories
 ▶ Sealing
 ▶ Cover
 ▶ Terminal module
 ▶ HF module
 ▶ Electronic
 ▶ Power supply
 ▶ Antenna module



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

◀ | 1 / 2 | ▶ | 🔍

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

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

9.5 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 separate the different components according to their material consistence.

9.7 Software history

Date	Software version	Software modifications	Documentation	Description of Instrument Functions
04.2002	01.02.00	Original software. Operated via: – ToF Tool – Commuwin II (as of Version 2.08-1 Update C) – HART-Communicator DXR375 with Rev. 1, DD 1.	BA277F/00/en/11.03 52021035	BA245F/00/en/02.04 52011936
08.2003	01.02.02	<ul style="list-style-type: none"> ■ Function group: envelope curve display ■ Katakana (japanese) ■ current turn down (HART only) ■ the customer tank map can be edited Operated via: – ToF Tool – Commuwin II (ab Version 2.08-1 Update C) – HART-Communicator DXR 375 mit Rev. 1, DD 1.	BA277F/00/en/02.04 52021035	—
07.2004	01.02.04	<ul style="list-style-type: none"> ■ "mapping" function improved ■ Specification of the measuring accuracy at the end of the probe 	BA277F/00/en/06.04 52021035 BA277F/00/en/01.06 52021035	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	<ul style="list-style-type: none"> ■ Function "detection window" ■ Description of Instrument Functions ■ Operating menu extended 	BA277F/00/en/05.06 52021035 BA277F/00/en/11.06 52021035 BA277F/00/en/03.09 71074803 BA00277F/00/EN/13.10 71120288	BA245F/00/en/06.06 52011936

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., → 12) and the product surface. Subject to the input empty distance "E" (see Fig., → 49), the level is calculated. Alternatively, the level can be converted by means of linearisation (32 points) into other variables (volume, mass).
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10.1.2 Output

Output signal	<ul style="list-style-type: none"> ■ PROFIBUS PA: <ul style="list-style-type: none"> – 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: <ul style="list-style-type: none"> ■ Local display: <ul style="list-style-type: none"> – Error symbol (→ 28) – 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.
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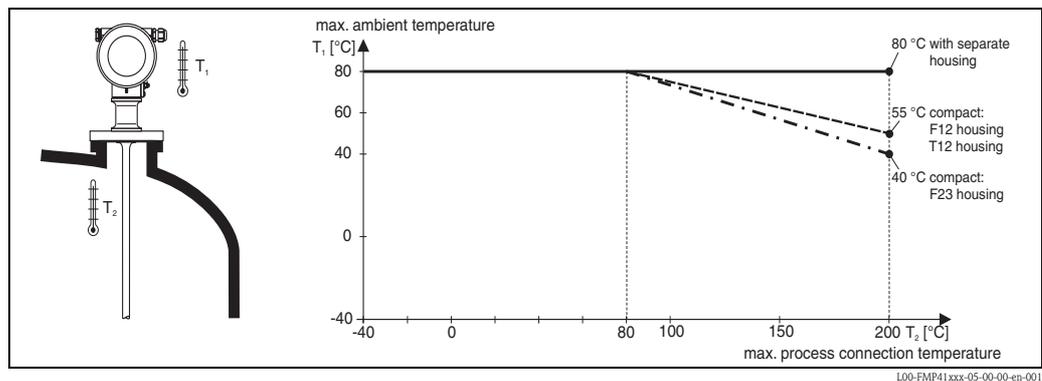
10.1.3 Performance characteristics

Reference operating conditions	<ul style="list-style-type: none"> ■ temperature = +20 °C (68 °F) ±5 °C (9 °F) ■ pressure = 1013 mbar abs. (14.7 psia) ±20 mbar (0.3 psi) ■ 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 Ø) ■ Flange for rod or rope probe ≥ 30 cm Ø ■ Distance to obstructions ≥ 1 m
Maximum measured error	Is in Function group "basic setup" (00), → 51.
Resolution	Digital: 1 mm
Reaction time	The reaction time is dependent on the configuration. Shortest time: <ul style="list-style-type: none"> ■ 2-wire electronics: 1 s
Influence of ambiente temperature	The measurements are carried out in accordance with EN 61298-3: <ul style="list-style-type: none"> ■ digital output: <ul style="list-style-type: none"> – average T_K: 0.6 mm/10 K, max. ±3.5 mm over the entire temperature range -40 °C to +80 °C

10.1.4 Operating conditions: Environment

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

Ambient temperature limits If temperatures above 80 °C are present at the process connection, the permitted ambient temperature is reduced according to the following diagram (temperature derating):



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/s²)/Hz

Cleaning the probe Depending on the application, contamination or build-up can accumulate on the probe. A thin, even layer only influences measurement 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:

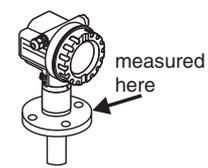
- Interference emission to EN 61326 - x series, electrical equipment Class B.
- Interference Immunity to EN 61326 - x series, requirements for industrial areas and NAMUR Recommendation NE21 (EMC)

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.

10.1.5 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:

Min. temperature	Max. temperature	
-40° C [-40 °F]	+200° C [392 °F]	

For FMP41C with Endress+Hauser adapter 43 mm: 0 °C to +150 °C.
Lateral load-bearing capacity of the rod probe: 30 Nm

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

Please refer to the following standards for the pressure values permitted for higher temperatures:

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

All models: Vacuum up to -1 to 40 bar (585,9psi) (over the entire temperature range).

FMP41C with

- Endress+Hauser universal adapter: max. 6 bar (87 psi).
- Tri-Clamp see the following table:

Version		Pressure (bar/psi)
TCK	Tri-Clamp ISO2852 1-1/2", PTFE > 316L	16 (232)
TDK	Tri-Clamp ISO2852 2", PTFE > 316L	16 (232)
TFK	Tri-Clamp ISO2852 3", PTFE > 316L	10 (145)
TJK	Tri-Clamp ISO2852 1-1/2", PTFE > 316L, 3A, EHEDG	16 (232)
TLK	Tri-Clamp ISO2852 2", PTFE > 316L, 3A, EHEDG	16 (232)
TNK	Tri-Clamp ISO2852 3", PTFE > 316L, 3A, EHEDG	10 (145)

Dielectric constant ■ Rod and rope probe: $\epsilon_r \geq 1.6$

10.1.6 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 / inch)	-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	FMP41C + rod probe	FMP41C + rope probe
Weight for the F12 or T12 housing	approx. 3.5 kg + approx. 1.1 kg/m Probe length + Flange weight	approx. 3.5 kg + approx. 0.5 kg/m Probe length + Flange weight
Weight for the F23 housing	approx. 6.8 kg + approx. 1.1 kg/m Probe length + Flange weight	approx. 6.8 kg + approx. 0.5 kg/m Probe length + Flange weight

10.1.7 Certificates and approvals

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

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

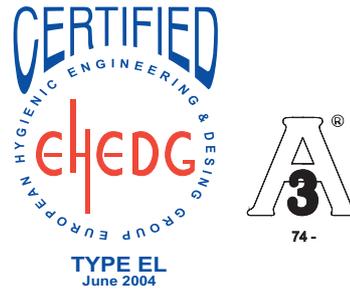
Correlation of Certificates (XA, ZD, ZE) to the device:

Feature	Variant	XA261F	XA262F	XA263F	XA264F	XA266F	XA268F	XA269F	XA270F	XA272F	XA273F	XA274F	XA299F	XA377F	XA387F	XA388F	XA404F	XA405F	ZD158F	ZD159F	ZD162F	ZD163F	ZD165F	ZD168F	ZD202F	ZD172F	ZD173F	ZD174F	ZD176F	ZD177F	ZD198F	ZD199F	ZE296F					
10 Approval:	Non-hazardous area	A																																				
	NEPSI Ex emb (ia) IIC T6	C																																				
	Non-hazardous area, WHG	F X																																				
	ATEX II 3G Ex nA II T6	G																																				
	NEPSI Ex ia IIC T6	I															X	X																				
	NEPSI Ex d(ia) IIC T6	J															X																					
	*TIIS Ex ia IIC T4	K																																				
	TIIS Ex d (ia) IIC T4	L																																				
	CSA General Purpose	N																																				
	*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, 2	U	X	X	X	X																				X	X											
	CSA XP Cl.I,II,III Div.1 Gr. A-D, G + coal dust, N.I., Zone 1, 2	V																									X											
	ATEX II 1/2G Ex ia IIC T6 Note safety instruction (XA) (electrostatic charging)!	1																																		X	X	
	ATEX II 2G Ex emb (ia) IIC T6 Note safety instruction (XA) (electrostatic charging)!	3																																		X		
	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D Note safety instruction (XA) (electrostatic charging)!	5																																				
	ATEX II 1/2G Ex ia IIC T6, WHG Note safety instruction (XA) (electrostatic charging)!	6	X																																		X	X
ATEX II 1/2G Ex d (ia) IIC T6 Note safety instruction (XA) (electrostatic charging)!	7																																			X		
ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D, WHG Note safety instruction (XA) (electrostatic charging)!	8	X																																				
40 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	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	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	X	X	X	X	X	X	X	X	X	X
	4-wire 90-250VAC 4-20mA SIL HART	G																																				
	4-wire 10.5-32VDC 4-20mA SIL HART	H																																				
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	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
70 Housing:	F12 Alu, coated IP68 NEMA 6P	A															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	F23 316L IP68 NEMA 6P	B			X	X											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	T12 Alu, coated IP68 NEMA 6P	C				X											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	T12 Alu, coated IP68 NEMA 6P + OVP	D	X	X													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
80 Cable entry:	thread M20 (Ex d > thread M20)	2															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	thread G1/2	3															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	thread NPT1/2	4															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Plug M12	5															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Plug 7/8"	6															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

* in preparation

Suitability for hygienic processes

Overview of permitted process connections from →  6.



Note!
 The gap-free connections can be cleaned without residue using the usual cleaning methods.
 Many versions of Levelflex M meet the requirements of the 3A-Sanitary Standard No. 74.
 Endress+Hauser confirms this compliance by affixing the 3A symbol.

Overspill protection

WHG. See "Ordering structure", →  6 (see 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 meet the requirements for a "Class B Digital Device".

External standards and guidelines

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

EN 60529
 Protection class of housing (IP-code)

Namur - international user association of automation technology in process industries.

- NE21
 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NE43
 Standardization of the signal level for the failure information of digital transmitters.

10.1.8 Additional documentation

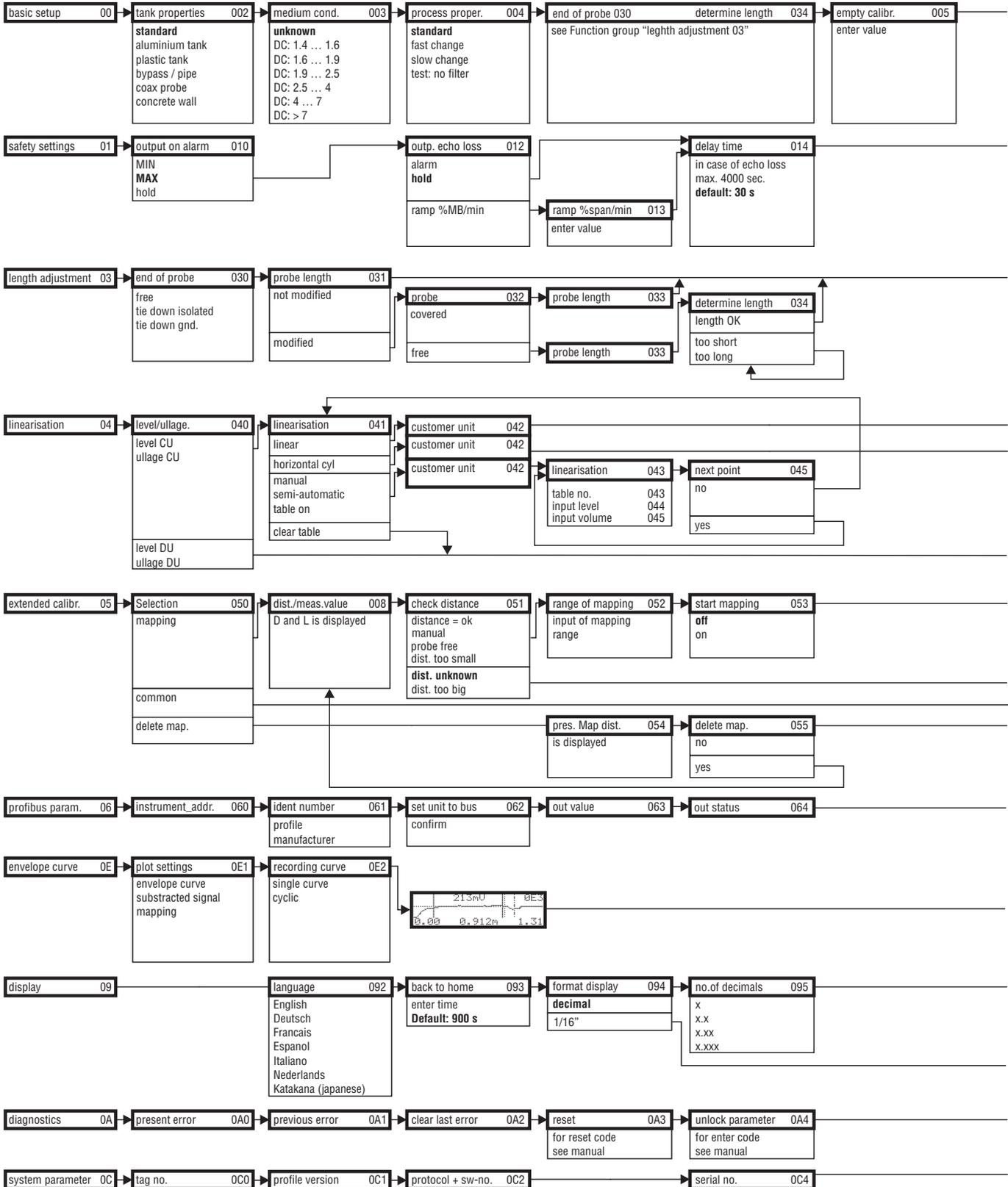
Additional documentation

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

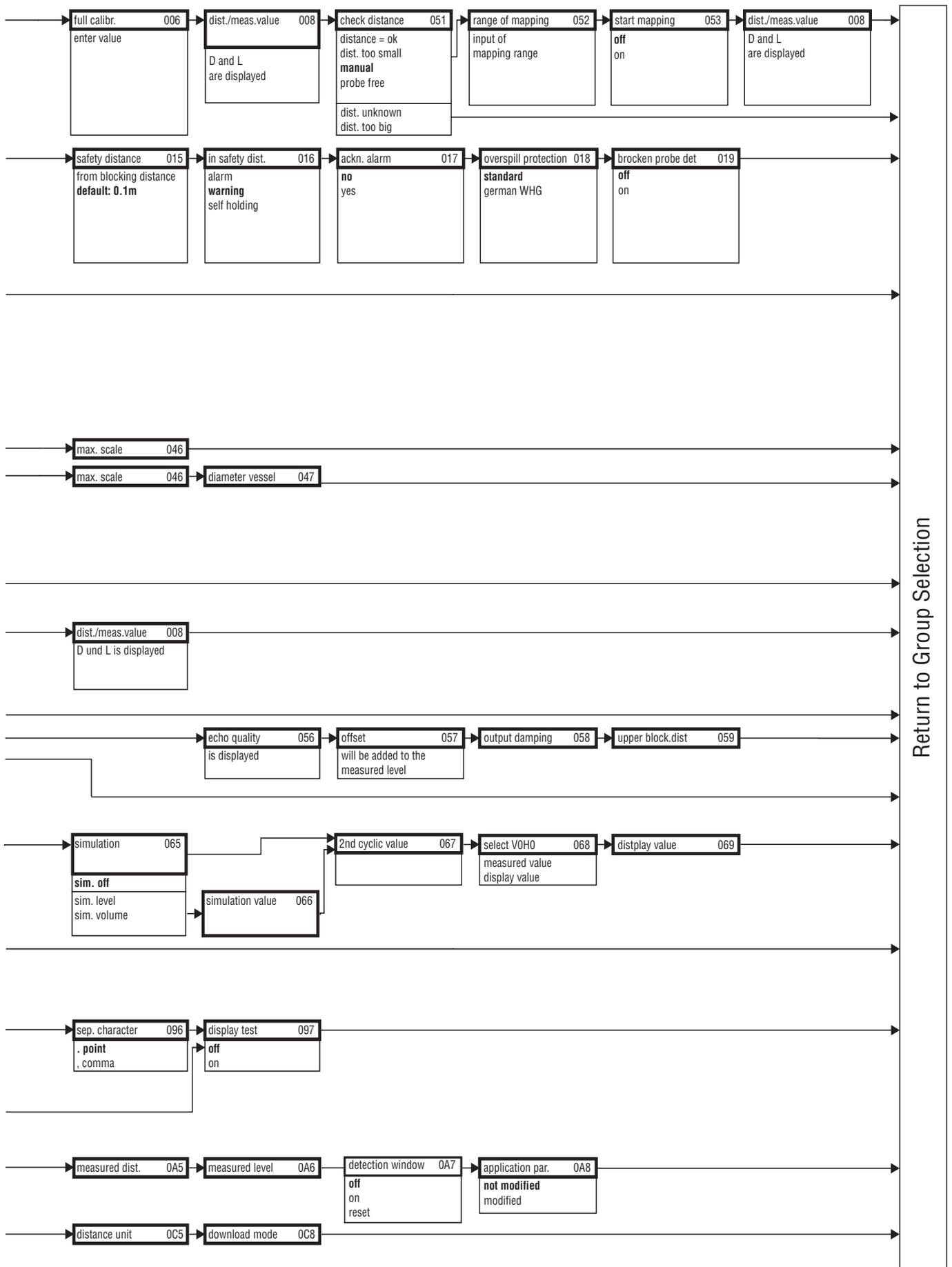
- Technical Information (TI00386F/00/EN)
- Certificate "Allgemeine bauaufsichtliche Zulassung" (ZE00256F/00/DE)
- Guideline for planning and commissioning (BA034S/04/EN)
- Brief Operating Instructions (KA01042F/00/EN)

11 Appendix

11.1 Operating menu PA (Display modul)



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



11.2 Patents

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

- US 5,661,251 \cong EP 0 780 664
- US 5,827,985 \cong EP 0 780 664
- US 5,884,231 \cong EP 0 780 665
- US 5,973,637 \cong 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.

Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

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

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

Type of instrument / sensor

Geräte-/Sensortyp _____

Serial number

Seriennummer _____

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

Process data / Prozessdaten

Temperature / Temperatur _____ [°F] _____ [°C]

Pressure / Druck _____ [psi] _____ [Pa]

Conductivity / Leitfähigkeit _____ [µS/cm]

Viscosity / Viskosität _____ [cp] _____ [mm²/s]

Medium and warnings

Warnhinweise zum Medium



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

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

* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

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

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

Description of failure / Fehlerbeschreibung _____

Company data / Angaben zum Absender

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

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

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

(place, date / Ort, Datum)

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

Signature / Unterschrift

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