



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



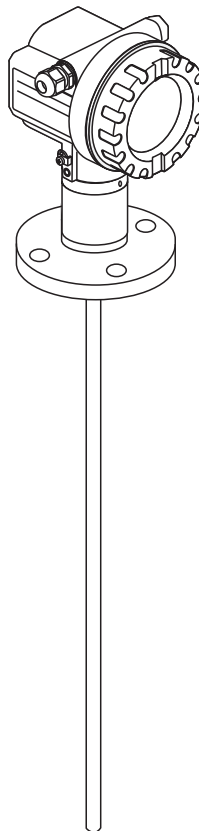
Solutions

Operating Instructions

Levelflex M FMP41C

Interface measurement

Guided Level-Radar



Endress+Hauser

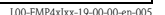


Table of contents

1	Safety instructions	4	8	Accessories	54
1.1	Designated use	4	8.1	Weather protection cover	54
1.2	Installation, commissioning and operation	4	8.2	Welding boss for 43 mm adapter	54
1.3	Operational safety and process safety	4	8.3	Remote display and operation FHX40	55
1.4	Safety conventions and icons	5	8.4	Centering disk	56
2	Identification	6	8.5	Commubox FXA195 HART	56
2.1	Device designation	6	8.6	Commubox FXA291	56
2.2	Scope of delivery	9	8.7	ToF adapter FXA291	56
2.3	Certificates and approvals	9	9	Troubleshooting	57
2.4	Registered trademarks	9	9.1	Troubleshooting instructions	57
3	Installation	10	9.2	System error messages	58
3.1	Incoming acceptance, transport, storage	10	9.3	Application errors	60
3.2	Installation conditions	11	9.4	Spare Parts	62
3.3	General information on interface measurement	13	9.5	Return	63
3.4	Special information on interface measurement	15	9.6	Disposal	63
3.5	Installation instructions	16	9.7	Software history	63
3.6	Post-installation check	20	9.8	Contact addresses of Endress+Hauser	63
4	Wiring	21	10	Technical data	64
4.1	Quick wiring guide	21	10.1	Additional technical data	64
4.2	Connecting the measuring unit	23	11	Appendix	72
4.3	Recommended connection	26	11.1	HART operating menu (display module)	72
4.4	Degree of protection	26	11.2	Patents	74
4.5	Post-connection check	26	Index	77	
5	Operation	27			
5.1	Quick operation guide	27			
5.2	Display and operating elements	29			
5.3	Local operation	31			
5.4	Displaying and acknowledging error messages	34			
5.5	HART communication	35			
6	Commissioning	37			
6.1	Function check	37			
6.2	Switching on the measuring device	37			
6.3	Basic setup	38			
6.4	Basic Setup with the VU331	40			
6.5	Envelope curve with VU331	46			
6.6	Function "Envelope Curve Display" (OE3)	47			
6.7	Basic Setup with the Endress+Hauser operating program	50			
7	Maintenance	53			
7.1	Exterior cleaning	53			
7.2	Repairs	53			
7.3	Repairs to Ex-approved devices	53			
7.4	Replacement	53			

1 Safety instructions

1.1 Designated use

The Levelflex M is a compact level transmitter for the continuous measurement of the total level and the interface level in liquids. Measuring principle: guided level radar / TDR:

Time **D**omain **R**eflectometry.

1.2 Installation, commissioning and operation

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

1.3 Operational safety and process safety

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

The measuring device meets the general safety requirements according to EN 61010-1 and the EMC requirements of IEC/EN 61326 in addition to NAMUR Recommendations NE 21 and NE 43.













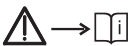
Hazardous areas

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

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

1.4 Safety conventions and icons

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

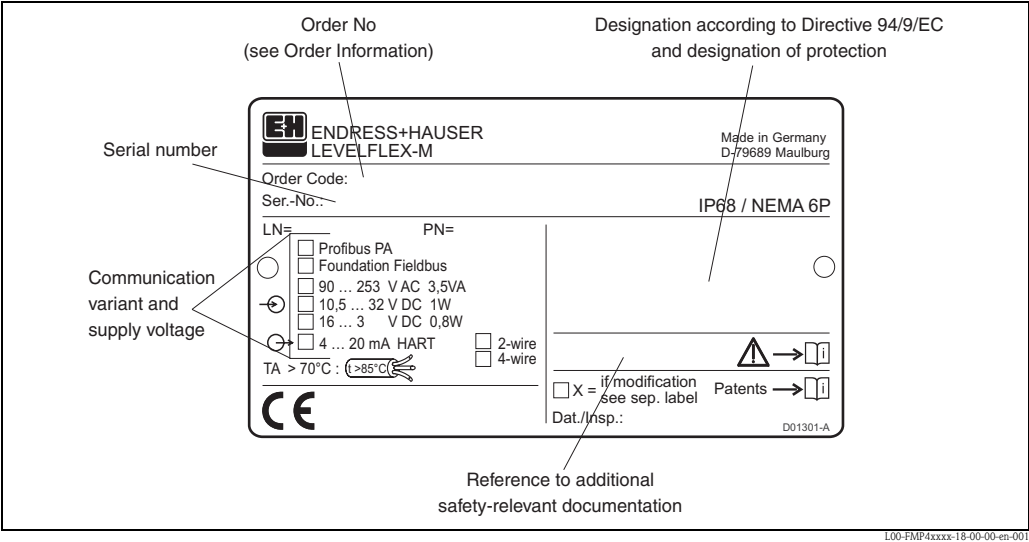
Safety instructions	
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or the destruction of the device.
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the device.
	Note! A note highlights actions or procedures which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.
Explosion protection	
	Explosion-protected, type-examined equipment If the device has this symbol embossed on its nameplate, it can be used in a hazardous area or a non-hazardous area, according to the approval.
	Hazardous areas This symbol is used in the drawings of these Operating Instructions to indicate hazardous areas. Devices in hazardous areas, or cables for such devices, must have appropriate explosion protection.
	Safe area (non-hazardous area) This symbol is used in the drawings of these Operating Instructions to indicate non-hazardous areas. Devices in the non-hazardous area also have to be certified if connecting cables lead into the hazardous area.
Electrical symbols	
	Direct voltage A terminal to which DC voltage is applied or through which direct current flows.
	Alternating voltage A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded by means of a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to making any other connection to the equipment.
	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.
	Temperature resistance of the connection cables States that the connection cables must be resistant to a temperature of at least 85 °C.
	Safety instruction For safety instructions refer to the manual for the appropriate device version.

2 Identification

2.1 Device designation

2.1.1 Nameplate

The following technical data are given on the device nameplate:



Information on the nameplate of the Levelflex M FMP41C

2.1.2 Ordering structure

This overview does not mark options which are mutually exclusive.

10	Approval:
	A Non-hazardous area
	F Non-hazardous area, WHG
	1 ATEX II 1/2G Ex ia IIC T6 Note safety instruction (XA) (electrostatic charging)!
	3 ATEX II 2G Ex em (ia) IIC T6 Note safety instruction (XA) (electrostatic charging)!
	5 ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D Note safety instruction (XA) (electrostatic charging)!
	6 ATEX II 1/2G Ex ia IIC T6, WHG Note safety instruction (XA) (electrostatic charging)!
	7 ATEX II 1/2G Ex d (ia) IIC T6 Note safety instruction (XA) (electrostatic charging)!
	8 ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D, WHG Note safety instruction (XA) (electrostatic charging)!
	G ATEX II 3G Ex nA II T6
	C NEPSI Ex emb (ia) IIC T6
	I NEPSI Ex ia IIC T6
	J NEPSI Ex d (ia) IIC T6
	Q NEPSI DIP (in preparation)
	R NEPSI Ex nA II T6
	S FM IS Cl.I,II,III Div.1 Gr.A-G N.I., zone 0, 1, 2
	T FM XP Cl.I,II,III Div.1 Gr.A-G, zone 1, 2
	N CSA General Purpose
	U CSA IS Cl.I,II,III Div.1 Gr.A-D,G + coal dust, N.I., zone 0, 1, 2
	V CSA XP Cl.I,II,III Div.1 Gr.A-D,G + coal dust, N.I., zone 1, 2
	K TIIS Ex ia IIC T4 (in preparation)
	L TIIS Ex d (ia) IIC T4
	Y Special version, TSP-No. to be spec.

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.

¹⁾ OVP = overvoltage protection

2.2 Scope of delivery



Caution!

It is essential to follow the instructions concerning the unpacking, transport and storage of measuring devices given in the chapter "Incoming acceptance, transport, storage", → 10!

The scope of delivery consists:

- Assembled device
- Accessories (→ 54)
- Endress+Hauser operating program on the enclosed CD-ROM
- Brief operating instructions KA00283F/00/A2 (basic setup/troubleshooting), housed in the device
- Brief operating instructions KA01051F/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 EC directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.4 Registered trademarks

KALREZ[®], VITON[®], TEFLON[®]

Registered trademark of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP[®]

Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART[®]

Registered trademark of the HART Communication Foundation, Austin, USA

PulseMaster[®]

Registered trademark of Endress+Hauser GmbH+Co. KG, Maulburg, Germany

3 Installation

3.1 Incoming acceptance, transport, storage

3.1.1 Incoming acceptance

Check the packaging and the contents for 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 device by the probe rod in order to transport it.

3.1.3 Storage

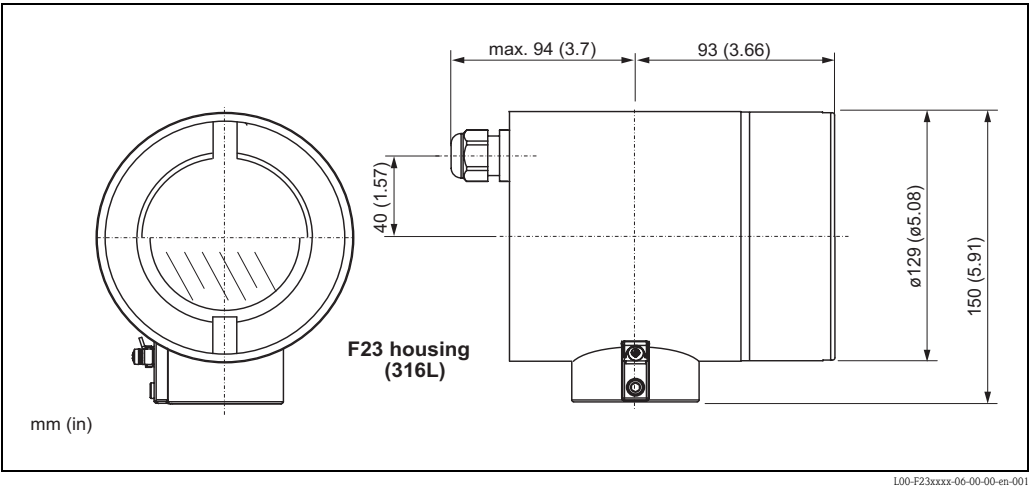
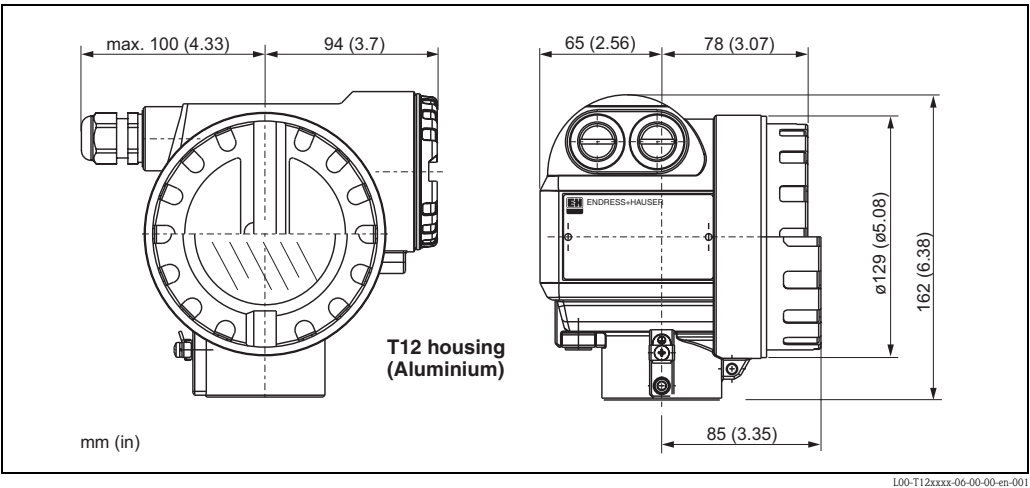
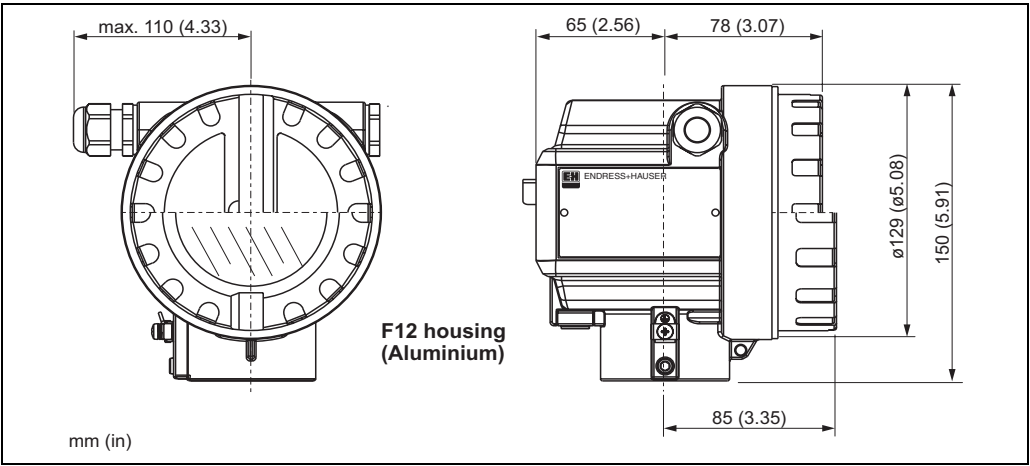
Pack the device so that is protected against impacts for storage and transport. The original packing material provides the optimum protection for this.

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

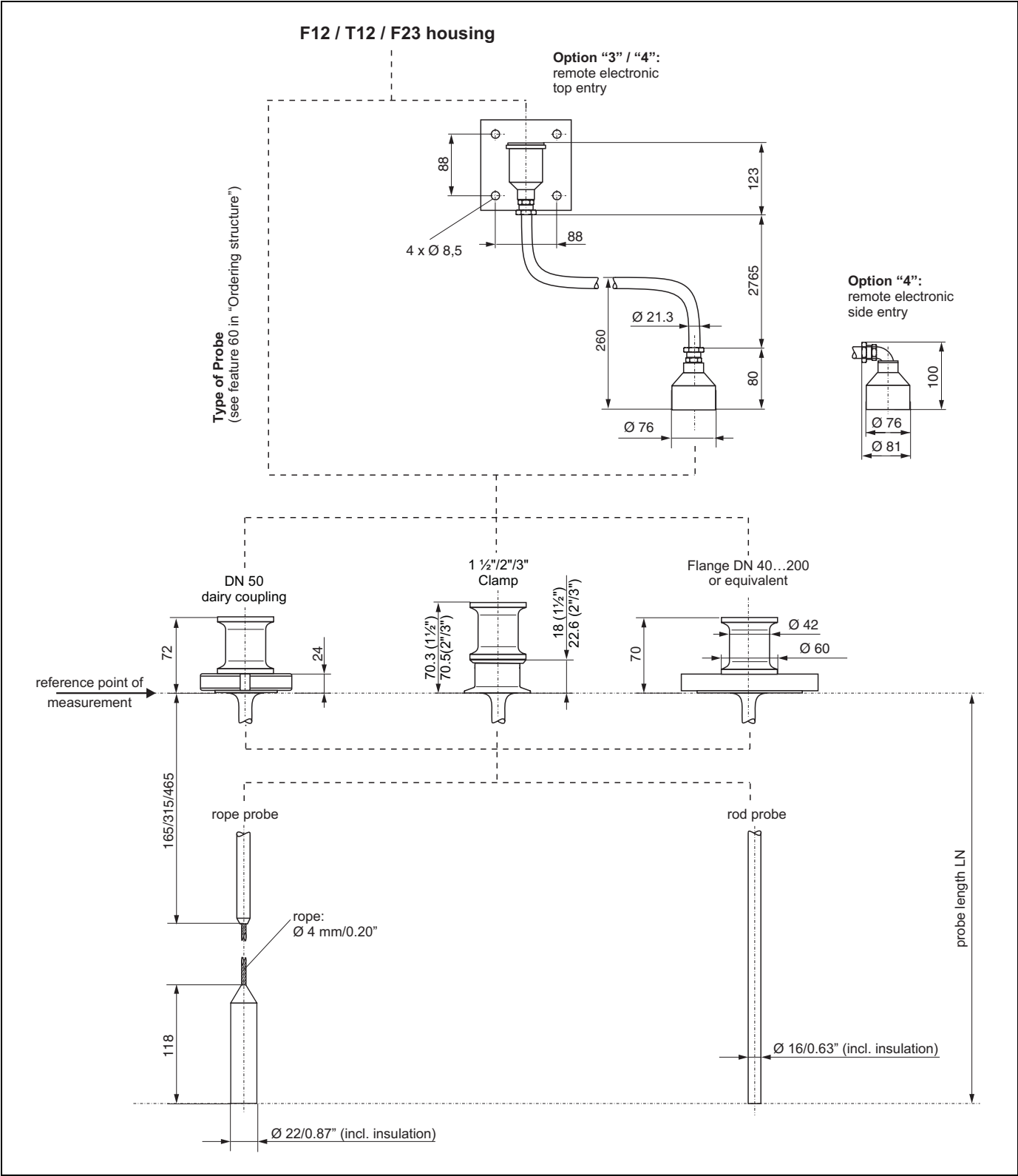
3.2 Installation conditions

3.2.1 Dimensions

Housing dimensions



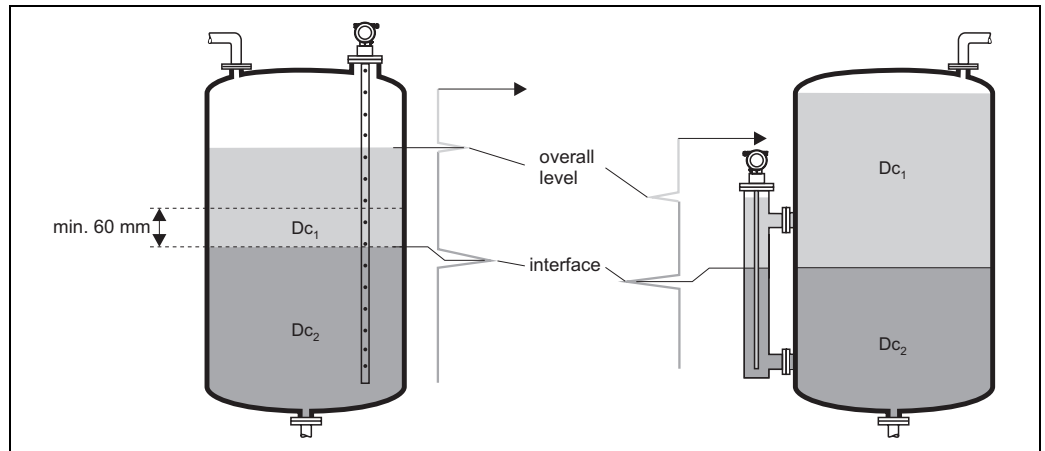
Process connection, type of probe



100-FMP41xxx-00-00-00-en-001

3.3 General information on interface measurement

The Levelflex M with the "interface" electronics version is the ideal solution for measuring interfaces. The device measures variable interfaces and variable total levels simultaneously.



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In addition, the following general conditions must be observed for interface measurement:

- The DC of the upper medium must be known and constant. The DC can be determined with the aid of the DC manual CP00019F/00/EN. In addition, it is also possible to calculate the DC automatically in FieldCare if the interface thickness is available and known.
- The DC of the upper medium may not be greater than 10.
- The DC difference between the upper medium and lower medium must be >10 .
- The interface must have a minimum thickness of 60 mm.
- Emulsion layers in the vicinity of the interface can severely dampen the signal. However, emulsion layers up to 50 mm are permitted.
- The measuring range for interface measurement is limited to 10 m. Larger measuring range available on request.

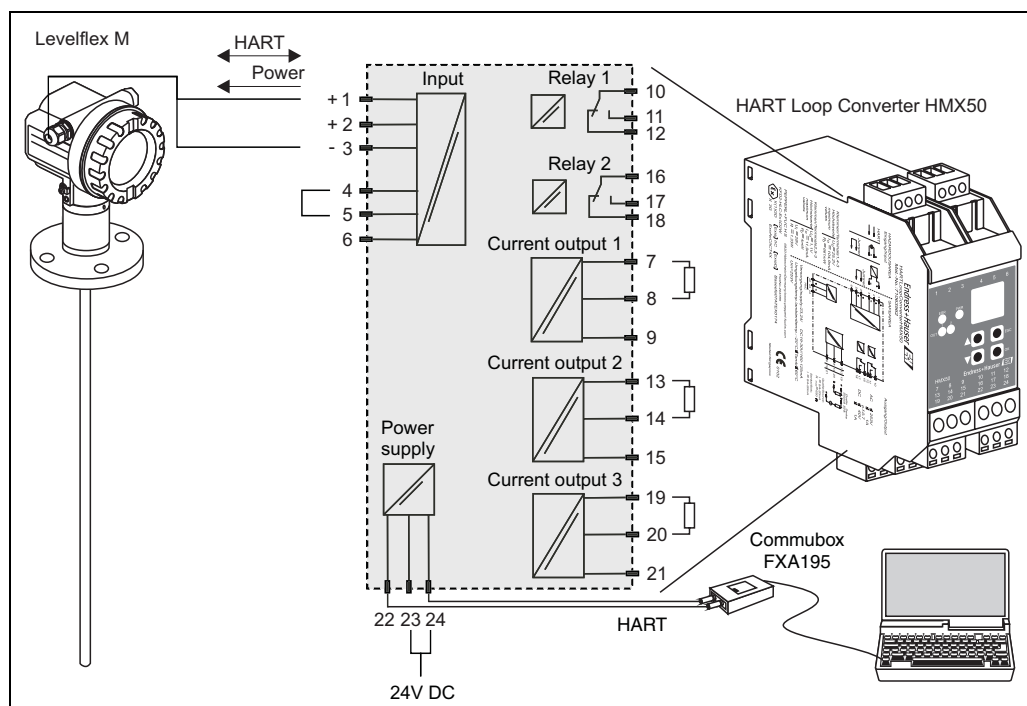
3.3.1 Electronics

The process variables are output using the dynamic variables of the HART protocol. The process variables can be flexibly assigned to the dynamic variables (primary, secondary, tertiary, quaternary value).

Dynamic variables of the HART protocol	Possible process variable assignment	Comment
Primary value (PV)	<ul style="list-style-type: none"> ■ Interface (default) ■ Total level ■ Thickness of the upper medium (upper phase) 	The "primary value" is permanently assigned to the 4 to 20 mA current output
Secondary value (SV)	<ul style="list-style-type: none"> ■ Total level (default) ■ Interface ■ Thickness of the upper medium (upper phase) 	—
Tertiary value (TV)	<ul style="list-style-type: none"> ■ Thickness of the upper medium (upper phase) (default) ■ Interface ■ Total level ■ Amplitude of the total level signal 	—
Quaternary (4 th) value (QV)	Amplitude of the interface level signal	No variable assignment

3.3.2 Using the HART loop converter HMX50

The dynamic variables of the HART protocol can be converted into individual 4 to 20 mA sections using the HART loop converter HMX50. The variables are assigned to the current output and the measuring ranges to the individual parameters in the HMX50.



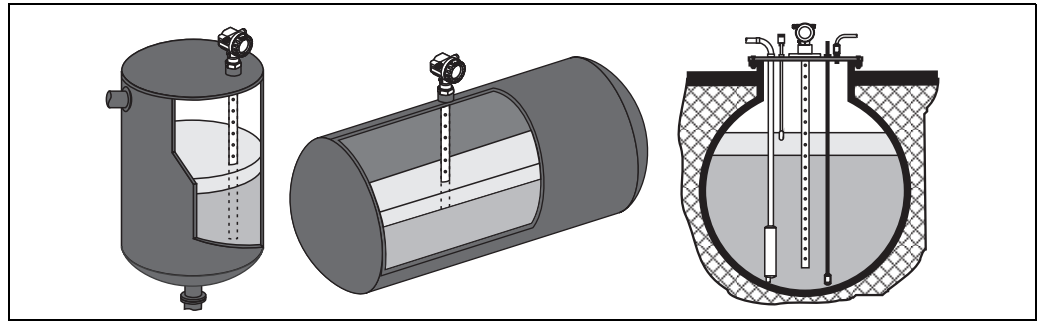
Connection diagram for HART loop converter HMX50 (example: passive 2-wire device and current outputs connected as power source)

The HART loop converter HMX50 can be acquired using the order number 71063562.
Additional documentation: TI00429F/00/EN and BA00371F/00/EN.

3.4 Special information on interface measurement

3.4.1 Installation in horizontal cylindrical, upright and underground tanks

- Use rod probes in the bypass/stilling well.
- Any distance from the wall is possible for rod probes in the stilling well. Contact with the wall must be ruled out.



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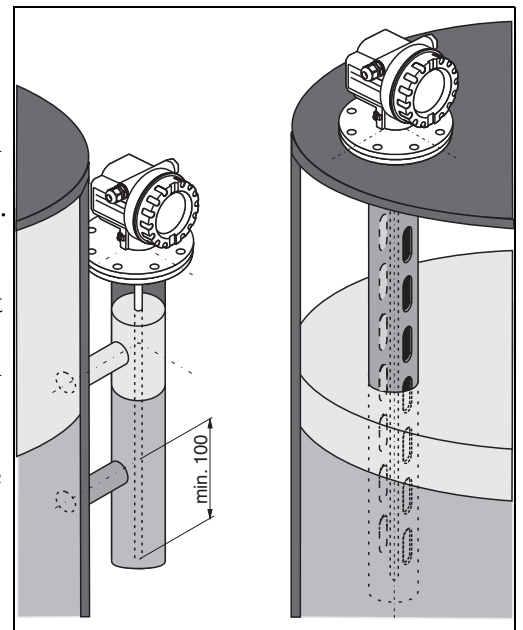
3.4.2 Installation in stilling well or bypass

- A rod probe can be used for pipe diameters bigger than 40 mm.
- Rod probe installation can take place up to a diameter size of 100 mm.
- Welded joints that protrude up to approx. 5 mm inwards do not affect the measurement.
- The pipe may not exhibit any steps in diameter.
- If a rod probe is used the probe length must be 100 mm longer than the lower disposal.
- In the case of rod probes, it must be ensured that the probe does not come into contact with the wall. If necessary, use a centering disk at the end of the probe.



Note!

A plastic centering disk has to be used for interface measurement ("Accessories", → 54).



100-FMP41rx-17-00-00-zx-003



Note!

Rope and rod probes can only be freely installed in the tank under certain circumstances – please contact your Endress+Hauser office.

3.5 Installation instructions

3.5.1 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

3.5.2 Minimum distance between the probe and the tank wall:

Any distance from the wall is allowed as long as the probe does not come into contact with the tank wall.



Note!

- When installing in plastic tanks, there should be no metal parts or movement of people outside the tank at a distance of 300 mm from the probe.
- Fouling or high-viscosity media should not create bridges to the wall.

3.5.3 Type of probe installation

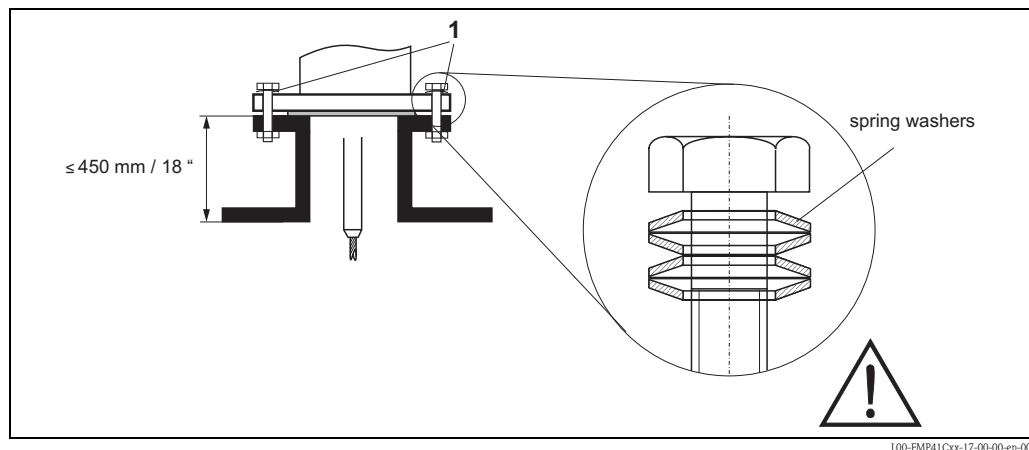
- When installing in plastic tanks, the nozzle must have at least DN50 (2"). The appropriate flange must be used as the process connection.
- For nozzles up to 450 mm high, select the length of the centering rod appropriate for the nozzle height when using rope probes.
- Use spring washers (1) (see Figure).



Note!

It is recommended to retighten the securing screws at regular intervals, depending on the process temperature and pressure. Recommended torque: 60 to 100 Nm.

- After mounting, the housing can be turned 350° to make it easier to access the display and the connection compartment.



Note!

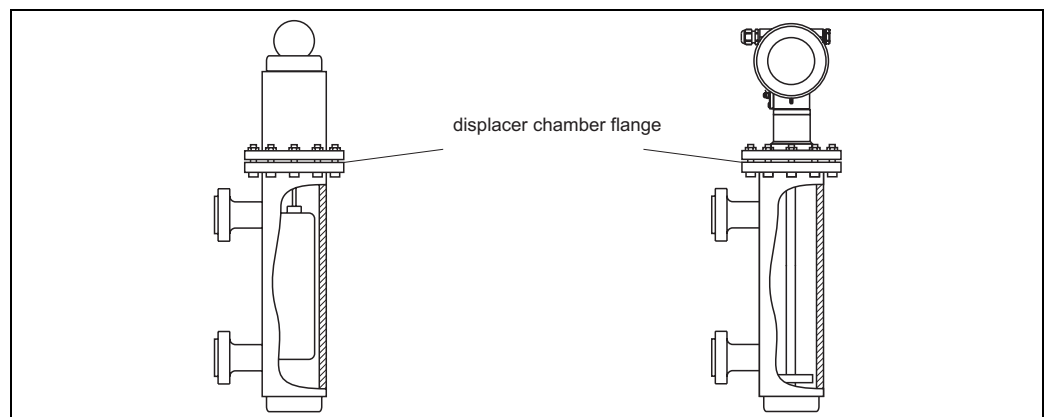
The PTFE plating of the FMP41C is used for sealing to the process. Usually no other sealing is necessary.

3.5.4 Replacing a displacement system in an existing displacer chamber

The Levelflex M is a perfect replacement for a conventional displacer system in an existing displacer chamber. In addition to the DIN and ANSI flanges, which are available as standard, Endress+Hauser also offers flanges that suit Fischer and Masoneilan displacer chamber (special product) for this purpose. Thanks to menu-guided local operation, commissioning the Levelflex M only takes a few minutes. Replacement is also possible when partially filled, and wet calibration is not required.

Your benefits:

- No moving parts, thus zero-maintenance operation.
- Not sensitive to process influences such as temperature, density, turbulence and vibrations.



100-FMP41cx-17-00-00-en-002

Planning instructions:

- In normal cases, use a rod probe. When installing into a metal displacement housing up to 150 mm (100 mm for interface), you have all the advantages of a coax probe.
- It must be ensured that the probe does not come into contact with the side wall.

Additional information on interface measurement:

- The pipe may not exhibit any steps in diameter.
- In the case of rod probes, it must be ensured that the probe does not come into contact with the wall. If necessary, use a centering disk at the end of the probe.



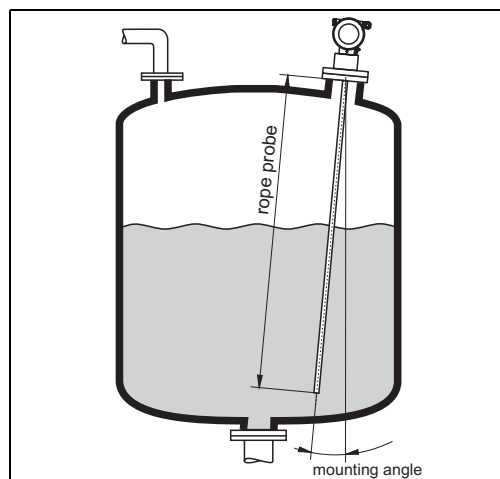
Note!

A plastic centering disk has to be used for interface measurement ("Accessories", → 54).

3.5.5 Notes on special mounting situations

Installation at an angle

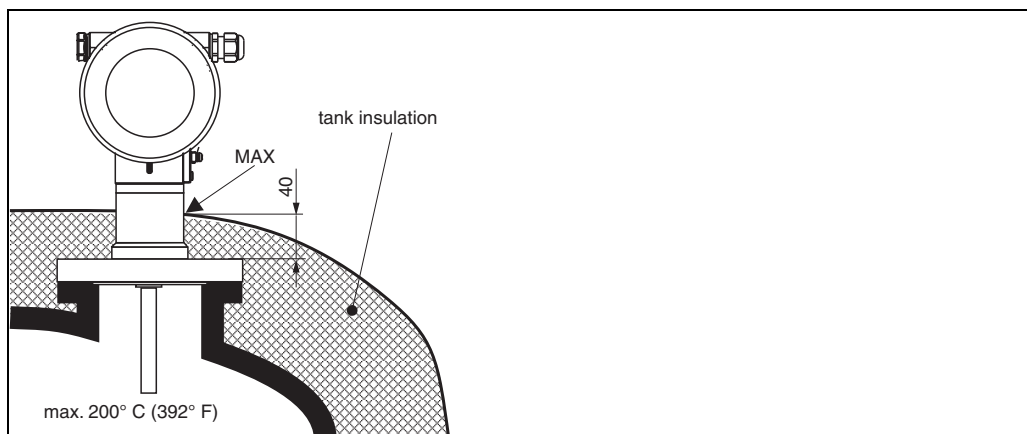
- For mechanical reasons, rod probes should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
 - Up to 1 m = 30°
 - Up to 2 m = 10°
 - Up to 4 m = 5°



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3.5.6 Installing with heat insulation

- If process temperatures are high, FMP41C must be included in normal tank insulation to prevent the electronics heating up as a result of thermal radiation or convection.
- The insulation may not go beyond the points labeled "**MAX**" in the drawing.




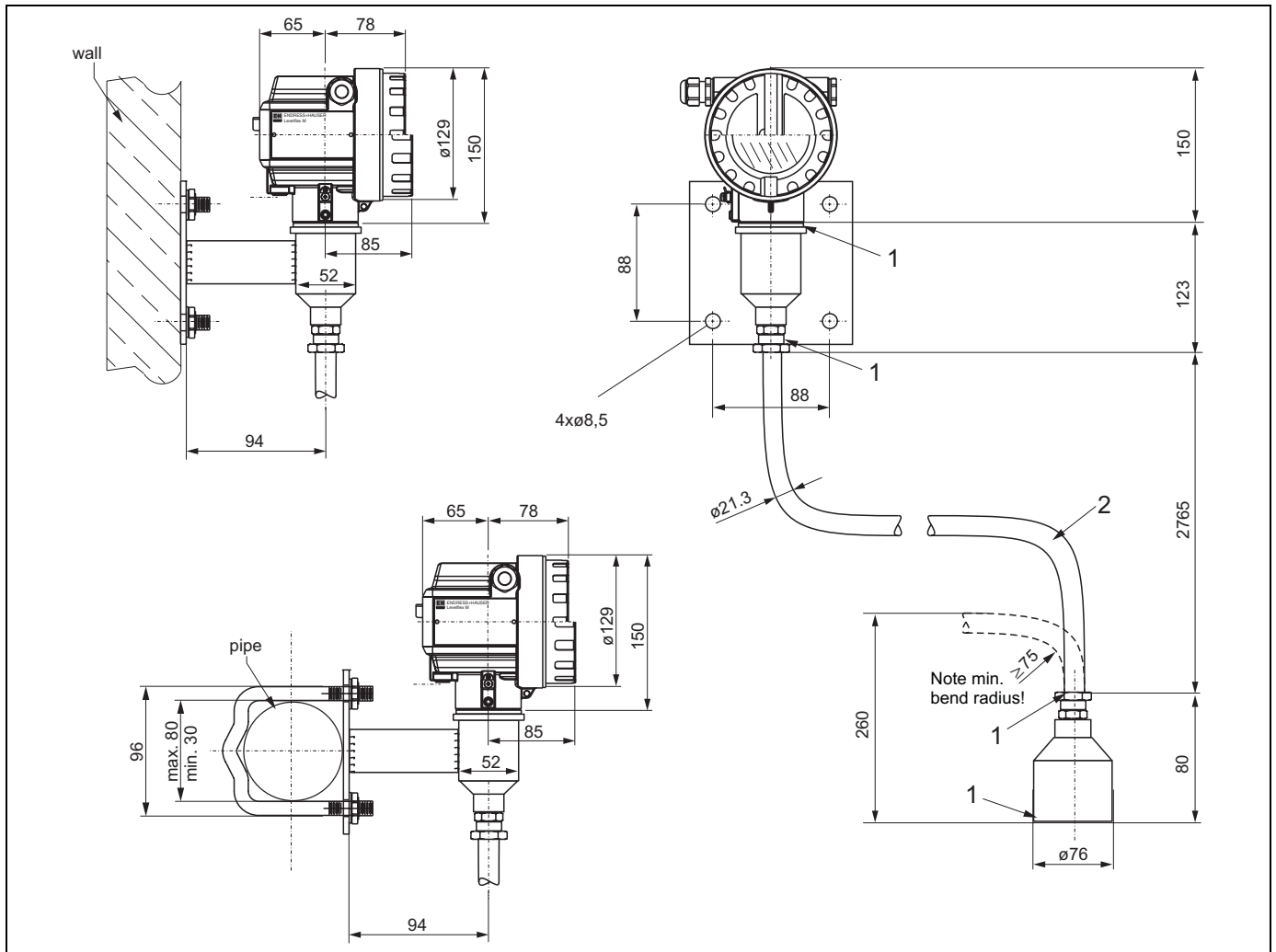
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Process connection with flange DN40 to DN100

3.5.7 Installation with hard-to-reach process connections

Installation with remote electronics

- Wall and pipe bracket is contained in the scope of delivery and already mounted.
- When installing, please observe the instructions, →  17.
- Mount housing on a wall or pipe (vertically or horizontally) as shown in the diagram.



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Note!

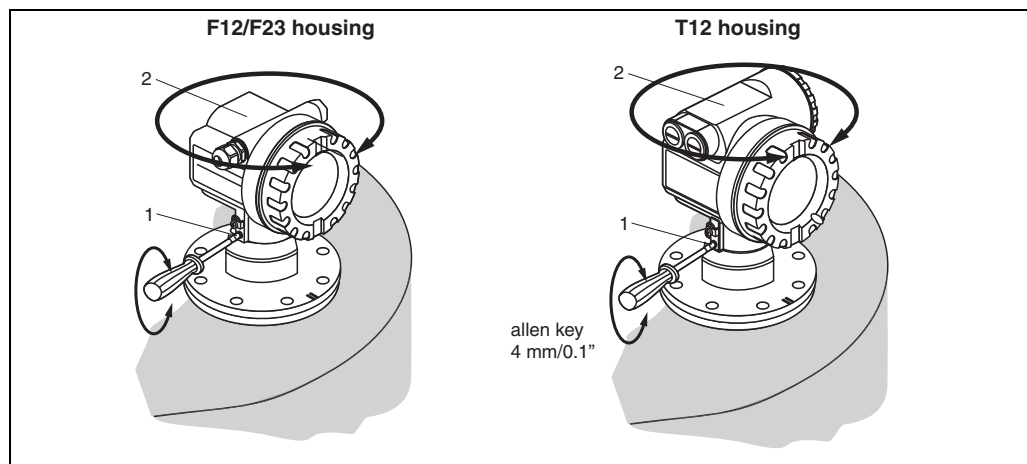
The protective hose cannot be disassembled at these points (1).

The ambient temperature for the connecting pipe (2) between the probe and the electronics must not exceed 105°C. The version with remote electronics consists of the probe, a connecting cable and the housing. If they are ordered as a complete unit they are assembled when delivered.

3.5.8 Turning the housing

After mounting, you can turn the housing 350° in order to make it easier to access the display and the connection compartment. Proceed as follows to turn the housing to the required position:

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



L00-FMP41Cxx-17-00-00-en-002

3.6 Post-installation check

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

- Is the measuring device damaged (visual inspection)?
- Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range, etc.?
- Are the measuring point number and labeling correct (visual inspection)?
- Is the measuring device adequately protected against rain and direct sunlight (→ 54)?

4 Wiring

4.1 Quick wiring guide

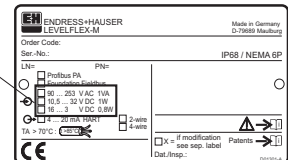
Wiring in F12/F23 housing



Before connection please note the following:

Caution!

- The power supply must be identical to the data on the nameplate (1).
- Switch off power supply before connecting up the device.
- Connect Equipotential bonding to transmitter ground terminal (7) before connecting up the device.
- Tighten the locking screw (8):
It forms the connection between the probe and the housing ground potential.

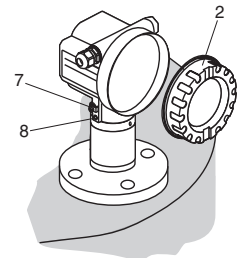


When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's).
Make sure you use the specific cable gland.



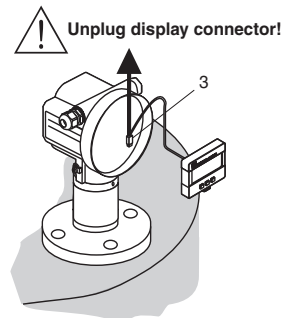
On devices supplied with a certificate, the explosion protection is designed as follows:

- Housing F12/F23 - Ex ia:
Power supply must be intrinsically safe (not for dust-Ex).
- The electronics and the current output are galvanically separated from the probe circuit.



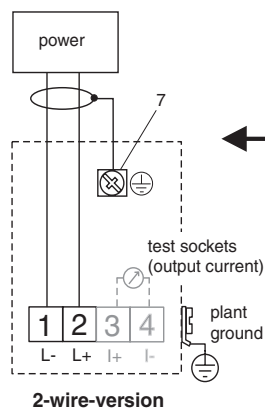
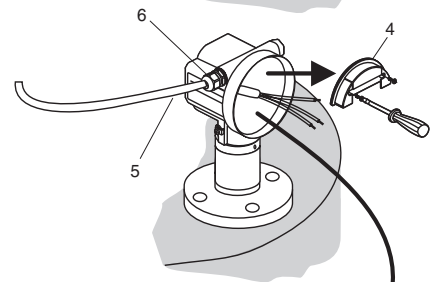
Connect up the Levelflex M as follows:

- 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" (only 2-wire).
 - Insert cable (5) through gland (6).
- A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).




Only ground screening of the line (7) on sensor side.

- Make connection (see pin assignment).
- Re-insert terminal module.
- Tighten cable gland (6). Max. torque 10...12 Nm!
- Tighten screws on cover plate (4).
- Insert display if fitted.
- Screw on housing cover (2).
(on dust-Ex torque \approx 40 Nm).
- Switch on power supply.

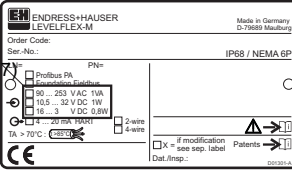


100-EMP41Cix-04-00-00-en-001


Wiring in T12 housing

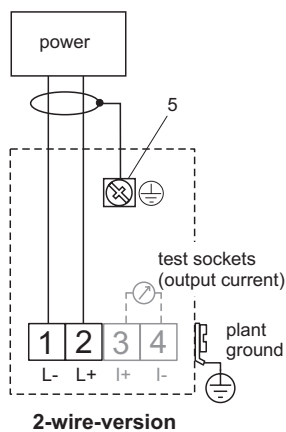
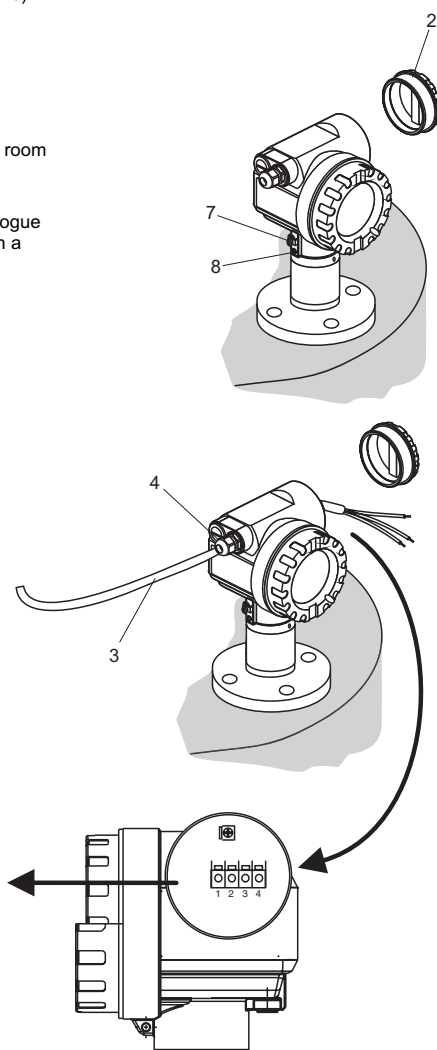
 **Caution!** Before connection please note the following:

- The power supply must be identical to the data on the nameplate (1).
- Switch off power supply before connecting up the device.
- Connect Equipotential bonding to transmitter ground terminal (8) before connecting up the device.
- Tighten the locking screw (8): It forms the connection between the probe and the housing ground 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 Levellflex M as follows:
- Before unscrew housing cover (2) at separate connection room turn off the power supply!
- Insert cable (3) through gland (4).
A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).
 - On ground screening of the line (5) on sensor side.
 - Make connection (see pin assignment).
 - Tighten cable gland (4).
Max. torque 10 to 12 Nm!
 - Screw on housing cover (2).
(on dust-Ex torquet » 40 Nm)
 - Switch on power supply.



L00-FMP41Cxx-04-00-00-en-002

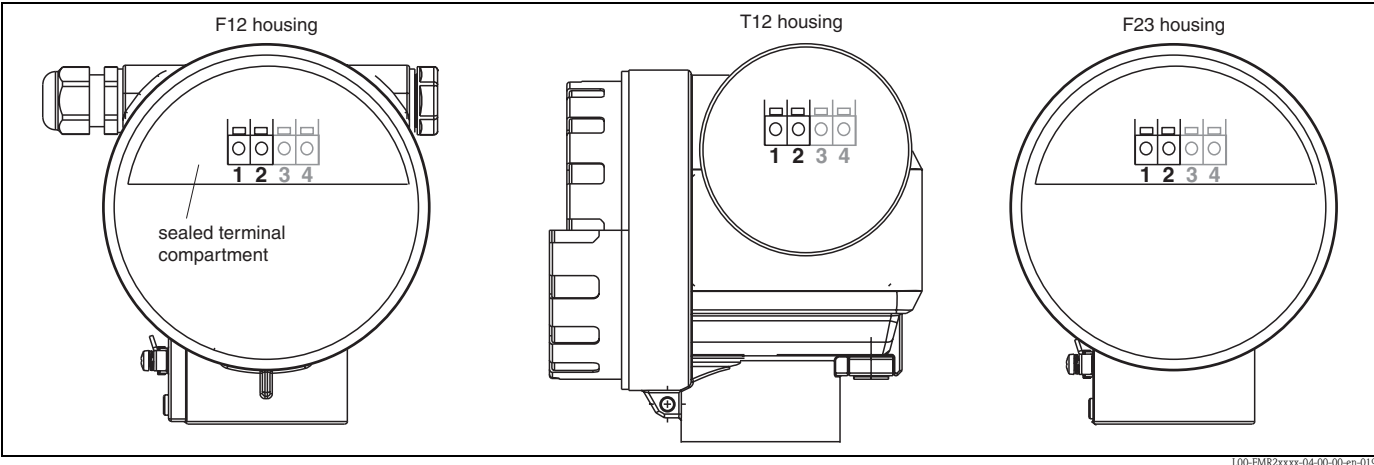
4.2 Connecting the measuring unit

Connection compartment

Three housing types are available:

- Aluminum housing F12 with additionally sealed connection compartment for:
 - Standard
 - Ex ia
- Aluminum housing T12 with separate connection compartment for:
 - Standard
 - Ex e
 - Ex d
 - Ex ia (with overvoltage protection)
- Stainless steel 316L (1.4435) housing F23 for:
 - Standard
 - Ex ia

After mounting, you can turn the housing 350° in order make it easier to access the display and the connection compartment.



The device data are given on the nameplate together with important information regarding the analog output and power supply.

Housing rotation regarding the wiring see "Turning the housing", → 20.

HART load

Minimum load for HART communication: 250 Ω

Ground connection

A good ground connection has to be made to the ground terminal on the outside of the housing in order to achieve EMC immunity.

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

Supply voltage

HART, 2-wire

All the following values are terminal voltages directly at the device:

Communication		Current consumption	Terminal voltage
HART	Standard	4 mA	16 V to 36 V
		20 mA	7.5 V to 36 V
	Ex ia	4 mA	16 V to 30 V
		20 mA	7.5 V to 30 V
	Ex em Ex d	4 mA	16 V to 30 V
		20 mA	11 V to 30 V
Fixed current, adjustable e.g. for solar power operation (measured value transmitted via HART)	Standard	11 mA	10 V to 36 V
	Ex ia	11 mA	10 V to 30 V
Fixed current for HART Multidrop mode	Standard	4 mA ¹⁾	16 V to 36 V
	Ex ia	4 mA ¹⁾	16 V to 30 V

1) Startup current 11 mA.

HART residual ripple, 2-wire: $U_{ss} \leq 200 \text{ mV}$


Current consumption

Communication	Output current	Current consumption	Power consumption
HART, 2-wire	3.6 to 22 mA ¹⁾	—	min. 60 mW, max. 900 mW

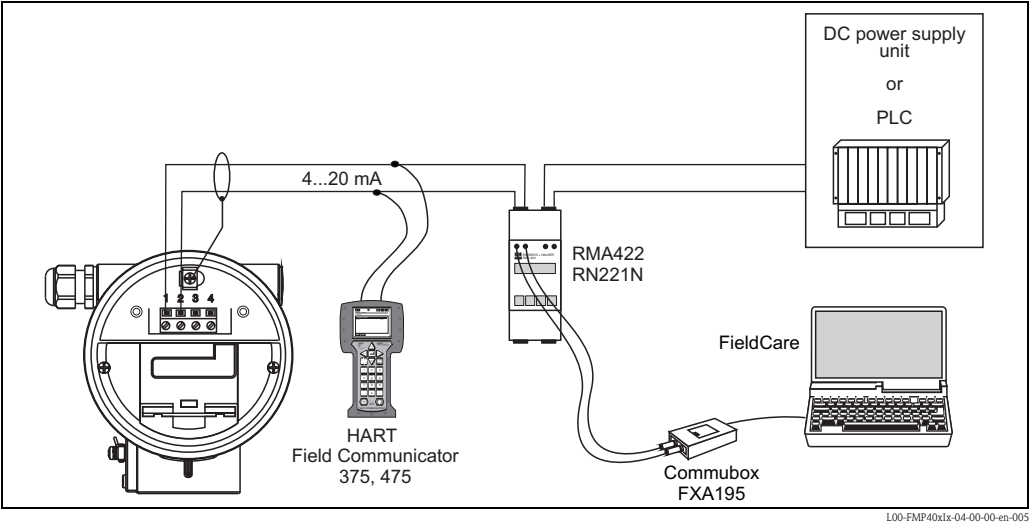
1) For HART-Multidrop: start up current is 11 mA.

Overvoltage protection

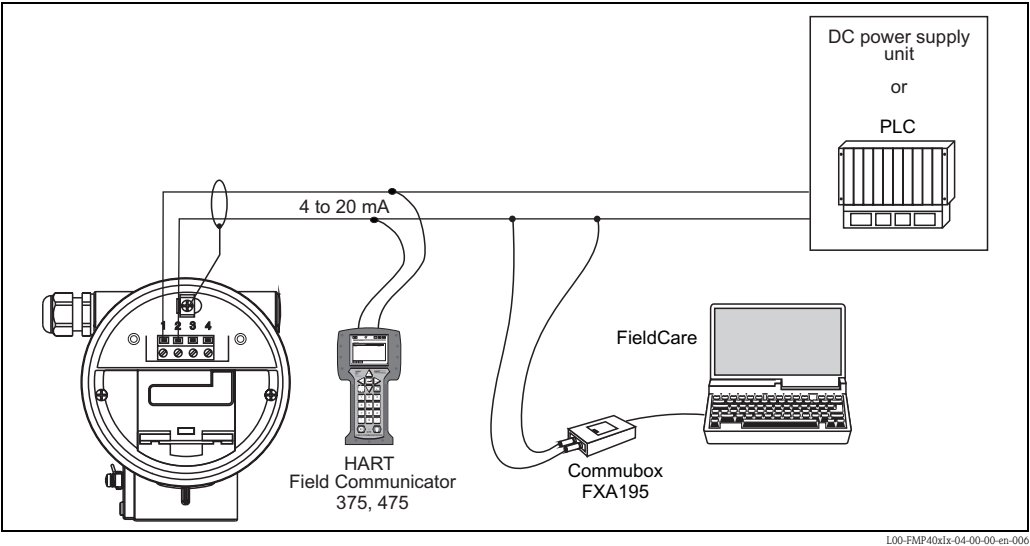
If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to EN/IEC 60079-14 or EN/IEC 60060-1 (10 kA, pulse 8/20 µs), the following applies:

- The measuring device is used with integrated overvoltage protection with 600V gas tube surge arrester in the T12 housing, refer to "Ordering structure", →  6
- or
- This protection is achieved by the use of other appropriate measures (external protection devices e.g. HAW562Z).

4.2.1 HART connection with Endress+Hauser RMA422 / RN221N



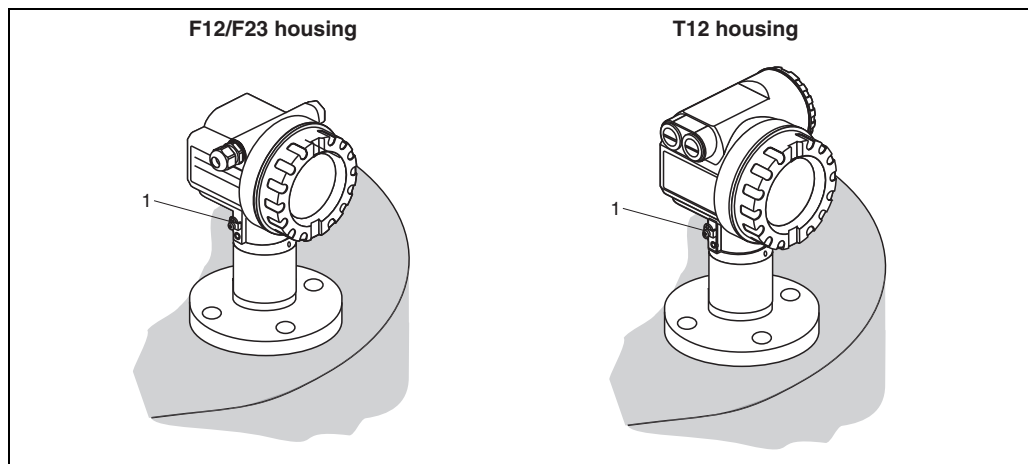
4.2.2 HART connection with other supply units



4.3 Recommended connection

4.3.1 Potential equalization

Connect the potential equalization to the external ground terminal (1) of the transmitter.



L00-FMP41Cxx-17-00-00-en-003

4.3.2 Wiring a shielded cable



Caution!

In Ex applications, the device must only be grounded on the sensor side. Further safety instructions are given in the separate documentation for applications in hazardous areas (→ 70).

4.4 Degree of protection

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

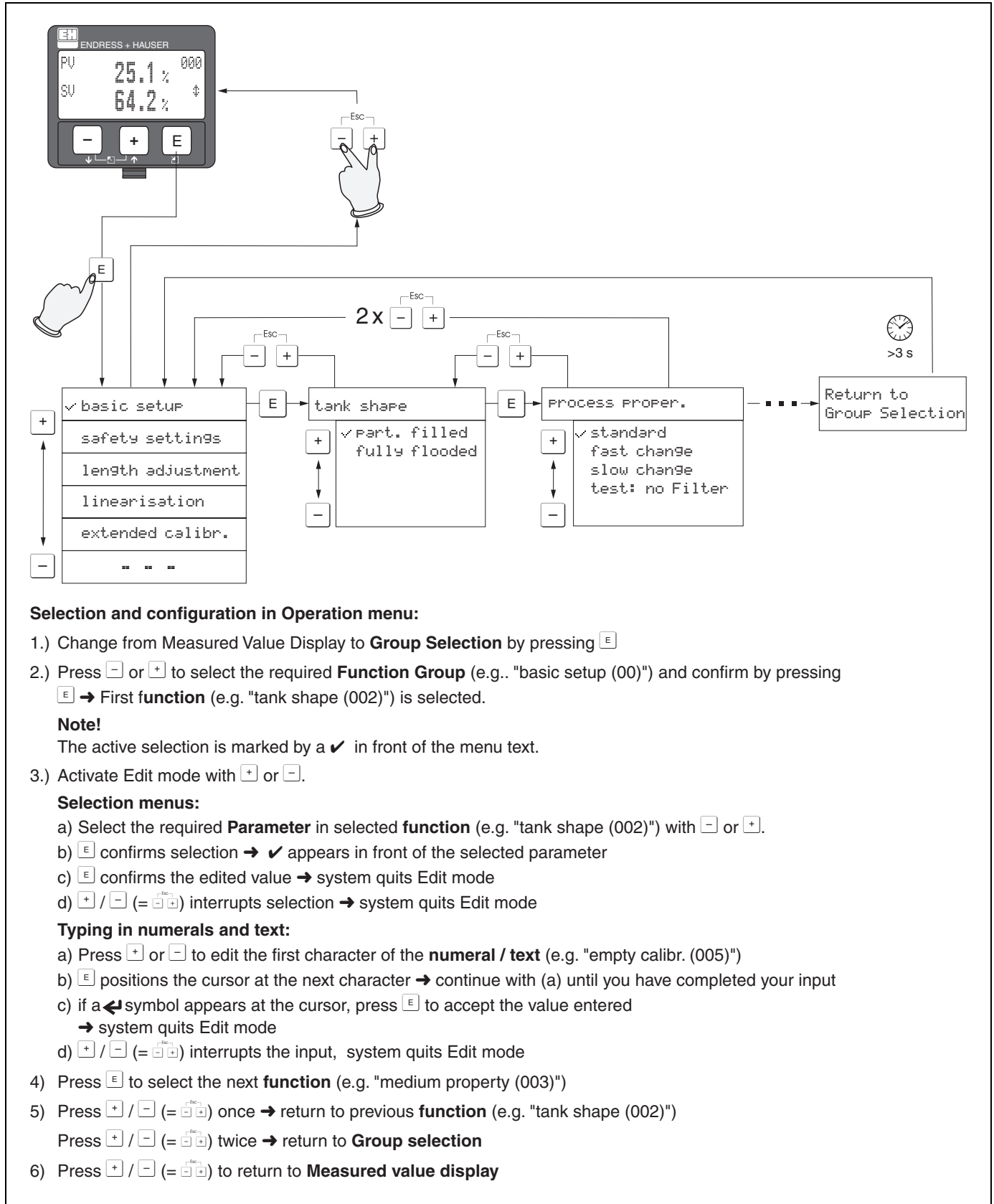
4.5 Post-connection check

After wiring the measuring device, perform the following checks:

- Is the terminal assignment correct (→ 23)?
- Is the cable gland tight?
- Is the housing cover screwed tight?
- If power is supplied:
 - Is the device ready for operation and is the liquid crystal display lit?

5 Operation

5.1 Quick operation guide



5.1.1 General structure of the operating menu

The operating menu is made up of two levels:

■ **Function groups (00, 01, 03, ..., 0C, 0D):**

The individual operating options of the device are split up roughly into different function groups. The function groups that are available include: "Basic Setup", "Safety Settings", "Output", "Display", etc.

■ **Functions (001, 002, 003, ..., 0D8, 0D9):**

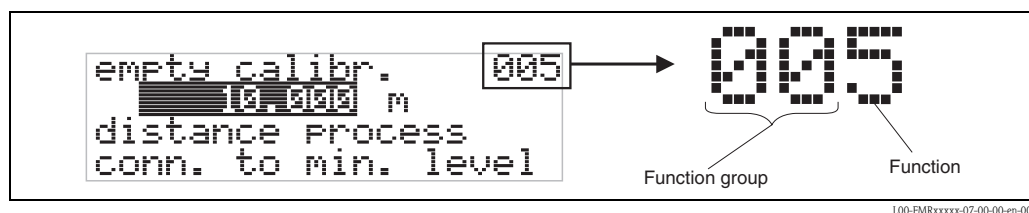
Each function group consists of one or more functions. The functions perform the actual operation or configuration of the device. Numerical values can be entered here and parameters can be selected and saved. The functions available for the "Basic Setup" (00) function group include: "Tank Properties" (002), "Process Cond." (004), "Empty Calibr." (005), etc.

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

1. Select the "Basic Setup" (00) function group.
2. Select the "Tank Properties" (002) function (where the tank level is selected).

5.1.2 Identifying the functions

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



The first two digits identify the function group:

- Basic setup 00
- Safety Settings 01
- Length Adjustment 02

...

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

- Basic setup 00 → ■ Tank Properties 002
- Process Properties 004

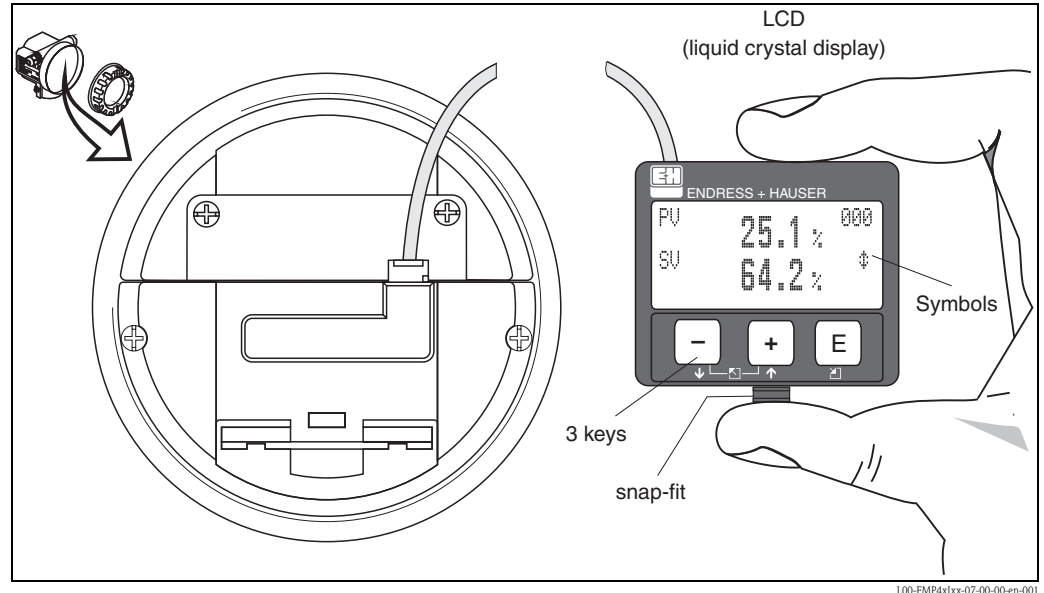
...

In the following section, the position is always indicated in brackets (e.g. "Tank Properties" (002)) after the function described.

5.2 Display and operating elements

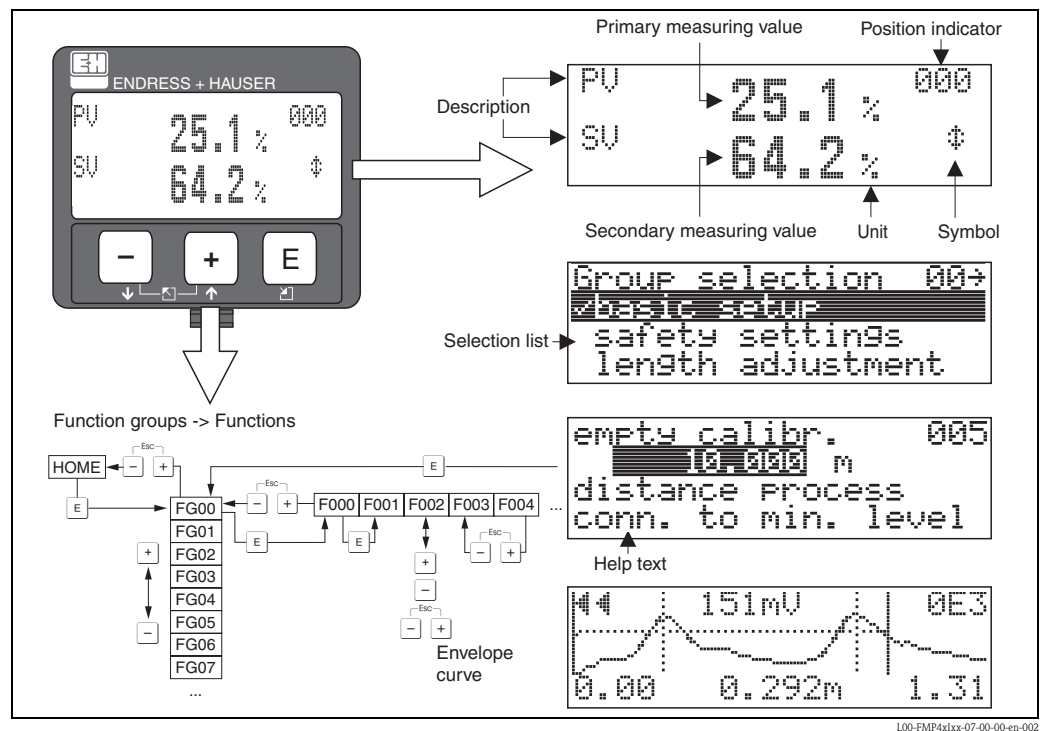
5.2.1 Liquid crystal display (LCD)

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






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



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 condition. 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 data transmission via 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 picklist. Edit the numeric values within a function.
 or 	Navigate downwards in the picklist. Edit the numeric values 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 locking/unlocking Following hardware locking, it is not possible to operate the device via the display or communication! Unlocking can only be performed via the display. A release code must be entered to do so.

5.3 Local operation




5.3.1 Locking of the configuration mode





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

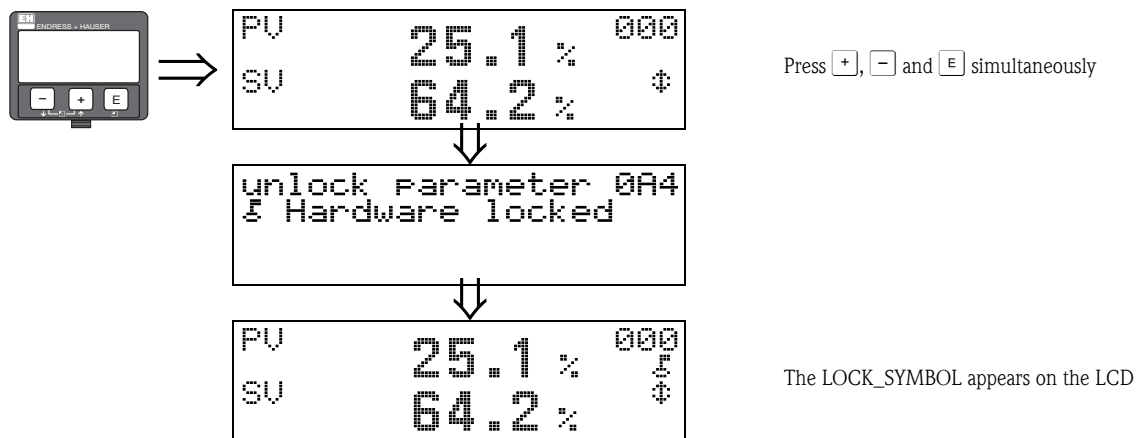
Function "Unlock Parameter" (0A4):

A value ≤ 100 (e.g. 99) must be entered in the "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 locking:

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 here. All parameters can be displayed even if the device is locked.



5.3.2 Unlocking the configuration mode

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

Function "Unlock Parameter" (0A4):

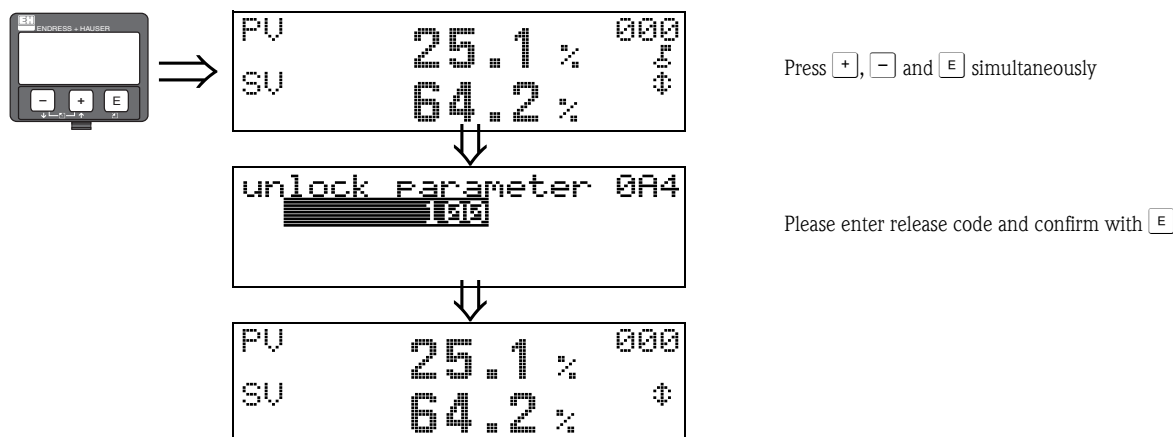
The Levelflex is released for operation by entering the release code (on the display or via communication)

100 = for HART devices

Hardware unlocking:

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

100 = for HART 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)

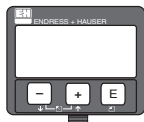


Caution!

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



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

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

- 333 = customer parameters

333 = reset customer parameters

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

- The Levelflex is reset to the default values.
- **Customer-specific interference echo suppression is not deleted.**
- The mapping can be deleted in the "Cust. Tank Map" (055) function of the "Extended Calibr" (05) function group.
- A linearization is switched to "Linear" although the table values are retained. The table can be reactivated in the "Linearization" (04) function group.

List of functions that are affected by a reset:







- | | |
|--------------------------|-----------------------------|
| ■ Tank Properties (002) | ■ Max. Scale (046) |
| ■ Medium Propert. (003) | ■ Diameter Vessel (047) |
| ■ Process Proper. (004) | ■ Range of Mapping (052) |
| ■ Empty Calibr. (005) | ■ Start Mapping (053) |
| ■ Full Calibr. (006) | ■ Offset (057) |
| ■ Installation (007) | ■ Output Damping (058) |
| ■ Outp. on Alarm (010) | ■ Low Output Limit (062) |
| ■ Outp. on Alarm (011) | ■ Current Output Mode (063) |
| ■ Outp. Echo Loss (012) | ■ Fixed Curr. Value (064) |
| ■ Delay Time (014) | ■ 4mA Value (068) |
| ■ Safety Distance. (015) | ■ Language (092) |
| ■ In Safety Dist. (016) | ■ Back to Home (093) |
| ■ Probe (032) | ■ Format Display (094) |
| ■ PV Assignment (035) | ■ No of Decimals (095) |
| ■ SV Assignment (036) | ■ Sep. Character (096) |
| ■ TV Assignment (037) | ■ Display Layout (098) |
| ■ Level/Ullage (040) | ■ Unlock Parameter (0A4) |
| ■ Linearization (041) | ■ Application Param. (0A8) |
| ■ Customer Unit (042) | ■ Medium Propert. 2 (018) |
- The mapping can be deleted in the "Cust. Tank Map" (055) function of the "Extended Calibr" (05) function group.
 - A complete "Basic Setup" (00) must be performed.

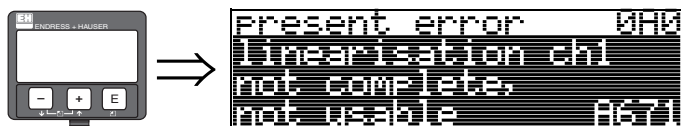
5.4 Displaying and acknowledging error messages

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 the following 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, →  58)
- **W (Warning):**
Device continues measuring, error message is displayed.
Indicated by a flashing  symbol.
(For a description of the codes, →  58)
- **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, →  58)



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, →  58.

- The "**Diagnostics**" (0A) function group can display the current error as well as the last error that occurred.
- If several errors are pending, use  or  to scroll through the error messages.
- The last error to occur can be deleted in the "**Diagnostics**" (0A) function group "**Clear Last. Error**" (0A2) function.

5.5 HART communication

Apart from local operation, you can also configure the measuring device and view measured values by means of the HART protocol. There are two options available for operation:

- Operation via the Field Communicator 375, 475.
- Operation via the personal computer (PC) using an operating program (e.g. FieldCare: for connection, → 25).

5.5.1 Operation with the Field Communicator 375, 475

With the Field Communicator 375, 475 handheld terminal, you can configure all the device functions via menu operation.



Note!

Further information on the HART handheld terminal is given in the appropriate Operating Instructions included in the carrying case of the Field Communicator 375, 475.

5.5.2 Endress+Hauser operating program

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

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

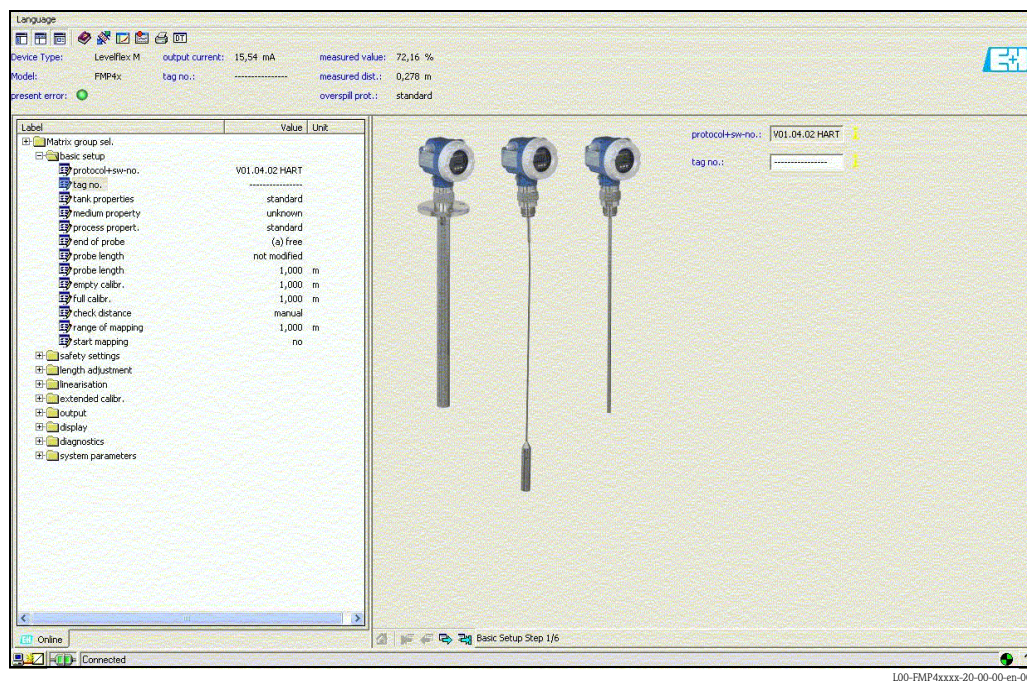
FieldCare supports the following functions:

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

Connection options:

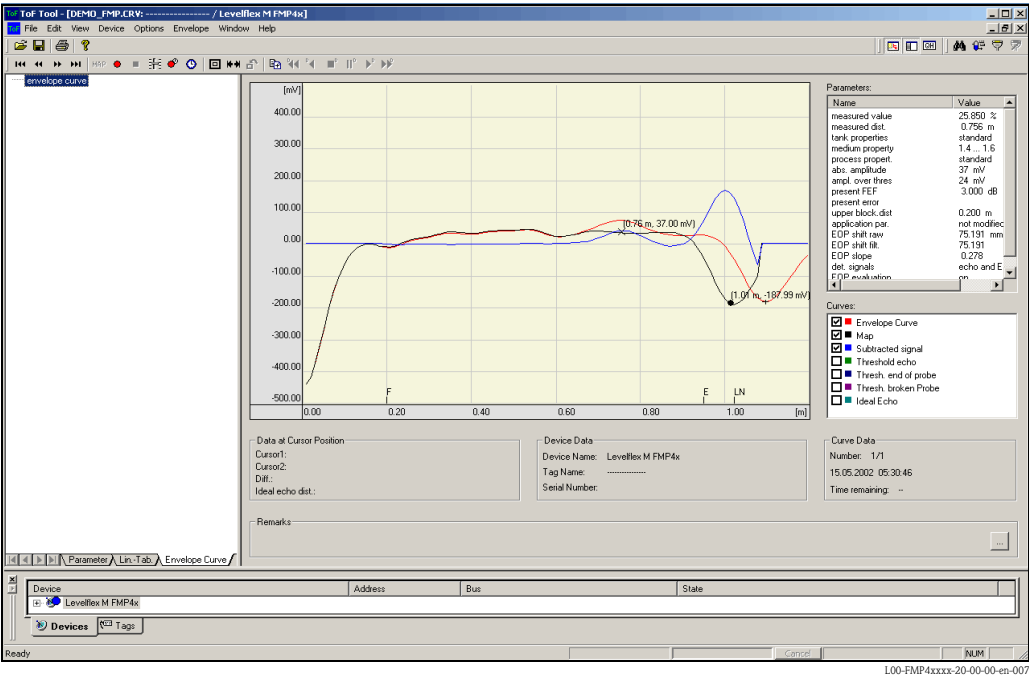
- HART via Commubox FXA195 and the USB port of a computer
- Commubox FXA291 with ToF Adapter FXA291 via service interface.

Menu-guided commissioning

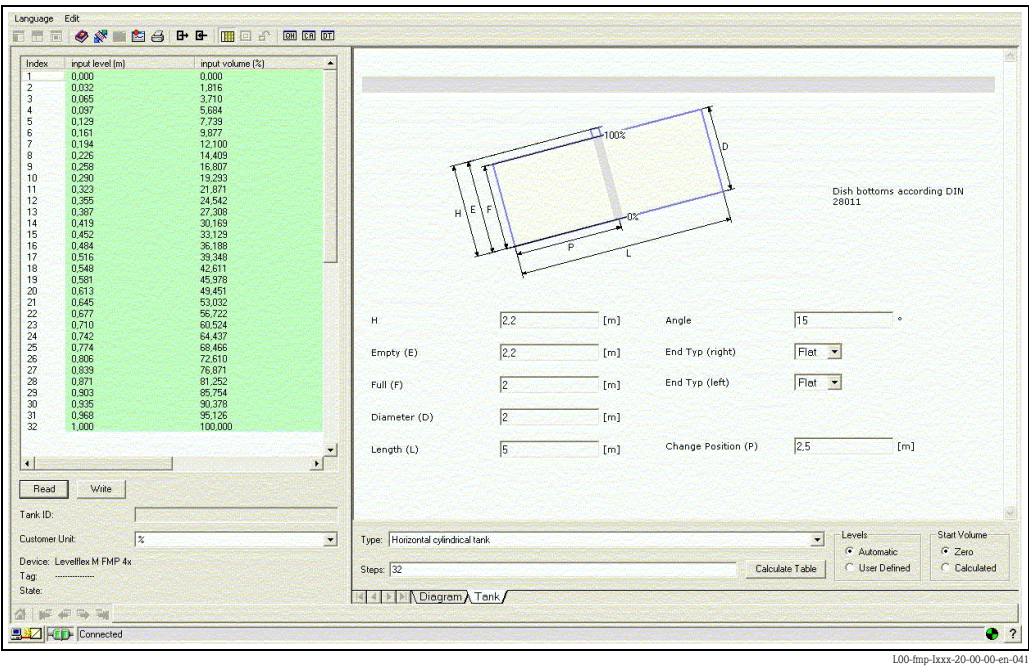


100-FMP4xxxx-20-00-00-en-001

Signal analysis via envelope curve



Tank linearization



6 Commissioning

6.1 Function check

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

- Checklist "Post-installation check", → 20.
- Checklist "Post-connection check", → 26.

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)

```
PV 25.1 % 000
SV 64.2 % 0
```

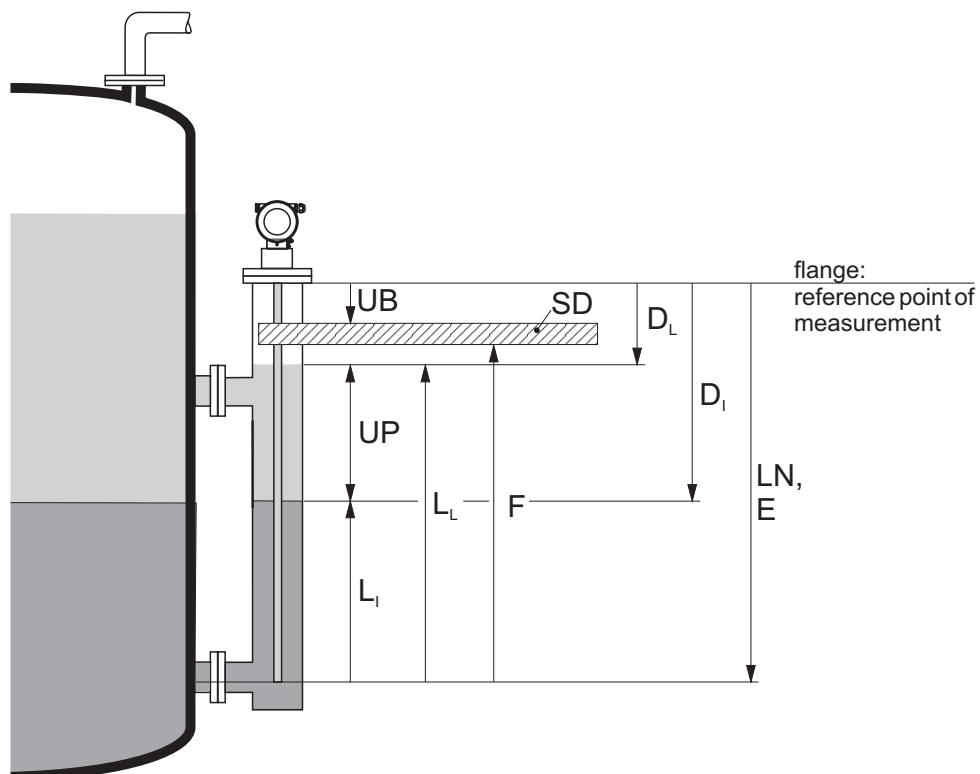
The current measured values PV (interface layer) and SV (level) are displayed in the standard settings.

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

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

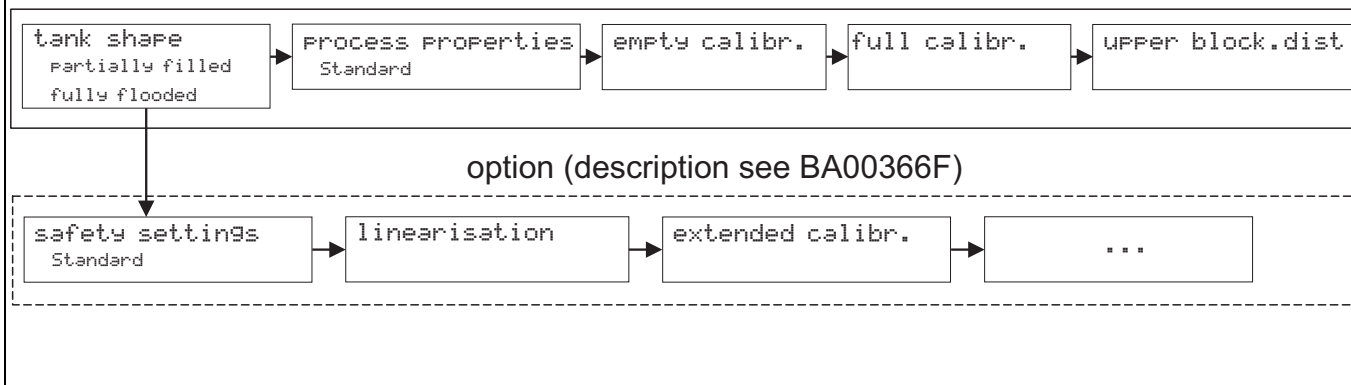
This selection enables you to perform the basic setup

6.3 Basic setup



- E = empty calibr. (= zero) - setting in 005
- F = full calibr. (= span) - setting in 006
- D_I = distance interface (distance flange / DK_2) - display in 0A6
- L_I = level interface (distance probe end / DK_1) - display in 0A5
- D_L = distance complete level - display in 0A5
- L_L = level complete - display in 0A6
- LN = probe length - setting in 033
- UB = upper blocking distance - setting in 059
- UP = thickness upper medium
- SD = safety distance - setting in 015

basic setup (standard)



L00-FMP41cx-19-00-00-en-001



Caution!

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

The Levellflex is precalibrated 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 models with a current output, the factory adjustment for zero point "E" and span "F" is 4 mA and 20 mA. 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 a maximum of 32 points, which is based on a table entered manually or semi-automatically, can be activated on site or via remote operation. This function makes it possible to convert the level to volume and mass units and has a uniform effect on the interface and the total level.

Complex measuring operations necessitate additional functions that the user can use to customize the Levellflex as necessary to suit his specific requirements. The functions available to do this are described in detail in BA00366F/00/EN.

Comply with the following instructions when configuring the functions in the **"Basic Setup" (00)**:

- Select the functions as described, → 27.
- Certain functions (e.g. starting an interference echo mapping (053)) prompt you to confirm your data entries. Press **[+]** or **[-]** to select **"YES"** and press **[E]** to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group **"Display (09)"**) an automatic return is made to the home position (measured value display).



Note!

- The device continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimized.
- If the power supply fails, all preset and configured values remain safely stored in the EEPROM.
- All functions are described in detail, as is the overview of the operating menu itself, in **"BA00366F - Description of Instrument Functions"** on the enclosed CD-ROM.

6.4 Basic Setup with the VU331

Function "Measured Value" (000)

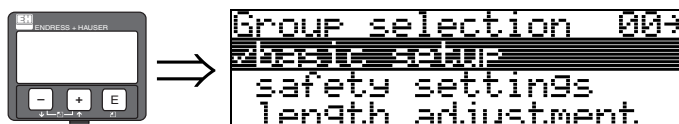


This function displays the current measured value in the selected unit (see **"Customer Unit" (042)** function). The number of digits after the decimal point can be selected in the **"No. of Decimals." (095)** function.

The standard settings for PV and SV assignment are as follows:

PV corresponds to the interface layer; SV = total level

6.4.1 Function group "Basic Setup" (00)



Function "Tank Properties" (002)



This function is used to select the tank properties.

Depending on the settings, the system searches for one (fully flooded) echo or 2 (partially filled) echoes.

Options:

- Partially Filled
- Fully Flooded

Partially Filled

The system searches for 2 signals in the measuring range. The upper signal is assigned to the total level and the lower signal to the level of the interface layer. The difference between the two levels corresponds to the thickness of the upper medium (upper phase).

Fully Flooded

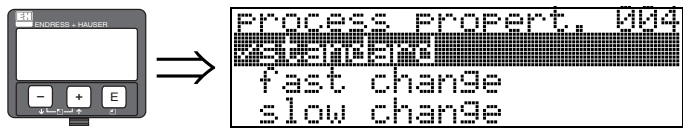
The biggest signal in the measuring range is evaluated. If the signal for the total level is within the upper blocking distance, the signal detected corresponds to the level of the interface layer. If an echo is not found, echo loss is detected.



Note!

- If "fully flooded" is selected, it is absolutely essential that the upper signal for the total level is within the upper blocking distance so that it is not evaluated incorrectly. The setting for the upper blocking distance is an integral part of the basic setup if "fully flooded" is selected.
- A change in the total level when "fully flooded" is selected impacts the accuracy.

Function "Process Propert." (004)

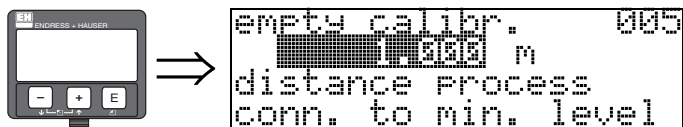


Use this function to adapt the device reaction to the filling speed in the tank. The setting influences an intelligent filter and affects the total level and interface layer level in the same way.

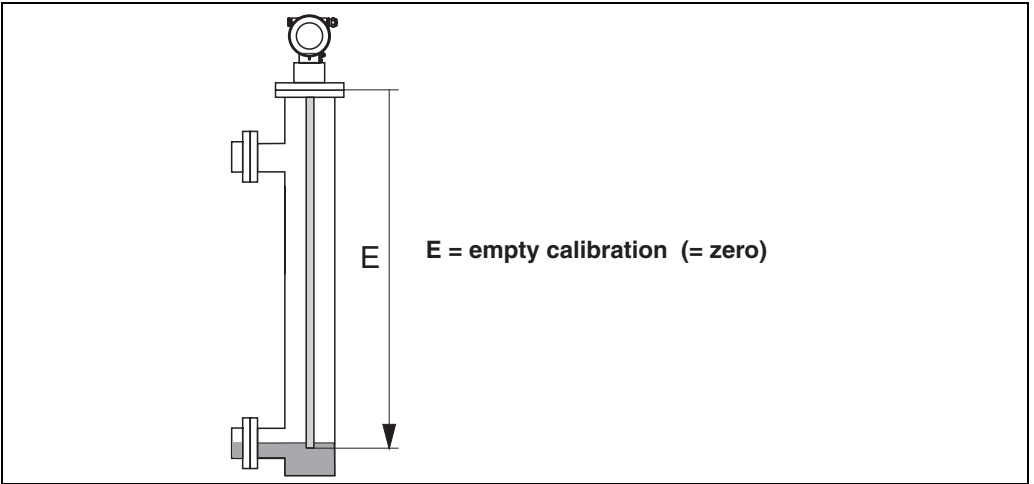
- Options:
- Standard
 - Fast change
 - Slow change
 - Test: no Filter

Options:	Standard	Fast Change	Slow Change	Test: No Filter
Application:	For all normal applications with low to medium filling speeds and sufficiently large tanks.	Small tanks, primarily with liquids, at high filling speeds.	Applications with slow to medium filling speeds.	Shortest reaction time: <ul style="list-style-type: none">■ For test purposes■ Measurement in small tanks at high filling speeds, if "Fast Change" setting is too slow.
2-wire electronics:	Dead time: 4 s Rise time: 18 s	Dead time: 2 s Rise time: 5 s	Dead time: 6 s Rise time: 40 s	Dead time: 1 s Rise time: 0 s

Function "Empty Calibr." (005)



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

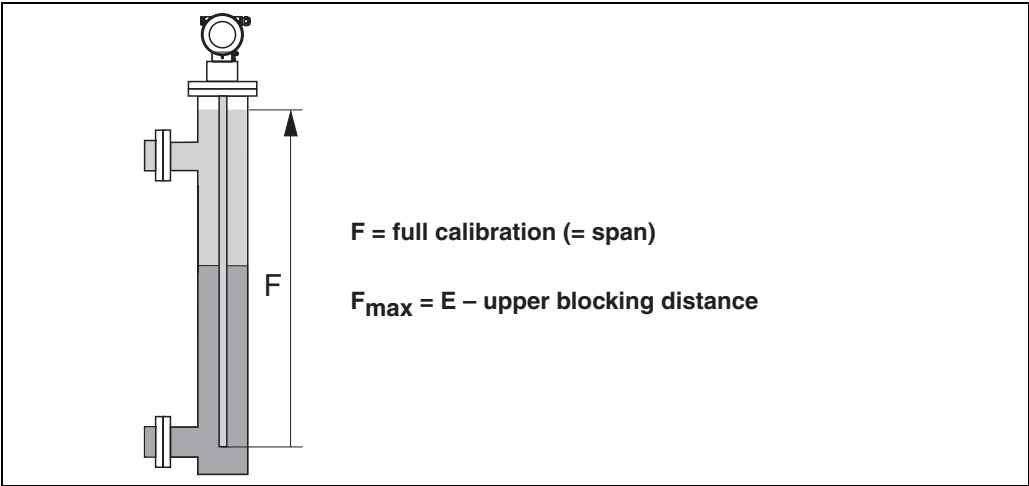


100-FMP41cx-14-00-06-en-001

Function "Full Calibr." (006)



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

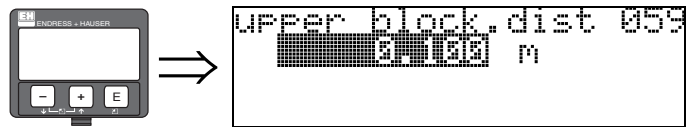


L00-FMP41cx-14-00-06-en-002



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

Function "Upper Block. Dist" (059)



For rod probes with lengths of up to 8 m, the upper blocking distance is preset to 0.2 m on delivery.

Blocking distances and measuring range depending on probe type

At the lower end of the probe, accurate measuring is not possible, see section "Maximum measured error", → 43.

FMP41C	LN [m] min	LN [m] max	UB [m] min
Rod probe in bypass	0,3	4	0,1 ¹⁾

1) The blocking distances indicated are preset.

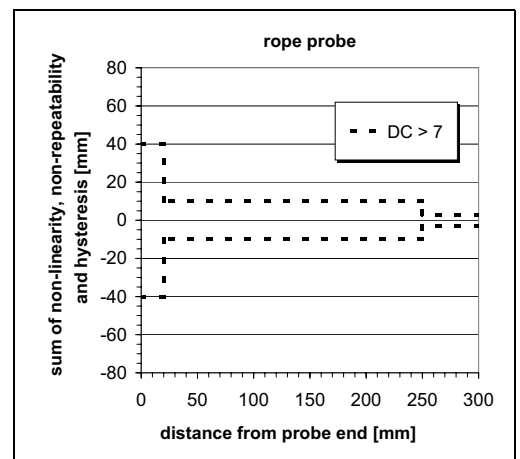
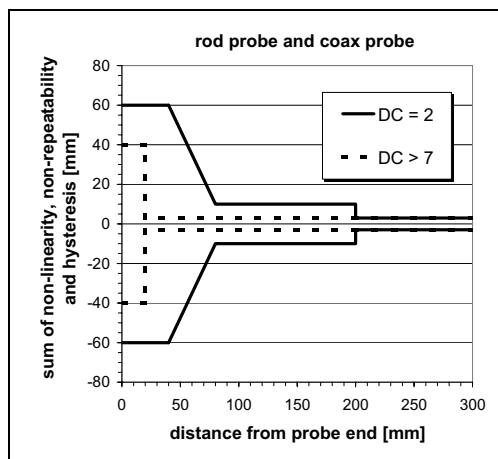
6.4.2 Maximum measured error

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

Output:	Digital	Analog
Sum of non-linearity, non-repeatability and hysteresis	Level (level and interface electronics version): FMP41C measuring range: – Up to 10 m: ± 5 mm – > 10 m: ± 0.05 % Interface (only "K" interface measurement electronics version): – Measuring range up to 10 m: ± 10 mm If the thickness of the interface is <60 mm, the interface can no longer be differentiated from the overall level such that both output signals are identical.	± 0.06 %
Offset/zero point	± 4 mm	± 0.03 %

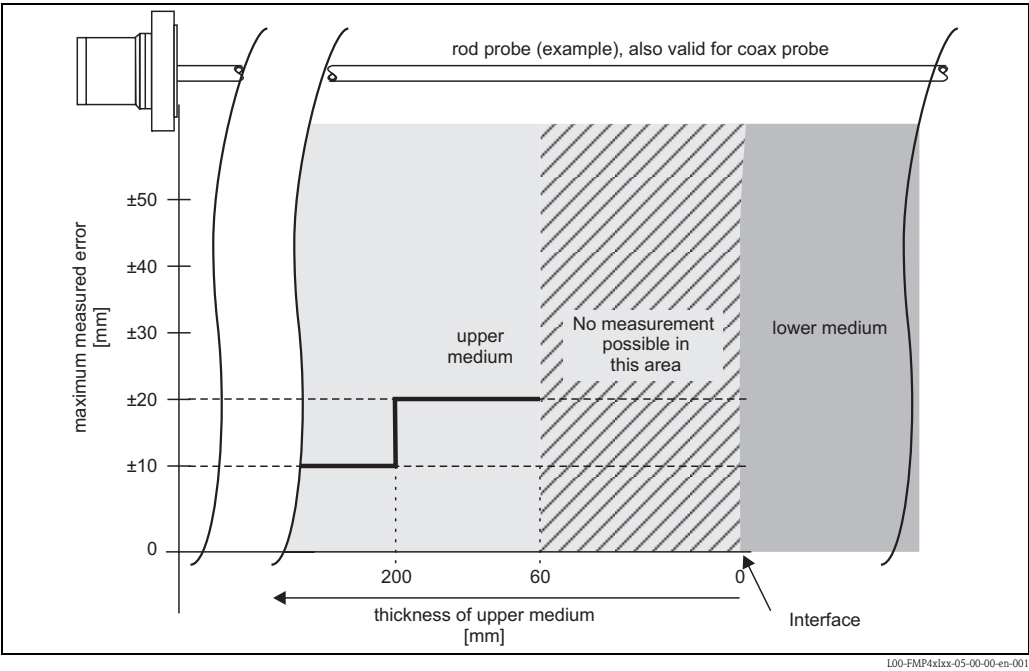
If the reference conditions are not met, the offset/zero point arising from the mounting situation may be up to ± 12 mm for rod probes. This additional offset/zero point can be compensated for by entering a correction ("Offset" function (057)) during commissioning.

In the area around the lower probe end, the following measured error occurs for the level measurement (level and interface electronics version):

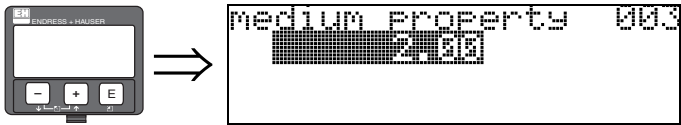


If the DC value is less than 7 for rope probes, then measurement is not possible in the area of the tensioning weight (0 to 250 mm from end of probe; lower blocking distance).

Deviating from this, the following measured error occurs for thin interface layers (only "K" interface measurement electronics version):



Function "Medium Property" (003)



Use this function to enter the dielectric constant of the upper medium (upper phase).

Options:

■ 2.00

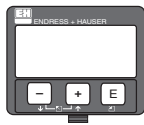
The tables below split the DC values by product group. However, it is not sufficient to assume a typical value. For accurate interface measurement, it is necessary to determine the DC of the upper medium (upper phase) as accurately as possible and enter the value in this function. The DC of the upper medium must be known and constant. The DC can be determined with the aid of the DC manual CP00019F/00/EN. In addition, it is also possible to calculate the DC automatically in FieldCare if the interface thickness is available and known.

DC (ϵ_r)	Typical liquids	DC (ϵ_r)	Typical liquids
1.4 to 1.6	– Liquefied gases, e.g. N ₂ , CO ₂	2.5 to 4	– Benzene, styrene, toluene – Furan – Naphthalene
1.6 to 1.9	– Liquefied gas, e.g. propane – Solvent – Freon – Palm oil	4 to 7	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline
1.9 to 2.5	– Mineral oils, fuels	> 7	– Aqueous solutions (DC approx. 80) – Alcohols – Ammonia



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.

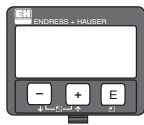
"Distance/Measured Value" display (008)



```
Dist./meas.value 008
level    0.000 m
inter    0.000 m
```

The measured distances from the reference point to the product level and the interface are shown. Check whether the values correspond to the actual distances. The following cases can occur:

- Distances correct → continue with group selection
- Distance to level incorrect → empty tank/bypass and perform mapping over the entire probe length (see BA00366F - "Description of Instrument Functions").
- Distance to interface incorrect → check entry for "**Medium Prop.**" (003).



```
Return to
Group Selection
```

```
Group selection 003
Basic Setup
safety settings
length adjustment
```

After 3 s, the following message appears

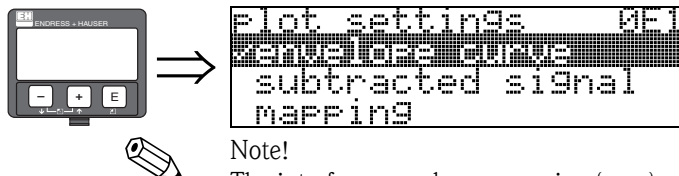
6.5 Envelope curve with VU331

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

6.5.1 Function "Plot Settings" (0E1)

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

- **Envelope Curve**
- Subtracted Signal
- Mapping



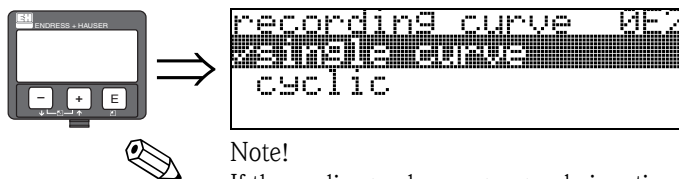
Note!

The interference echo suppression (map) are explained in BA00366F/00/EN "Description of Instrument Functions".

6.5.2 Function "Recording Curve" (0E2)

This function determines whether the envelope curve is read as

- **Single Curve** or
- **Cyclic**

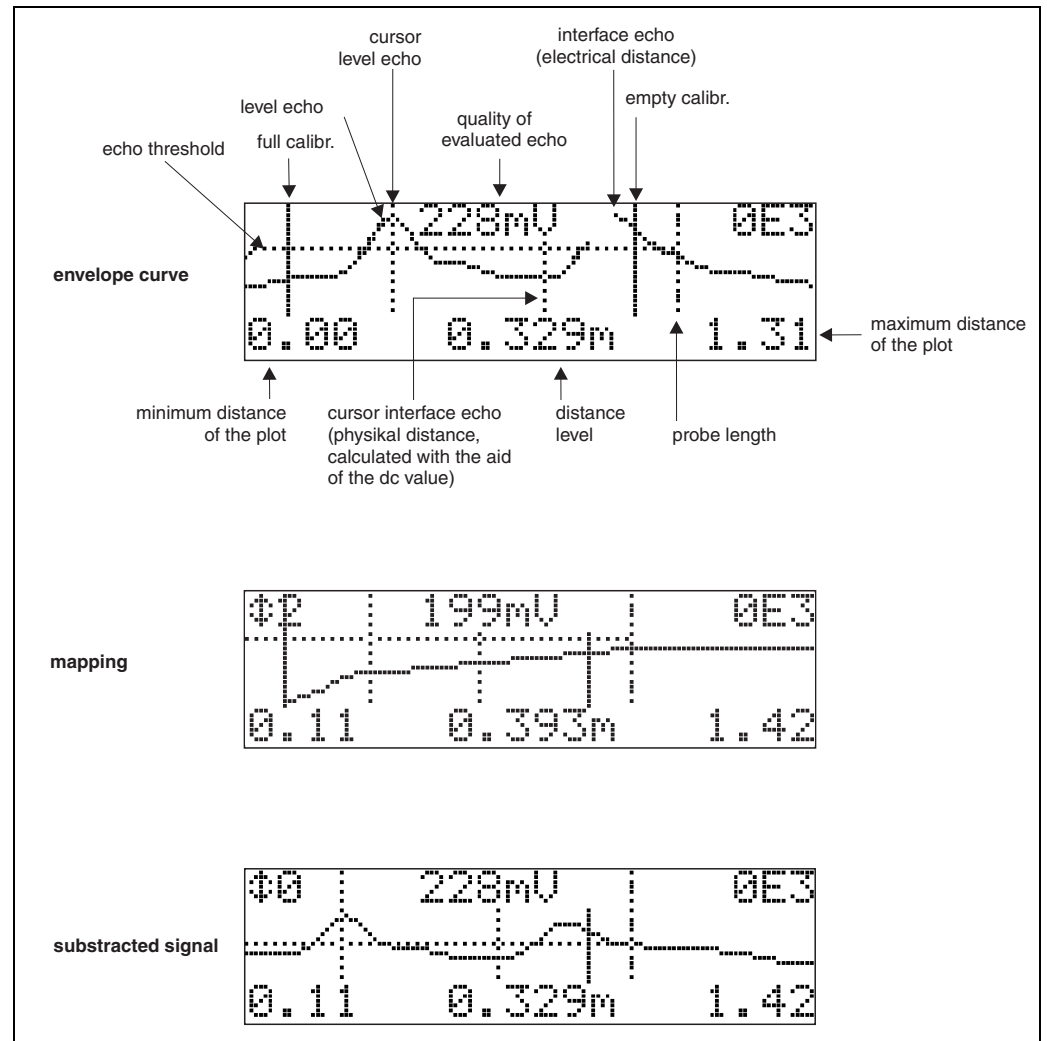


Note!

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

6.6 Function "Envelope Curve Display" (0E3)

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



L00-FMP41C-07-00-00-en-004

The difference curve (subtracted signal) is generated from the difference between the envelope curve and the mapping, and is used to determine levels and for additional calculations.

6.6.1 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".

6.6.2 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.

6.6.3 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**

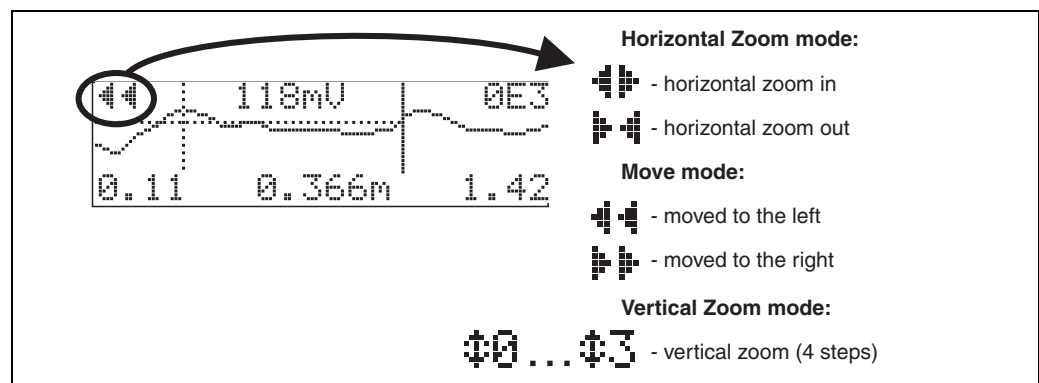
It is not static like factory and customer-specific interference echo suppression. Instead, it follows directly from static mapping and constantly adapts to the changing features of the probe environment during ongoing operation. Thus, dynamic mapping does not have to be recorded explicitly.

6.6.4 Echo threshold

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

6.6.5 Navigation in the envelope curve display

With the aid of the navigation, the envelope curve can be scaled horizontally and vertically, or moved to the right or to the left. The navigation mode that is currently active is indicated by an icon in the top left-hand corner of the display.



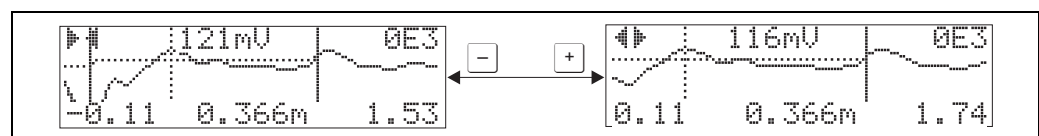
L00-FMP41cx-07-00-00-en-005

Horizontal Zoom mode

Press $\boxed{+}$ or $\boxed{-}$, to get to the envelope curve navigation. You are in the Horizontal Zoom mode. $\boxed{\leftarrow\leftarrow}$ or $\boxed{\rightarrow\rightarrow}$ is displayed.

You now have the following options:

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



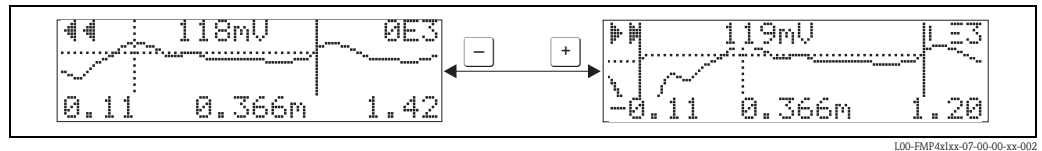
L00-FMP41cx-07-00-00-xx-001

Move mode

Then press **[E]** to get to the Move mode. **⏮** or **⏭** is displayed.

You now have the following options:

- **[+]** moves the curve to the right.
- **[-]** moves the curve to the left.



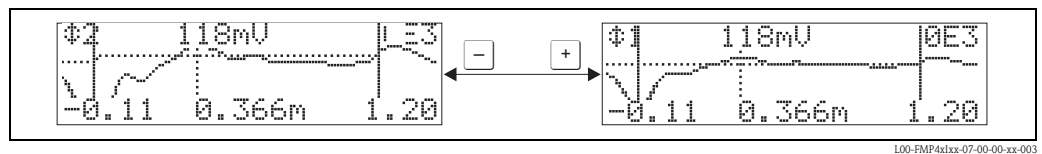
Vertical Zoom mode

Press **[E]** again to get to the Vertical Zoom mode. **⏏1** is displayed.

You now have the following options:

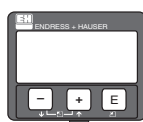
- **[+]** increases the vertical scale.
- **[-]** reduces the vertical scale.

The display symbol indicates the zoom mode that is currently active (**⏏0** to **⏏3**).



Ending the navigation

- By pressing **[E]** repeatedly, you change cyclically between the different modes of the envelope curve navigation system.
- By pressing **[+]** and **[-]** simultaneously, you leave the navigation. The zoom and shift settings configured are retained. The Levelflex does not use the standard display until you activate the "Recording Curve" function (**0E2**) again.



Return to
Group Selection



Group selection 0E→
Envelope curve
display
diagnostics

After 3 s, the following message appears

6.7 Basic Setup with the Endress+Hauser operating program

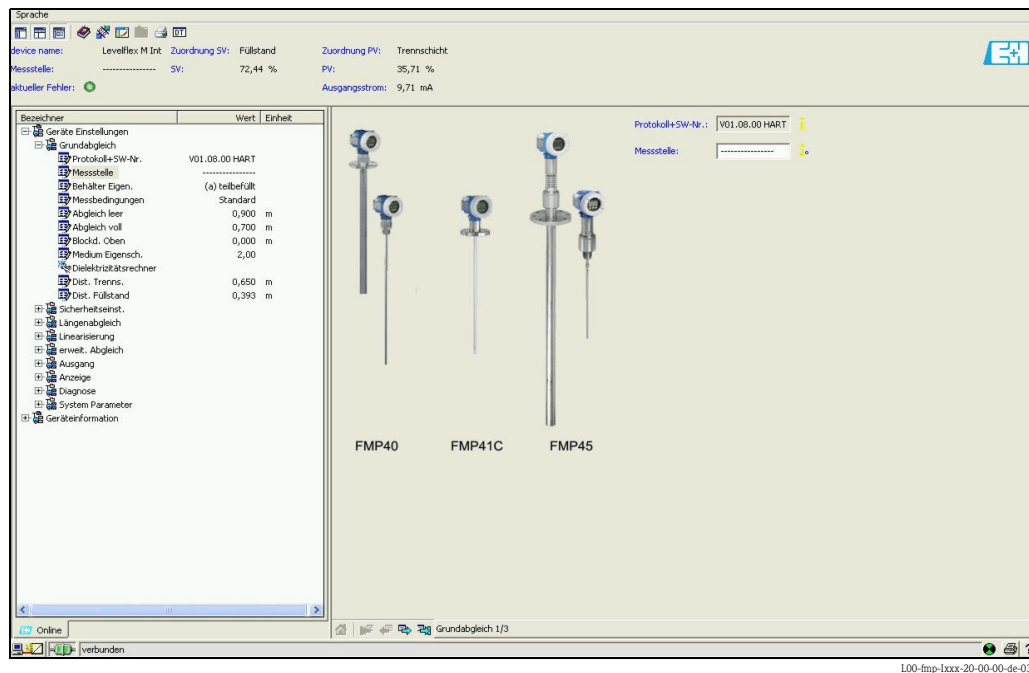
To carry out the basic setup with the operating program, proceed as follows:


- 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 1/3:

- Measuring point



- With the button  you move to the next screen display.

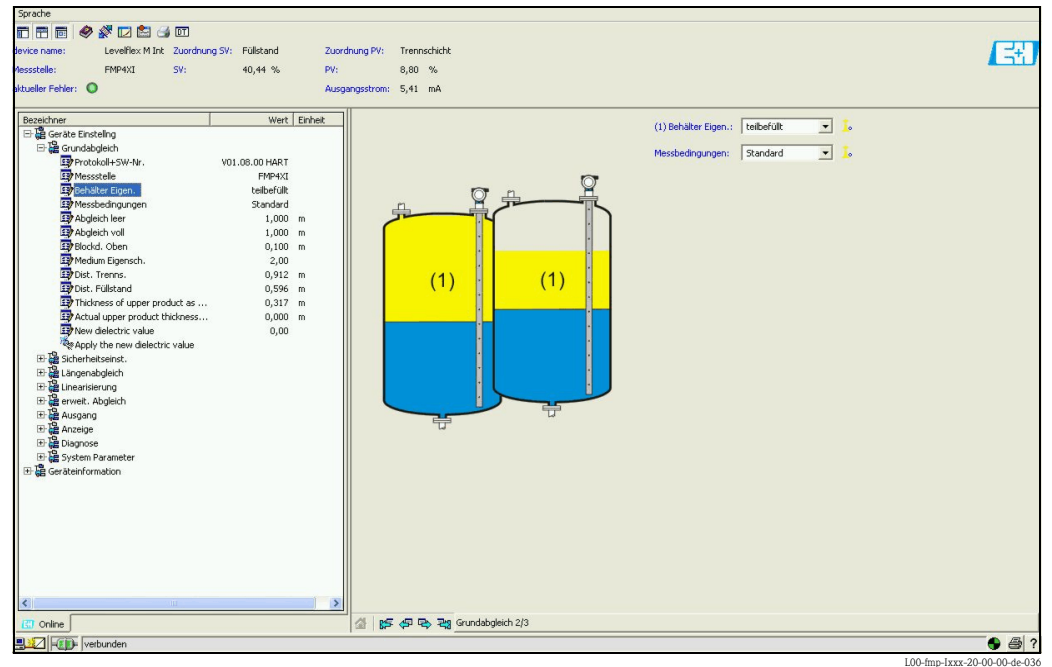


Note!

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

Basic Setup step 2/3:

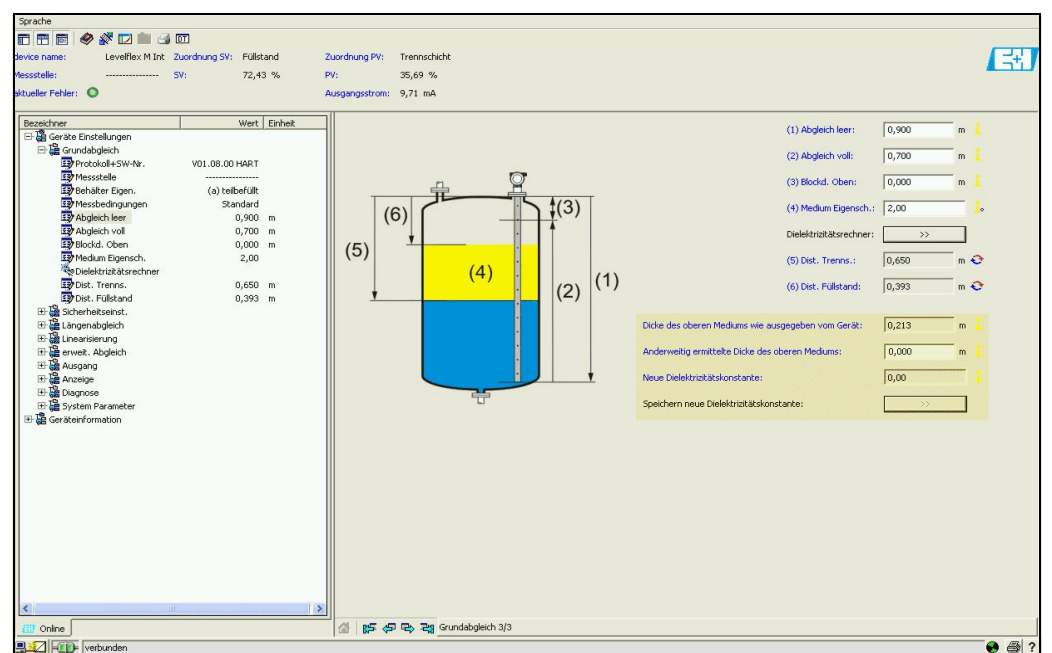
- Enter the application parameters:
 - Tank shape
 - Medium property



100-fmp-1xxx-20-00-00-de-036

Basic Setup step 3/3:

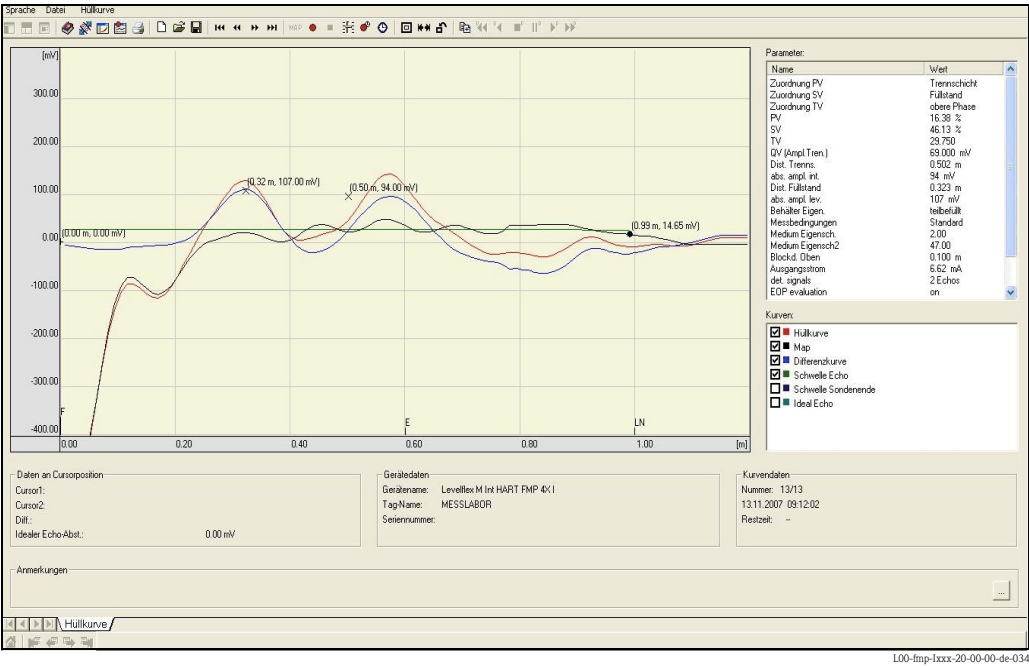
- Enter the application parameters:
 - Empty calibration
 - Full calibration
 - Upper blocking distance
 - Medium property
 - Dist. Level



100-fmp-1xxx-20-00-00-de-039

6.7.1 Signal analysis via envelope curve

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



6.7.2 User-specific applications (operation)

For details of setting the parameters of user-specific applications, see separate documentation BA00366F/00/EN "Description of Instrument Functions" on the enclosed CD-ROM.


7 Maintenance

The Levellflex M measuring device requires no special maintenance.

7.1 Exterior cleaning

When exterior-cleaning the Levellflex 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", →  62). Please contact Endress+Hauser Service for further information on service and spare parts.

7.3 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, please note the following:

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

7.4 Replacement

After a complete Levellflex M or electronic module has been replaced, the parameters can be downloaded into the device again via the communication interface. As a prerequisite, the data have to have been uploaded to the PC beforehand using FieldCare.

Measurement can continue without having to carry out a new calibration.

- You may have to activate linearization (see BA00366F/00/EN on the enclosed CD-ROM.)
- New interference echo suppression (see Basic Setup)

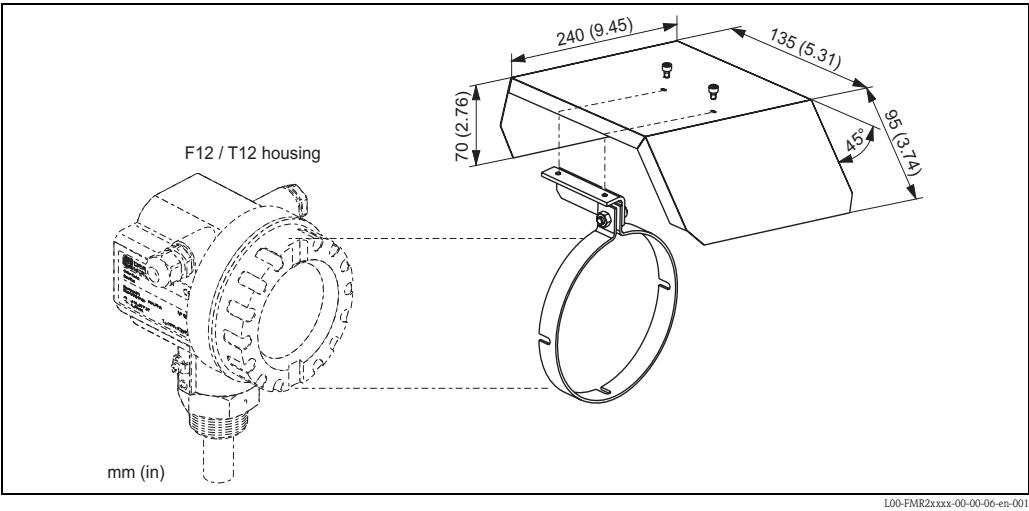
After a probe or the electronics have been replaced, a new calibration must be carried out. This is described in the repair instructions.

8 Accessories

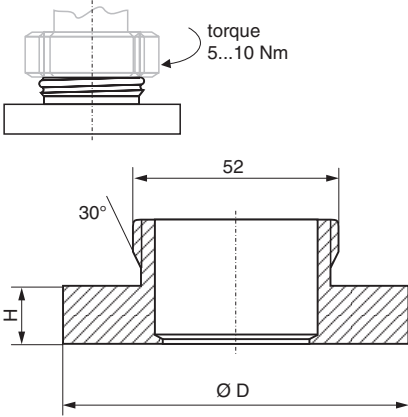
Various accessories, which can be ordered separately from Endress+Hauser, are available for the Levelflex M.

8.1 Weather protection cover

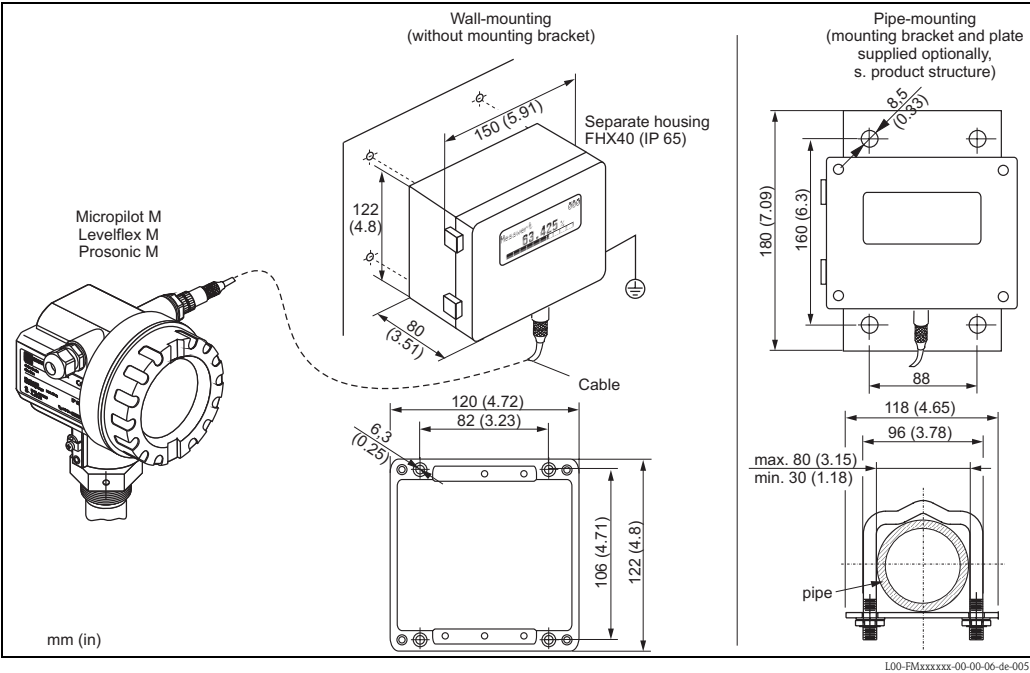
A weather protection cover made of stainless steel is available for outdoor installation (order code: 543199-0001). The shipment includes the protection cover and tension clamp.



8.2 Welding boss for 43 mm adapter

Dimensions of the welding ring		Order-No.	
Diameter D	Height H		
85	12	52006262	
65	8	214880-0002	
Material: 316L (1.4435)			L00-FMP4xxxx-00-00-06-en-006

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: AlSi12; cable glands: nickle plated brass
Dimensions [mm (in)]	122x150x80 (HxWxD) / 4.8x5.9x3.2

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

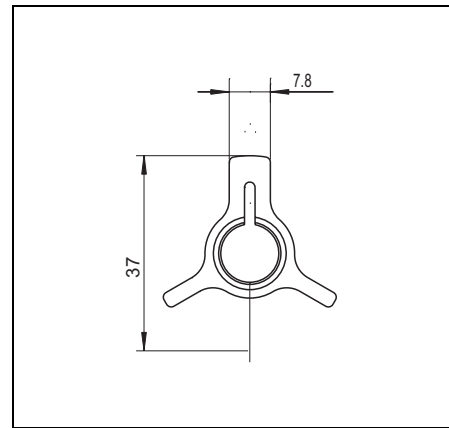
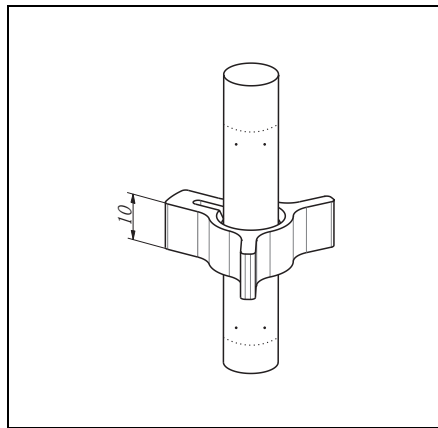
If the probes with rod version are used in stilling well or bypass, it must be ensured that the probe does not come into contact with the wall. The centering disk fixes the rod probe in the middle of the pipe.

8.4.1 Centering disk PFA Ø 1.46 inch

The centering disk is suitable for probes with a rod diameter of 0.63 in (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 FXA195 HART

For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI00404F/00/EN.

8.6 Commubox FXA291

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



Note!

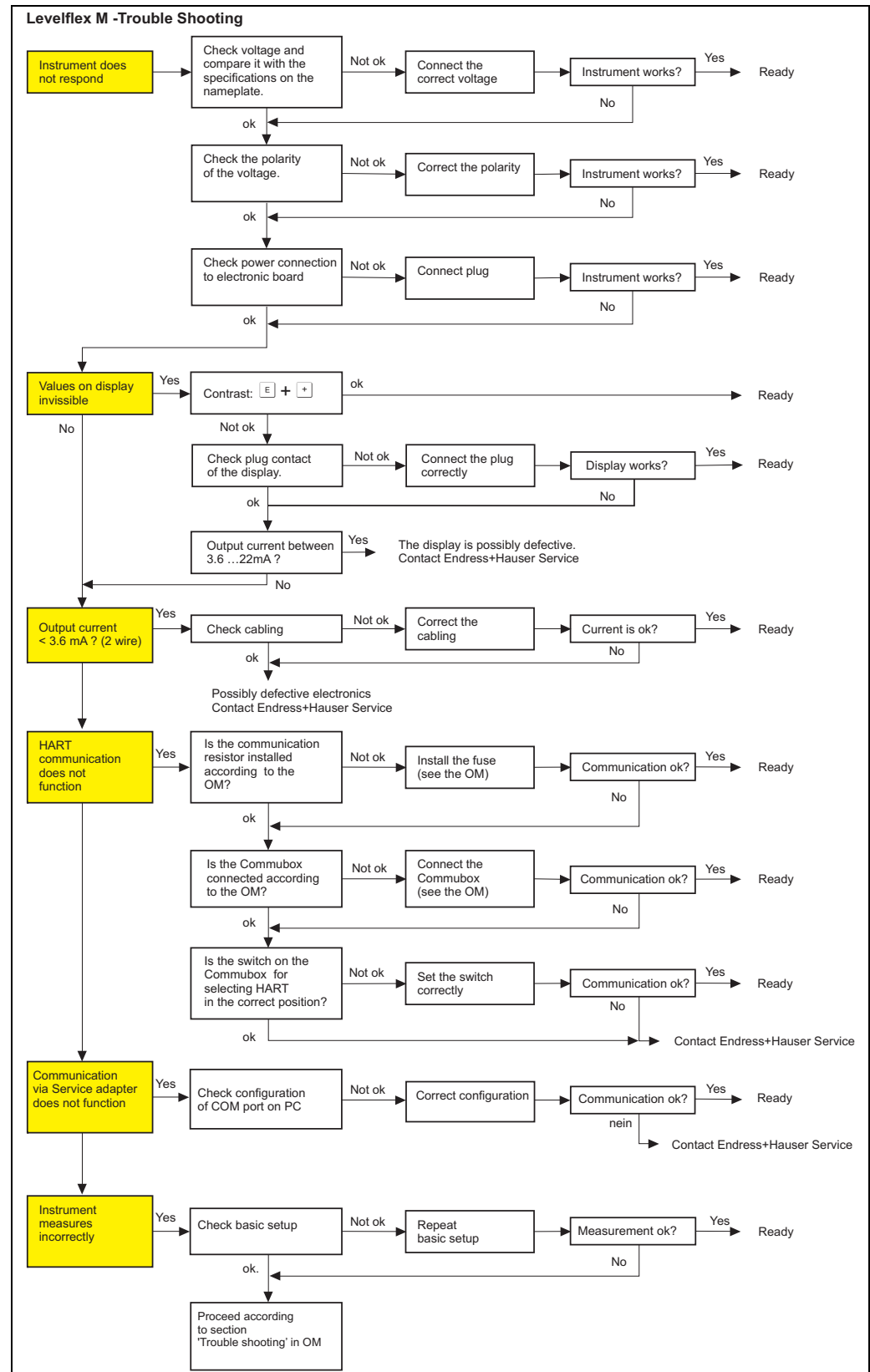
For the device you need the "ToF adapter FXA291" as an additional accessory.

8.7 ToF adapter FXA291

The ToF adapter FXA291 connects the Commubox FXA291 via the USB port of a personal computer or laptop to the device. For details refer to KA00271F/00/A2.

9 Troubleshooting

9.1 Troubleshooting instructions



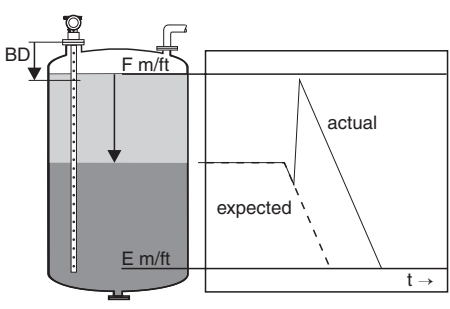
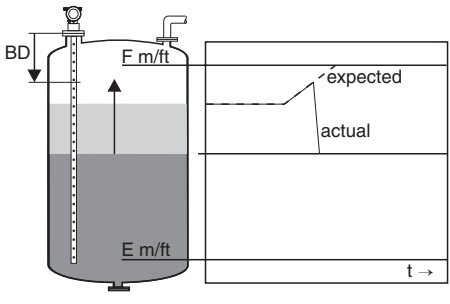
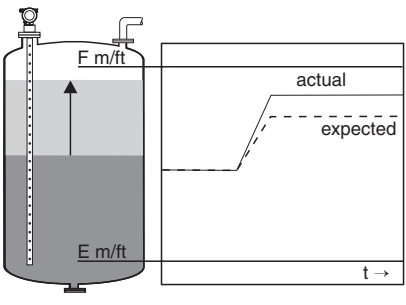
100-FMP4xxxx-19-00-00-en-101

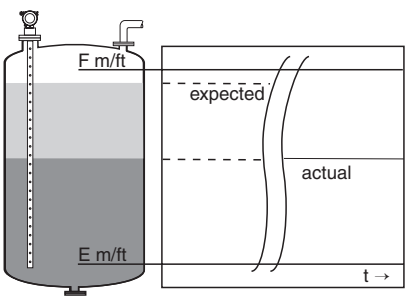
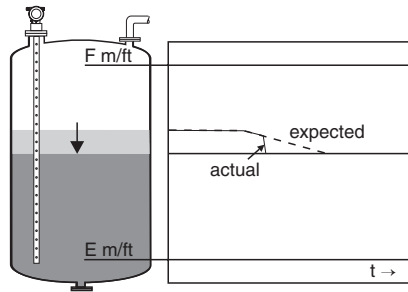
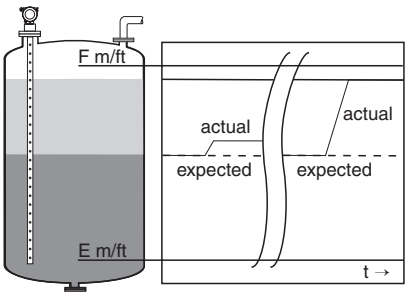
9.2 System error messages

Code	Description	Possible cause	Remedy
A102	Checksum error general reset & new calibr. required	Device was switched off before data could be stored; EMC problem EEPROM defective	Reset Avoid EMC problems; if alarm prevails after reset, exchange electronics
W103	Initializing - please wait	EEPROM storage not yet finished	Wait a few seconds; If error prevails, exchange electronics
A106	Downloading - please wait	Processing data download	Wait until warning disappears after the download procedure
A110	Checksum error general reset & new calibr. required	Device was switched off before the data were saved EMC problem EEPROM defective	Reset Avoid EMC problems; if alarm prevails after reset, exchange electronics
A111	Electronics defective	RAM defective	Reset If alarm prevails after reset, exchange electronics
A113	Electronics defective	ROM defective	Reset If alarm prevails after reset, exchange electronics
A114	Electronics defective	EEPROM defective	Reset If alarm prevails after reset, exchange electronics
A115	Electronics defective	General hardware problem	Reset If alarm prevails after reset, exchange electronics
A116	Download error Repeat download	Checksum of stored data not correct	Restart download of data
A121	Electronics defective	No factory calibration available, EEPROM deleted	Contact service
W153	Initializing - please wait	Initialization of electronics	Wait a few seconds; if warning prevails, switch off device and switch it on again
A160	Checksum error general reset & new calibr. required	Device was switched off before the data were saved EMC problem EEPROM defective	Reset Avoid EMC problems; If alarm prevails after reset, exchange electronics
A164	Electronics defective	Hardware problem	Reset If alarm prevails after reset, exchange electronics
A171	Electronics defective	Hardware problem	Reset If alarm prevails after reset, exchange electronics
A221	Probe pulse 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
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 a few seconds until alarm disappears
W601	Linearization ch1 curve not monotone	Linearization not monotone increasing	Correct table

Code	Description	Possible cause	Remedy
W611	Less than 2 linearization points for channel 1	Number of linearization coordinates entered < 2	Correct table
W621	Simulation ch. 1 on	Simulation mode is switched on	Switch off simulation mode
E641	No usable echo channel 1 Check calibr.	Echo lost due to application conditions or buildup, probe defective	Check basic setup Clean probe (cf. Operating Instructions)
W650	Signal/noise ratio too low or no echo	Noise amplitude too high	Eliminate electromagnetic interference
E651	Level in safety distance – risk of overspill	Level in safety distance	Alarm will disappear as soon as the level leaves safety distance Perform a reset if necessary
A671	Linearization ch1 not complete, not usable	Linearization table is in edit mode	Switch on linearization table
W681	Current ch1 out of range	Current out of valid range (3.8 mA to 20.5 mA)	Check calibration and linearization

9.3 Application errors

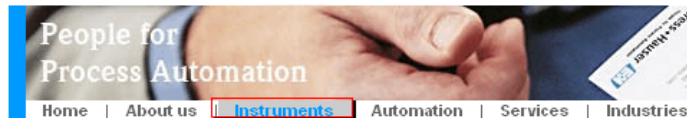
Error	Output	Possible cause	Remedial action
A warning or alarm is pending	Depends on configuration	See table of error messages (→ 58)	See table of error messages (→ 58)
When "fully flooded" is selected in "Tank Properties" (002), the measured value jumps during draining operations		The total level is detected outside the "Upper Block Distance" (059). Yes →	1. Increase "Upper Block Dist." (059) 2. "Partially Filled" setting in "Tank Properties" (002)
When "Partially Filled" is selected in "Tank Properties" (002), the measured value jumps during filling operations		The total level runs into the set "Upper Block Distance" (059). Yes →	Reduce "Upper Block Dist." (059)
Slope error in interface measured value		Wrong DC value set in "Medium Properties" (003) Yes →	Check the DC value setting in "Medium Properties" (003).

Error	Output	Possible cause		Remedial action
The measured values for the interface and the total level are identical		Echo threshold for the total level too high	Yes →	Check the DC value setting in "Medium Properties" (003).
If the interface layers are thin, the total level jumps to the interface level		The thickness of the upper phase is less than 60 mm.	Yes →	Interface measurement is only possible if the thickness of the interface is greater than 60 mm.
Interface measured value jumps		Emulsion layer present	Yes →	Emulsion layer affects the measurement. Please contact Endress+Hauser.

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 grooves for seals and crevices which could contain fluid residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.
- Always enclose a duly completed "Declaration of Contamination" form (a copy of the "Declaration of Contamination" is included at the end of these Operating Instructions). Only then can Endress +Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.

Additionally specify:

- The chemical and physical properties of the fluid
- A description of the application
- A description of the error that occurred (specify error code if possible)
- Operating duration of the device

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	HART	Description of Instrument Functions
02.2008	01.08.00	Original software. Operated via: – FieldCare – HART-Communicator 375 with Rev. 1, DD 1.	BA364F/00/en/03.08 71060883 BA364F/00/en/03.09 71074943 BA00364F/00/EN/13.10 71120284	BA366F/00/en/01.08 71060890



9.8 Contact addresses of Endress+Hauser

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

10 Technical data


10.1 Additional technical data

10.1.1 Input

Measured variable	The measured variable is the distance between the reference point (see Fig., → ) and the product surface. Subject to the input empty distance "E" (Fig., → ) the level is calculated. Alternatively, the level can be converted by means of linearization (32 points) into other variables (volume, mass).
-------------------	--

10.1.2 Output

Output signal	4 to 20 mA (invertible) with HART protocol
---------------	--

Signal on alarm	<p>Failure information can be accessed via the following interfaces:</p> <ul style="list-style-type: none"> ■ Local display: <ul style="list-style-type: none"> – Error symbol (→ ) – Plain-text display ■ Current output, failsafe mode can be selected (e.g. according to NAMUR Recommendation NE43) ■ Digital interface
-----------------	---

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

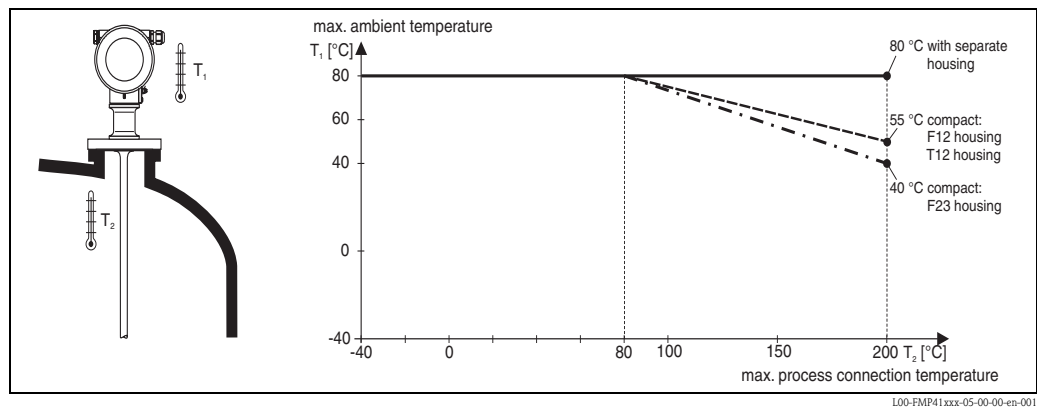
10.1.3 Performance characteristics

Reference operating conditions	<ul style="list-style-type: none"> ■ Temperature = +20 °C ±5 °C ■ Pressure = 1013 mbar abs. ±20 mbar ■ Humidity = 65 % ±20 % ■ Reflection factor ≥ 0.8 (surface of the water for coax probe, metal plate for rod and rope probe with min. 1 m Ø) ■ Flange for rod or rope probe ≥ 30 cm Ø ■ Distance to obstructions ≥ 1 m ■ For interface measurement: <ul style="list-style-type: none"> – Stilling well DN40 – DC of the lower medium = 80 (water) – DC of the upper medium = 2 (oil)
Maximum measured error	Is in the Function group "Basic Setup" (00) as of → 40.
Resolution	<ul style="list-style-type: none"> ■ Digital: 1 mm ■ Analog: 0.03 % of the measuring range
Reaction time	<p>The reaction time depends on the configuration.</p> <p>Shortest time:</p> <ul style="list-style-type: none"> ■ 2-wire electronics: 1 s
Influence of ambient temperature	<p>The measurements are carried out in accordance with EN 61298-3:</p> <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 <p>2-wire:</p> <ul style="list-style-type: none"> ■ Current output (additional error, in relation to the span of 16 mA): <ul style="list-style-type: none"> – Zero point (4 mA) Average T_K: 0.032 %/10 K, max. 0.35 % over the entire temperature range -40 °C to +80 °C – Span (20 mA) Average T_K: 0.05 %/10 K, max. 0.5 % over the entire temperature range -40 °C to +80 °C

10.1.4 Operating conditions: environment

Ambient temperature range	Ambient temperature at the electronics: -40 °C to +80 °C. The function of the LCD display is restricted at $T_A < -20$ °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)
---------------	-------------------------------

Degree of protection	<ul style="list-style-type: none"> ■ With closed housing tested according to: <ul style="list-style-type: none"> – IP68, NEMA6P (24 h at 1.83 m under water) – IP66, NEMA4X ■ With open housing: IP20, NEMA1 (also ingress protection of the display)
----------------------	--

Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: 20 to 2000 Hz, 1 (m/s ²) ² /Hz
----------------------	--

Cleaning the probe	Depending on the application, contamination or build-up can accumulate on the probe. A thin, even layer only influences measurement slightly. Thick layers can dampen the signal and then reduce the measuring range. Severe, uneven build-up, adhesion e.g. through crystallization, can lead to incorrect measurement. In this case, we recommend that you use a non-contact measuring principle, or check the probe regularly for soiling.
--------------------	---

Electromagnetic compatibility (EMC)	Electromagnetic compatibility to EN 61326 and NAMUR Recommendation EMC (NE21). Details are provided in the Declaration of Conformity. A standard installation cable is sufficient if only the analog signal is used. Use a shielded cable when working with a superimposed communication signal (HART).
-------------------------------------	---

When installing the probes in metal and concrete tanks and when using a coax probe:

- Interference emission to EN 61326 – x series, Class A equipment.
- Interference immunity to EN 61326 – x series, requirements for industrial areas and NAMUR Recommendation NE21 (EMC)

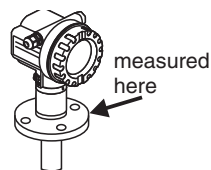
The measured value can be affected by strong electromagnetic fields when installing rod probes without a shielding/metal wall, e.g. plastic, and in wooden silos.

- Interference emission to EN 61326 – x series, Class A equipment.
- 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 Fig. for measuring point) is determined by the process connection ordered:

Min. temperature	Max. temperature	
-40 °C (-40 °F)	+200 °C (392 °F)	

High process temperatures (> 150° C) can also favor the diffusion of the fluid through the probe coating which can result in a limited service life. Recommendation: use FMP45.

For FMP41C with E+H universal adapter: 0 °C to 150 °C

Lateral loading capacity of the rod probe: 30 Nm

Process pressure limits

The specified range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for 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 EN1092-1 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 (over the entire temperature range).

FMP41C with

- Endress+Hauser universal adapter: max. 6 bar

- 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 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)".

Probe length tolerance	Rod probes				
	Over		1 m	3 m	6 m
	Up to	1 m	3 m	6 m	
	Admissible tolerance (mm)	- 5	- 10	- 20	- 30

Weight	Levelflex M	FMP41C + rod probe
	Weight for F12 or T12 housing	Approx. 3.5 kg + Approx. 1.1 kg/m Probe length + Weight of flange
	Weight for F23 housing	Approx. 6.8 kg + Approx. 1.1 kg/m Probe length + Weight of flange

10.1.7 Certificates and approvals

CE mark	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.	
Suitability for hygienic processes	Overview of permitted process connections, →  6.	 
	 <p>Note! The gap-free connections can be cleaned without residue using the usual cleaning methods.</p> <p>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.</p>	
Telecommunications	Complies with "Part 15" of the FCC rules for an "Unintentional Radiator". All probes meet the requirements for a "Class A Digital Device". All probes mounted in metal tanks also meet the requirements for a "Class B Digital Device".	
Standards and guidelines applied	<p>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:</p> <p>EN 60529 Protection class of housing (IP-code)</p> <p>NAMUR – international user association of automation technology in process industries.</p> <ul style="list-style-type: none"> ■ NE21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment. ■ NE43 Standardization of the signal level for the failure information of digital transmitters. 	

The devices are certified for use in hazardous areas. The safety instructions to be observed are enclosed and referenced on the nameplate:

- Europe: EC type-examination certificate, Safety Instructions XA
- USA: FM Approval, Control Drawing
- Canada: CSA Certificate of Compliance, Control Drawing
- China: NEPSI Explosion Protection Certificate of Conformity, Safety Instructions XA
- Japan: TIIS Certificate for Ex-apparatus

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

Feature		Variant	ZA281F	ZA282F	ZA283F	ZA284F	ZA286F	ZA288F	ZA270F	ZA272F	ZA273F	ZA274F	ZA329F	XA377F	XA387F	XA404F	XA405F	ZD158F	ZD159F	ZD162F	ZD163F	ZD165F	ZD166F	ZD2021F	ZD172F	ZD173F	ZD174F	ZD176F	ZD177F	ZD198F	ZD199F	ZC256F	
10 Approval:	Non-hazardous area	A																															
	NEPSI Ex emb (ia) IIC T6	C										X																					
	Non-hazardous area, WHG	F	X																														
	ATEX II 3G Ex nA II T6	G																															
	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										
	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	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																													X		
	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																												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	
	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	
	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	
	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	
70 Housing:	F12 Alu, coated IP68 NEMA 6P	A					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			
	T12 Alu, coated IP68 NEMA 6P	C					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											
80 Cable entry:	thread M20 (Ex d > thread M20)	2												X	X	X	X	X															
	thread G1/2	3												X	X	X	X	X															
	thread NPT 1/2	4												X	X	X	X	X															
	Plug M12	5												X	X	X																	
	Plug 7/8"	6												X	X	X																	

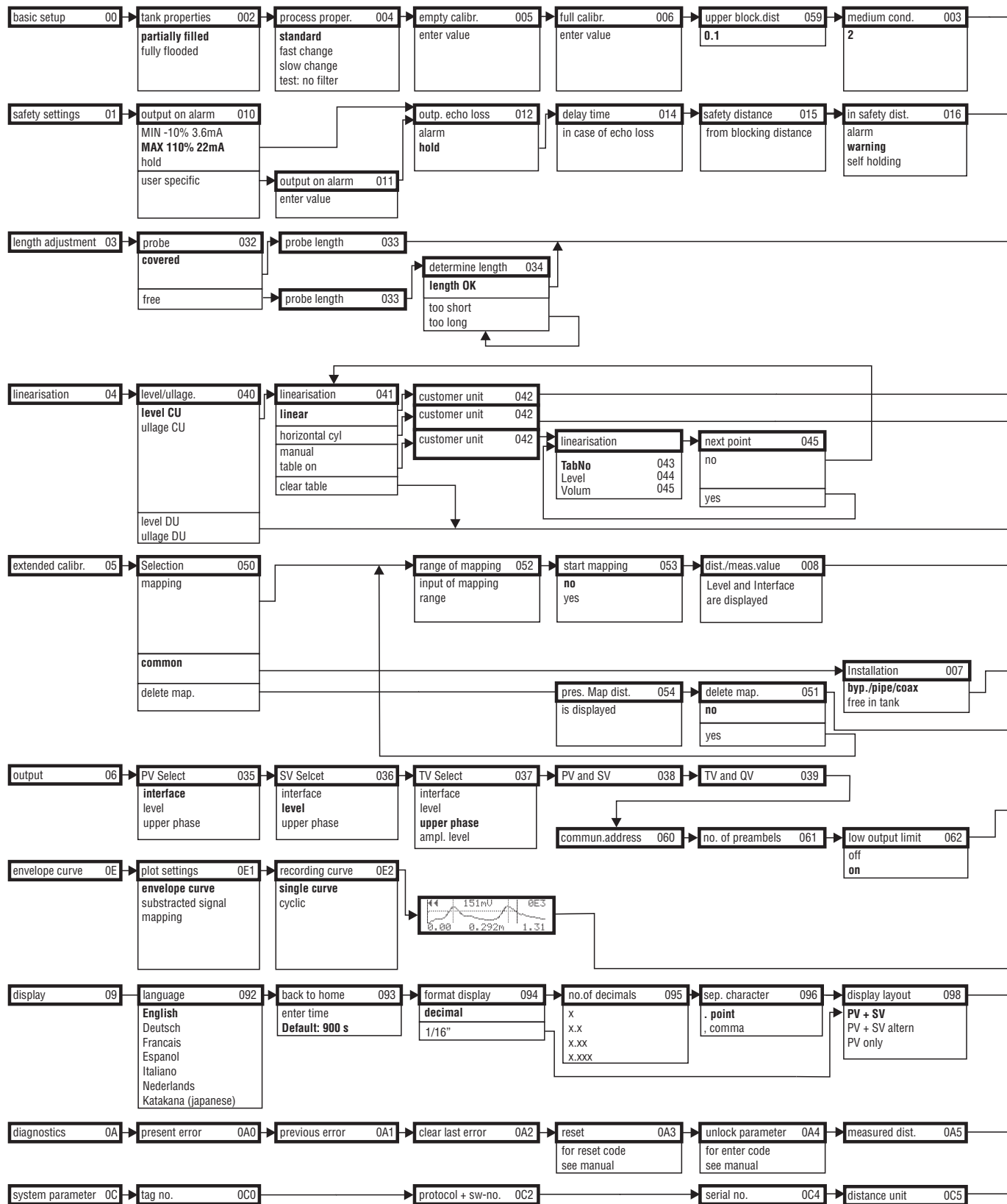
* in preparation

10.1.8 Additional documentation

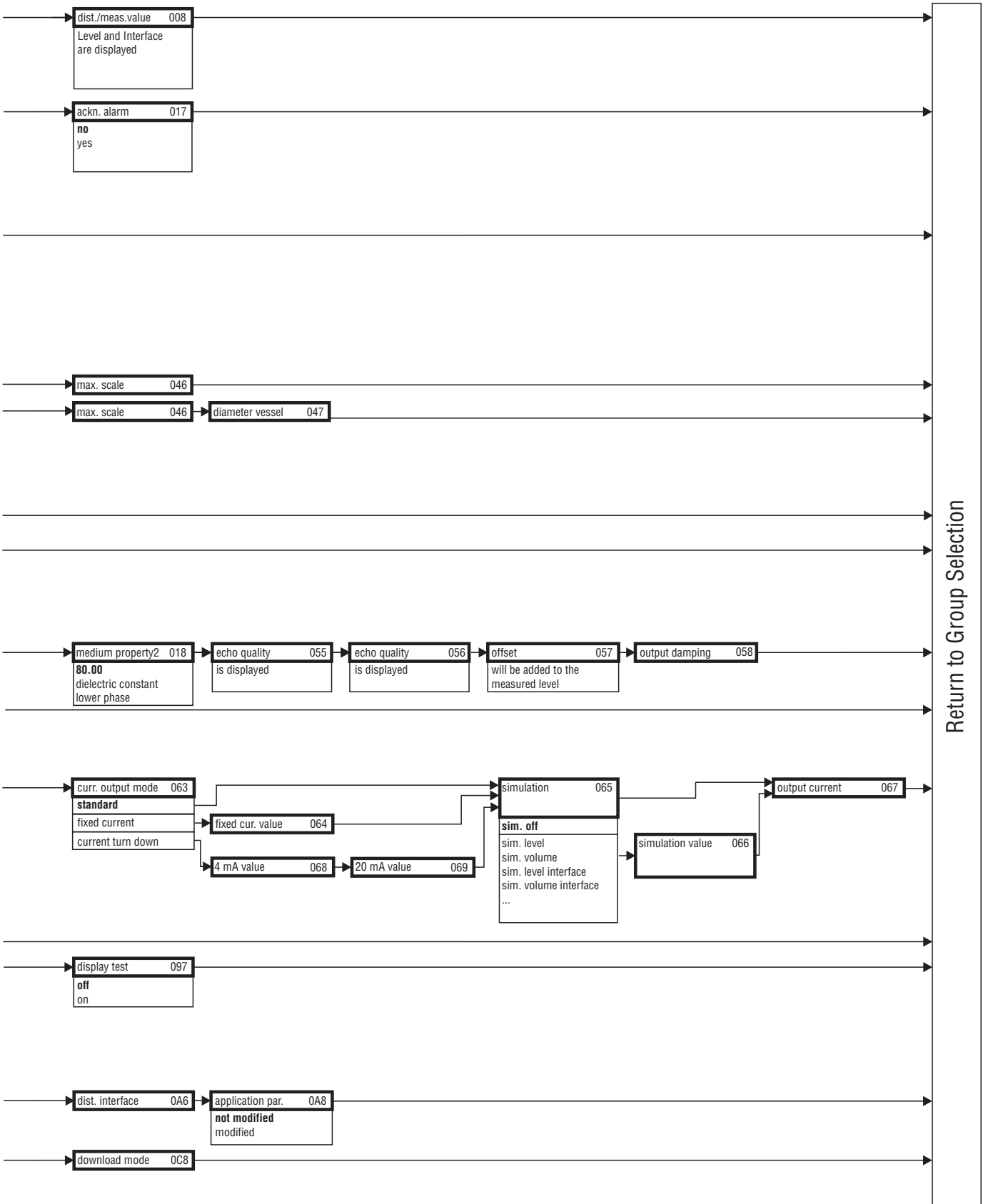
Additional documentation	<p>This additional documentation can be found on our product pages on www.endress.com.</p> <ul style="list-style-type: none">■ Technical Information (TI00386F/00/EN)■ Brief operating instructions (KA01051F/00/EN)
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11 Appendix

11.1 HART operating menu (display module)



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



11.2 Patents

This product is 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

Index

A

Accessories	54
Alarm	34
Application errors	60

B

Basic setup	38, 40
-------------------	--------

C

CE mark	9
Centering disk	56
Commissioning	37
Commubox	56
Connection	25
Connection compartment	23

D

Declaration of Conformity	9
Degree of protection	26
Designated use	4
Dimensions	11
Display	29

E

Empty calibration	41
Envelope curve	46
Error messages	34, 58
Ex approval	70
Exterior cleaning	53

F

F12 housing	21
F23 housing	21
FHX40	55
Field Communicator 375, 475	25
FieldCare	25, 72
Full Calibration	42

H

HART	23, 25, 35
------------	------------

I

Installation	10
--------------------	----

K

Key assignment	30
----------------------	----

L

Lock	31
------------	----

M

Maintenance	53
Medium Properties	44
Menu structure	72

N

Nameplate	6
-----------------	---

O

Operating menu	28
Operation	27, 31
Operational safety	4
Ordering structure	6

P

Potential equalization	26
Process Properties	41

R

Repairs	53
Repairs to Ex-approved devices	53
Replacement	53
Reset	33
Return	63
RMA422	25
RN221N	25

S

Safety conventions and icons	5
Service interface FXA291	56
Software history	63
Spare Parts	62
System error messages	58

T

T12 housing	22
Tank Properties	40
Technical data	64
Troubleshooting	57
Troubleshooting instructions	57
Turning the housing	20

U

Unlock parameter	32
------------------------	----

V

VU331	46
-------------	----

W

Warning	34
Weather protection cover	54
Wiring	21

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No.

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

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

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

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

Type of instrument / sensor

Geräte-/Sensortyp _____

Serial number

Seriennummer _____

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

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

Pressure / Druck _____ [psi] _____ [Pa]

Conductivity / Leitfähigkeit _____ [µS/cm]

Viscosity / Viskosität _____ [cp] _____ [mm²/s]**Medium and warnings**

Warnhinweise zum Medium



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

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

* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

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

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

Description of failure / Fehlerbeschreibung _____**Company data / Angaben zum Absender**

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

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

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

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

www.endress.com/worldwide

Endress+Hauser 
People for Process Automation

