



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



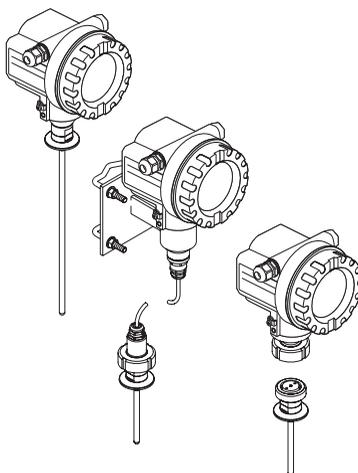
Solutions

Brief Operating Instructions

Levelflex M FMP43

Guided Level-Radar

HART
COMMUNICATION PROTOCOL



These are Brief Operating Instructions.

For more detailed information, please refer to the Operating Instructions and the additional documentation on the CD-ROM provided.

These Brief Operating Instructions are not intended to replace the Operating Instructions provided in the scope of supply.

The complete device documentation consists of:

- these Brief Operating Instructions
- Approvals and safety certificates
- a CD-ROM with:
 - the Operating Instructions
 - Technical Information

KA01047F/00/EN/13.10
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Endress+Hauser

People for Process Automation

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1 Safety instructions

1.1 Designated use

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

1.2 Installation, commissioning and operation

- The device must only be installed, connected, commissioned and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in this manual, the applicable norms, legal regulations and certificates (depending on the application).
- The specialist must have read and understood this manual and must follow the instructions it contains. If you are unclear on anything in these Brief Operating Instructions, you must read the Operating Instructions (on the CD-ROM). The Operating Instructions provide detailed information on the device/measuring system.
- The device may only be modified or repaired if such work is expressly permitted in the Operating Instructions (→ see CD-ROM).
- If faults cannot be rectified, the device must be taken out of service and secured against unintentional commissioning.
- Do not operate damaged devices. Mark them as defective.

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 device is safely built and tested according to state-of-the-art technology and has left the factory in perfect condition as regards technical safety. The applicable regulations and European standards have been taken into account.
- Pay particular attention to the technical data on the nameplate.
- If the device is to be installed in an explosion hazardous area, then the specifications in the certificate as well as all national and local regulations must be observed. The device is accompanied by separate "Ex documentation", which is an integral part of this Operating Instructions. The installation regulations, connection values and Safety Instructions listed in this Ex document must be observed. The documentation number of the related Safety Instructions is also indicated.
- If using devices for applications with safety integrity level, the separate manual on functional safety must be observed thoroughly (→ see CD-ROM).

1.4 Return

Follow the instructions on returning the device as outlined in the Operating Instructions on the CD-ROM provided.

1.5 Safety icons

Symbol	Meaning
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the device.
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the device.
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an device response which is not planned.

2 Mounting

2.1 Incoming acceptance, transport, storage

2.1.1 Incoming acceptance

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

2.1.2 Transport



Caution!

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

2.1.3 Storage

Pack the measuring device so that is protected against impacts for storage and transport. The original packing material provides the optimum protection for this. The permissible storage temperature is -20 °C to $+80\text{ °C}$.

2.2 Installation

2.2.1 Mounting kit

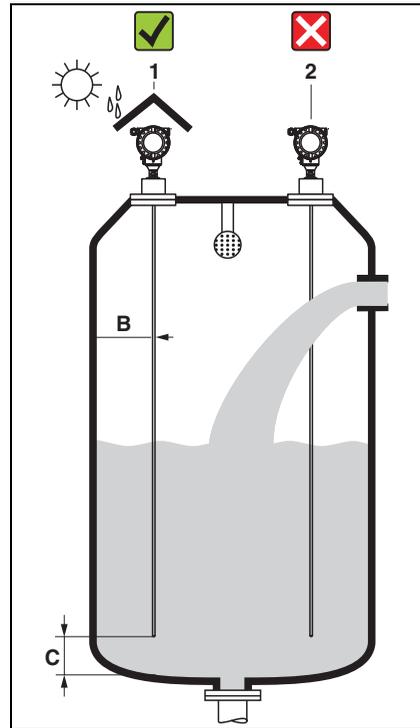
A 4 mm Allen key is needed to turn the housing

2.2.2 General instructions

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

Mounting location

- Do not mount the probe in the filling curtain (2).
- Mount the probe at such a distance away from the wall (B) that, in the event of buildup on the wall, there is still a minimum distance of 100 mm between the probe and the buildup.
- Mount the probe as far away as possible from internals.
- The minimum distance from the probe end to the tank floor is 10 mm.
- If installing outdoors, it is recommended that you use a weather protection cover (1), see Accessories in Operation Instructions on the CD-ROM.



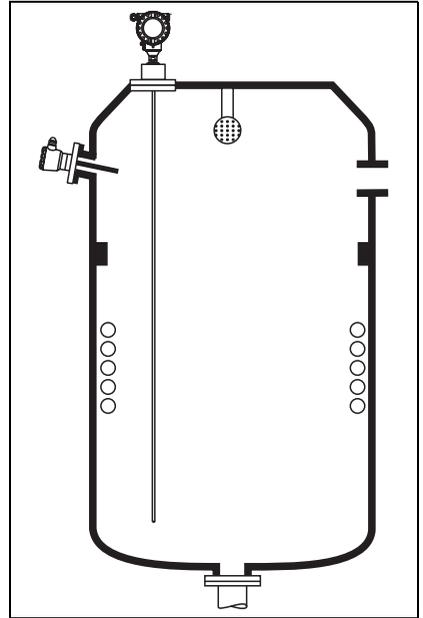
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Tank internals

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

Optimization options

- Interference echo suppression: measurement can be optimized by electronically suppressing interference echoes.



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Note!

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

2.2.3 Special instructions

When installing in tanks with agitator, observe the lateral loading capacity of rod probes:

- 10 Nm with 316L (1.4435)
- 16 Nm with Hasteloy C22 (auf Anfrage).

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

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

with

c_w : Friction factor

ρ [kg/m³]: Density of the medium

v [m/s]: Velocity of the medium perpendicular to the probe rod

d [m]: Diameter of the probe rod (8 mm)

L [m]: Level

L_N [m]: Probe length

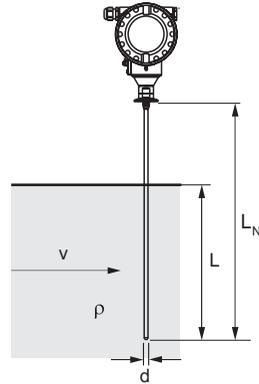
Calculation example

Friction factor $[c_w]$ 0,9 (on the assumption of a turbulent current (high Reynolds number)

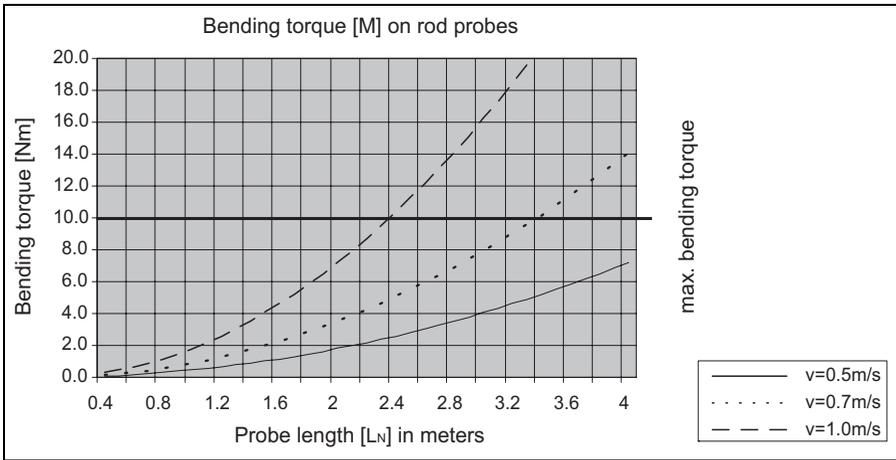
Density $[\rho]$ in kg/m^3 1000 (e.g. water)

Probe diameter $[d]$ in m 0,008

$L = L_N$
(worst case)



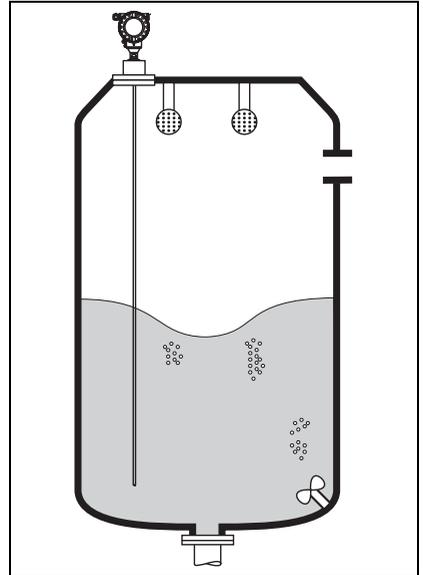
L00-FMP43xxx-16-00-00-xx-003



L00-FMP43xxx-16-00-00-en-004

The probe must be mounted opposite the agitator.

If possible, check whether a non-contact process, ultrasonic or level-radar would be better suited, particularly if the agitator generates large mechanical loads on the probe.

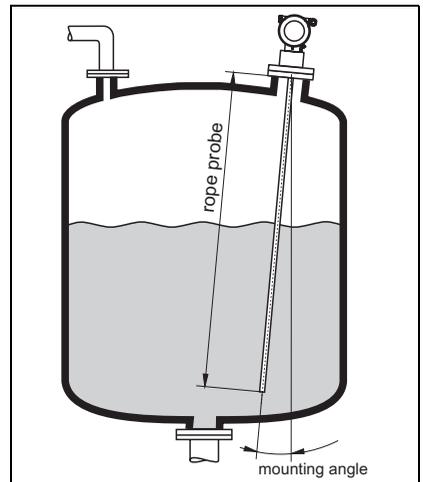


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2.2.4 Notes on special installation situations

Installation at an angle

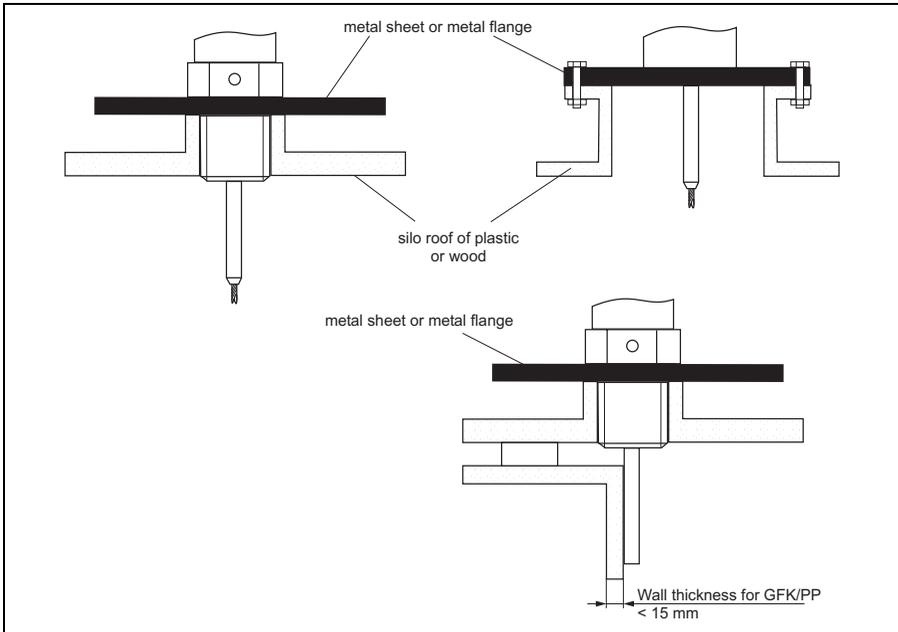
- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
 - up to 1 m = 30°
 - up to 2 m = 10°
 - up to 4 m = 5°



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Installation in plastic containers

Please note that the "guided level radar" measuring principle requires a metallic surface at the process connection! When installing rod or robe probes in plastic silos, whose silo cover is also made of plastic or silos with wood cover, the probes must either be mounted in a $\geq \text{DN}50$ (2") metallic flange, or a metal sheet with diameter of ≥ 200 mm must be mounted under screw-in piece.

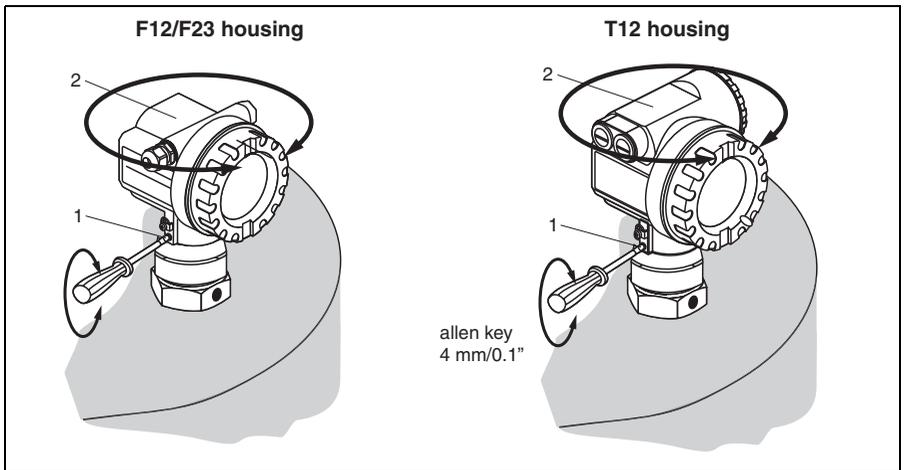


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2.2.5 Turn housing

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

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



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2.3 Post-installation check

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

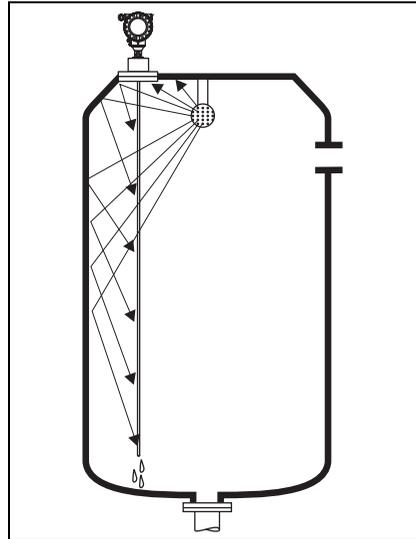
- Is the measuring device damaged (visual check) ?
- Does the measuring device correspond to the measuring point specifications such as process temperature/pressure, ambient temperature, measuring range, etc.?
- Are the measuring point number and labeling correct (visual check) ?
- Is the measuring device adequately protected against rain and direct sunlight (see Chapter "Accessories" in the Operating Instructions on the CD-ROM) ?

2.4 Cleaning of the probe

2.4.1 Cleaning of the probe in the tank

Installation close to tank wall

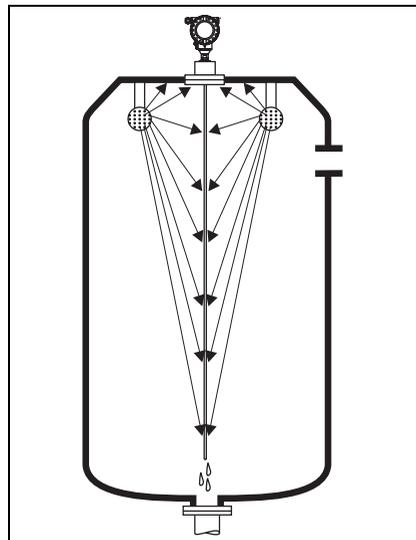
By installing the probe close to the tank wall, the cleaning effect is improved in cases where a spray ball is used. The cleaning jet is deflected against the tank wall and onto the probe. This means that those parts of the probe are cleaned which would normally not be reached by the spray ball jet.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



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Installation in the center of the tank

If the probe is mounted in the center of the tank, it may be necessary to use a second spray ball. The spray balls should then be mounted to the left and right of the probe.



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3 Wiring



Warning!

When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.



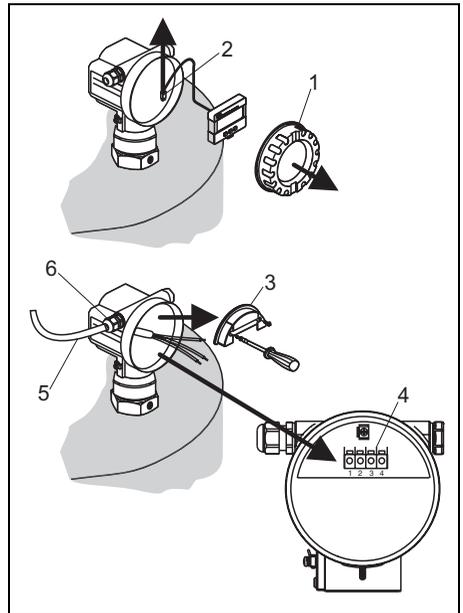
Caution!

Before connection please note the following:

- The power supply must be identical to the data on the nameplate.
- Switch off power supply before connecting up the device.
- 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).

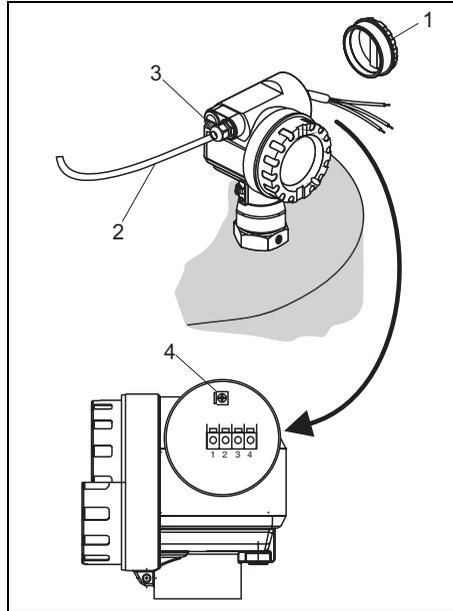
3.1 Wiring in F12/F23 housing

1. Unscrew housing cover (1).
2. Remove any display (2) if fitted.
3. Remove cover plate from terminal compartment (3).
4. Pull out terminal module (4) slightly using "pulling loop" (only 2-wire).
5. Insert cable (5) through gland (6).
6. Make connection (see terminal assignment).
7. Re-insert terminal module (4).
8. Tighten cable gland (6).
Max. torque 10 to 12 Nm!
9. Tighten screws on cover plate (3).
10. Insert display (2) if fitted.
11. Screw on housing cover (1).
12. Switch on power supply.



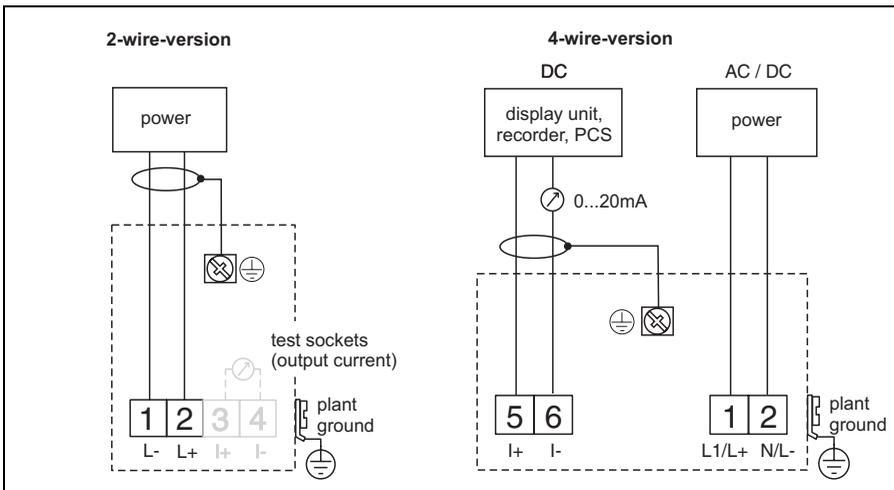
3.2 Wiring in T12 housing

1. Unscrew housing cover (1).
2. Insert cable (2) through gland (3).
3. Connect cable screen to the grounding terminal (4) within the terminal compartment.
4. Make connection (see terminal assignment).
5. Tighten cable gland (6).
Max. torque 10 to 12 Nm!
6. Screw on housing cover (1).
7. Switch on power supply.



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3.3 Terminal assignment



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3.4 Connecting the measuring unit

Load HART

Minimum load for Hart communication: 250 Ω

Ground connection

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

Cable entry

- Cable gland: M20x1.5
- Cable entry: G½ or ½NPT

Terminals

For wire cross-sections of 0.5 to 2.5 mm²

Supply voltage

HART, 2-wire

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

Communication	Current consumption	Terminal voltage
HART	4 mA	16 V to 36 V
	20 mA	7.5 V to 36 V
Fixed current, adjustable e.g. for solar power operation (measured value transferred at HART)	11 mA	10 V to 36 V
Fixed current for HART Multidrop mode	4 mA ¹⁾	16 V to 36 V

1) Start up current 11 mA

HART residual ripple, 2-wire: $U_{ss} \leq 200$ 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
HART, 4-wire (90 to 250 V _{AC})	2.4 to 22 mA	~ 3 to 6 mA	~ 3,5 VA
HART, 4-wire (10.5 to 32 V _{DC})	2.4 to 22 mA	~ 100 mA	~ 1 W

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

Overvoltage protection

If the measuring device is used for the level measurement in flammable liquids which requires the use of an overvoltage protection according to EN/IEC 60079-14 or EN/IEC 60060-1 (10 kA, Puls 8/20 µs) it has to be ensured that

- the measuring device with integrated overvoltage protection with gas discharge tubes within the T12-enclosure is used, refer to "Ordering structure" in the Operating Instructions on CD-ROM
- or
- this protection is achieved by the use of other appropriate measures (external protection devices e.g. HAW562Z).

3.5 Screening/potential matching

- You achieve optimum screening against disturbances if the screening is connected on both sides (in the cabinet and on the device). If you have to reckon with potential equalisation currents in the plant, only earth screening on one side, preferably at the transmitter.
- When using in hazardous areas, you must observe the applicable regulations and the separate Ex documentation.

3.6 Degree of protection

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

3.7 Post-connection check

After wiring the measuring device, perform the following checks:

- Is the terminal allocation correct (→  14)?
- Is the cable gland tight?
- Is the housing cover screwed tight?
- If auxiliary power is available:
Is the device ready for operation and is the liquid crystal display visible?

4 Operation

4.1 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, e.g.: **"basic setup"**, **"safety settings.."**, **"output"**, **"display"**, etc.

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

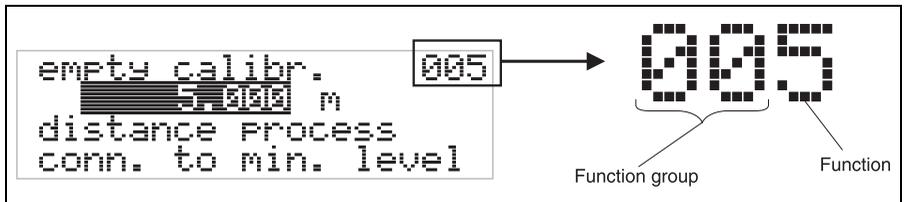
Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the device. Numerical values can be entered here and parameters can be selected and saved. The available functions of the **"basic setup" (00)** function group include, e.g.: **"tank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

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

1. Select the **"basic setup" (00)** function group
2. Select the **"tank properties" (002)** function (where the existing tank shape is selected).

4.1.1 Identifying the functions

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



L00-FMRxxxxx-07-00-00-de-005

The first two digits identify the function group:

- **basic setup** 00
- **safety settings** 01
- **linearisation** 04

...

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

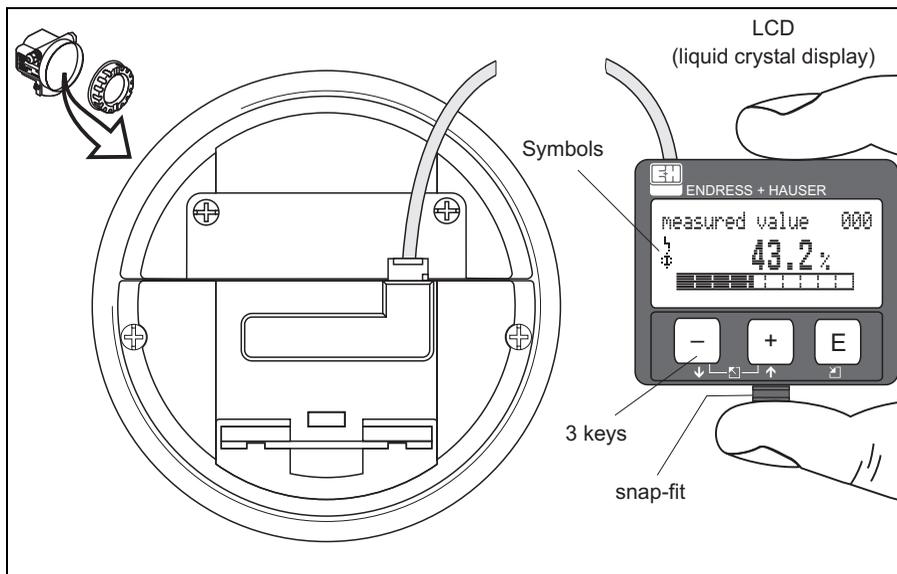
■ basic setup	00	→	■ tank properties	002
			■ medium properties	003
			■ process cond.	004
			...	

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

4.2 Display and operating elements

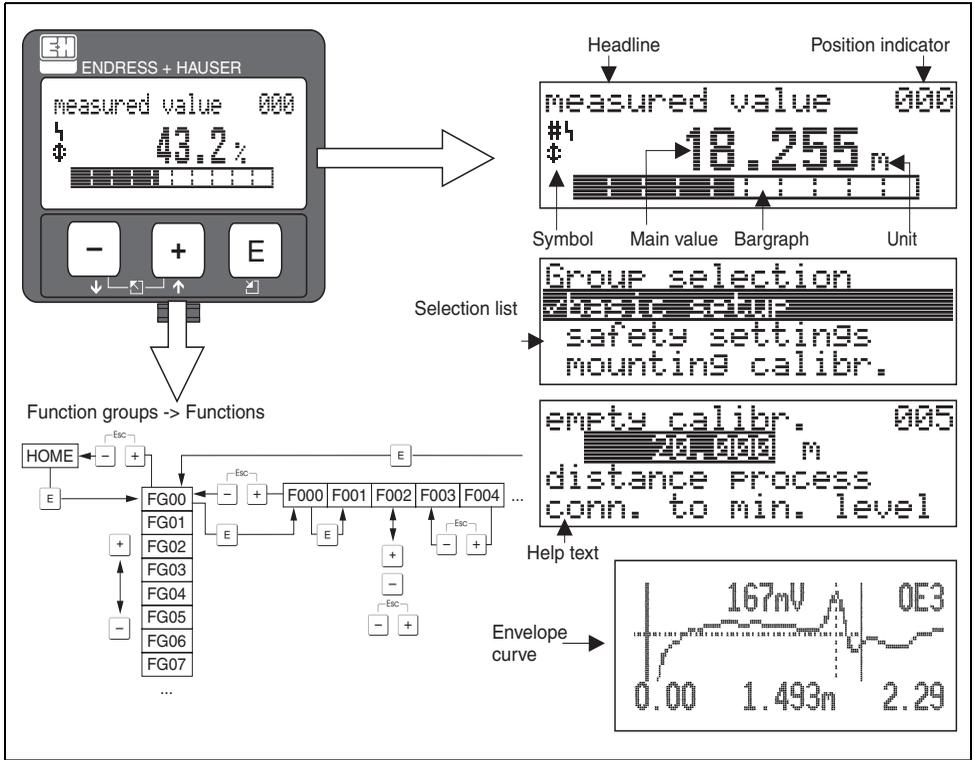
4.2.1 Liquid crystal display (LCD)

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.

4.2.2 Display



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

4.2.3 Display symbols

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

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

4.2.4 Key assignment

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

Function of the keys

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

5 Commissioning

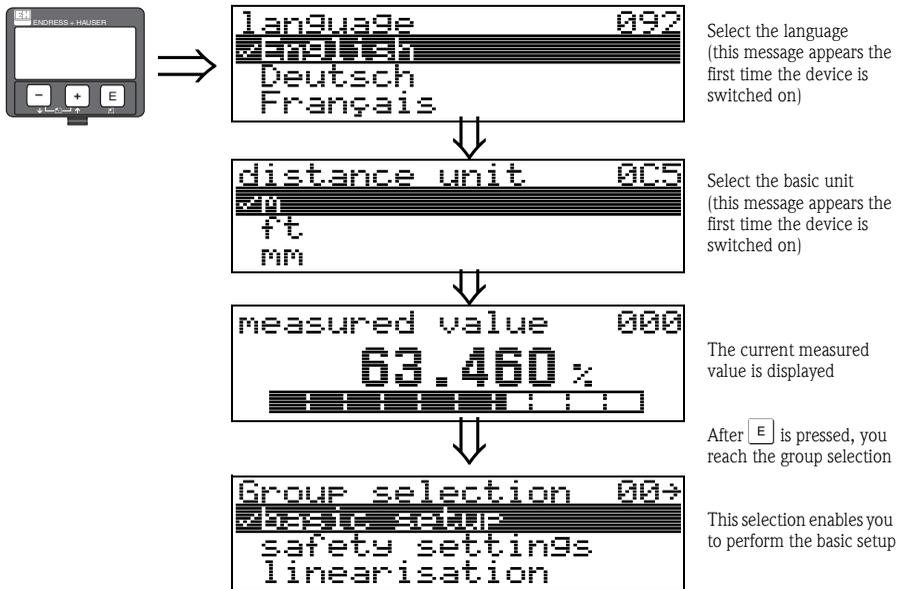
5.1 Function check

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

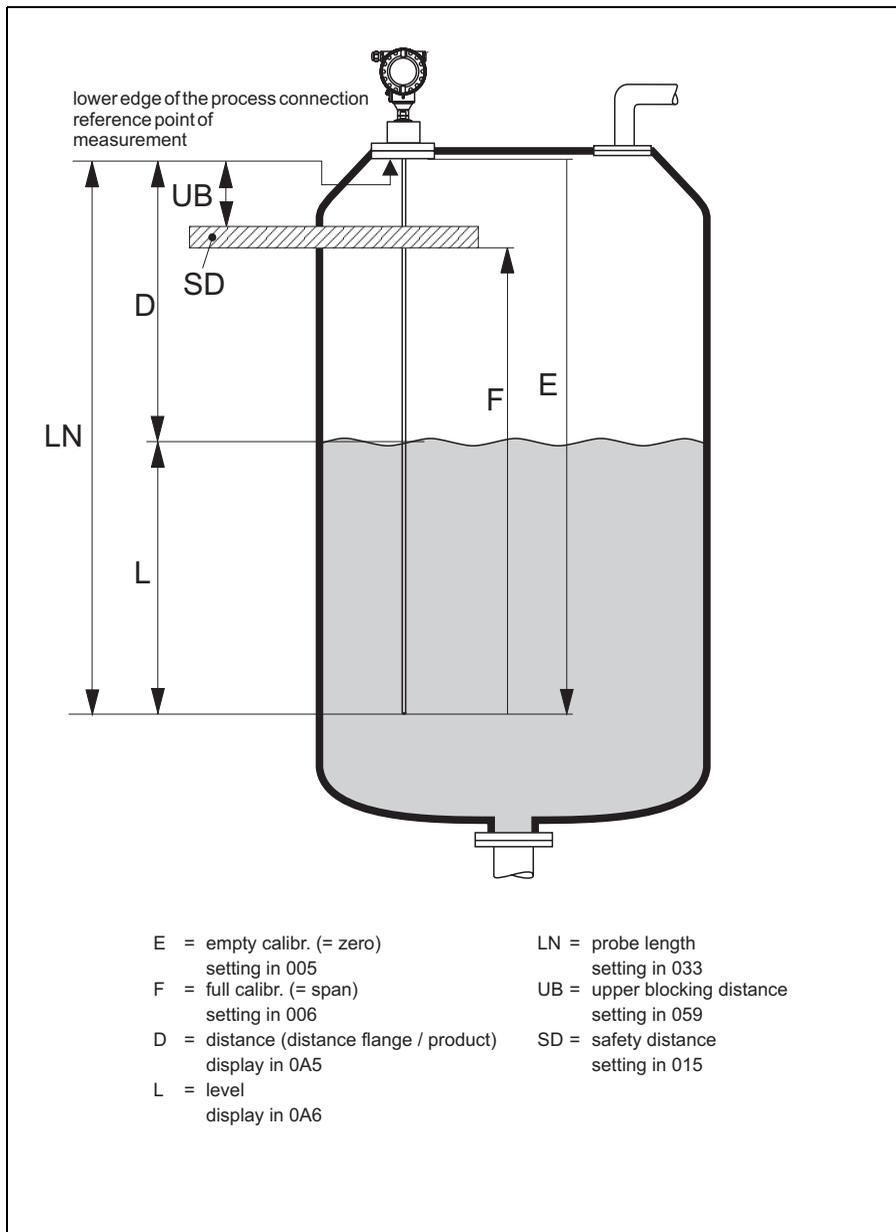
- Checklist "Post-installation check", → 11.
- Checklist "Post-connection check", → 16.

5.2 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.



5.3 Overview Basic Setup



100-FMP4xxxx-19-00-00-en-041

**Caution!**

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

The Levelflex is initially adjusted at the factory to the probe length ordered, so that in most cases only the application parameters, that automatically adapt the device to the measuring conditions, need to be entered. For models with 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 max. 32 points, that is based on a manually or semi-automatically input table, can be activated on-site or via remote operation. This function enables, for example, the conversion of the level into units of volume or weight

**Note!**

The Levelflex M allows to check for broken probe. On delivery, this function is switched off, because otherwise shortening of the probe would be mistaken for a broken probe. In order to activate this function, perform the following steps:

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

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

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

- Select the functions as described, → 17.
- Certain functions (e.g. starting an interference echo mapping (053)) prompt you to confirm your data entries. Press or to select "**YES**" and press to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group "**display** (09)") an automatic return is made to the home position (measured value display).

**Note!**

- The device continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimised.
- If the power supply fails, all preset and parameterised values remain safely stored in the EEPROM.
- All functions are described in detail, as is the overview of the operating menu itself, in the manual "**BA00245F - Description of Instrument Functions**" on the enclosed CD-ROM.

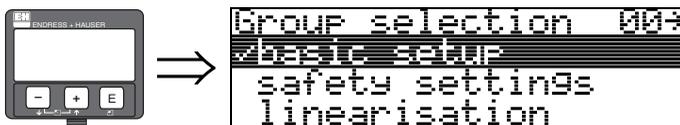
5.4 Basic Setup with the device display

5.4.1 Function "measured value" (000)

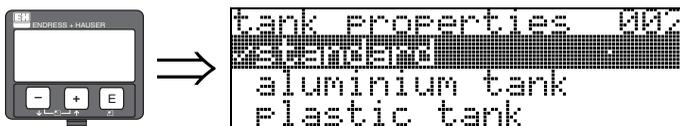


This function displays the current measured value in the selected unit (see "**customer unit**" (042) function). The number of digits after decimal point can be selected in the "**no.of decimals**" (095) function.

5.4.2 Function group "basic setup" (00)



5.4.3 Function "tank properties" (002)



This function is used to select the tank properties.

Selection:

- **standard**
- aluminium tank
- plastic tank
- bypass / pipe
- Coax probe
- concrete wall

standard

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

aluminium tank

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



Note!

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

plastic tank

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



Note!

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

bypass / pipe

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

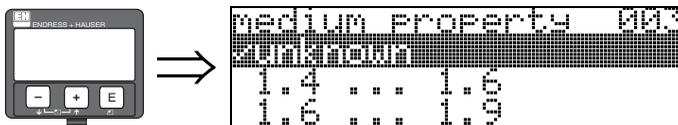
coax probe

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

concrete wall

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

5.4.4 Function "medium property" (003)



This function is used to select the dielectric constant.

Selection

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

Media group	DK (ϵ_r)	Typical liquids	Measuring range
1	1.4 to 1.6	– Condensed gases, e.g. N ₂ , CO ₂	—
2	1.6 to 1.9	– Liquefied gas, e.g. Propane – Solvent – Frigen / Freon – Palm oi	4 m
3	1.9 to 2.5	– Mineral oils, fuels	
4	2.5 to 4	– Benzene, styrene, toluene – Furan – Naphthalene	
5	4 to 7	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline	
6	> 7	– Aqueous solutions – Alcohols – Ammonia	

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

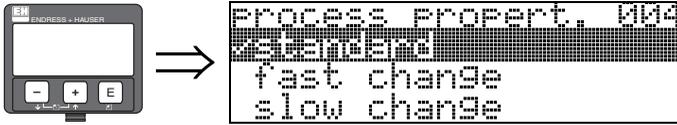
- Extremely loose surfaces of bulk solids, e.g. bulk solids with low piled density when filled pneumatically.
- Build-up, primarily of moist products.



Note!

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

5.4.5 Function "process propert." (004)



Use this function to adapt the device reaction to the filling speed in the tank. The setting impacts on an intelligent filter.

Selection:

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

Selection:	standard	fast change	slow change	test:no filter
Application:	For all normal applications, bulk solids and fluids at low to medium filling speed and sufficiently large tanks.	Small tanks, primarily with fluids, at high filling speeds.	Applications with strong surface movement, e.g. caused by stirrer, primarily large tanks with slow to medium filling speed.	Shortest reaction time: <ul style="list-style-type: none"> ■ For test purposes ■ Measurement in small tanks at high filling speeds, if "rapid change" setting is too slow.
2-wire electronics:	Dead time: 4 s Rise time: 18 s	Dead time: 2 s Rise time: 5 s	Dead time: 6 s Rise time: 40 s	Dead time: 1 s Rise time: 0 s
4-wire electronics:	Dead time: 2 s Rise time: 11 s	Dead time: 1 s Rise time: 3 s	Dead time: 3 s Rise time: 25 s	Dead time: 0,7 s Rise time: 0 s

5.4.6 Function "end of probe" (030)



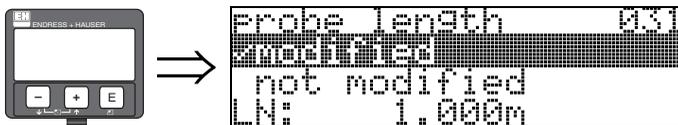
Use this function to select the polarity of the probe end signal. If the probe end is uncovered or in an insulated attachment, there is a negative probe end signal.

The signal from the probe end is positive if the attachment is grounded and a metallic centering of probe end is used.

Selection:

- free
- tie down isol.
- tie down gnd.

5.4.7 Function "probe length" (031)



Use this function to select whether the probe length was changed after factory calibration. Only then is it necessary to enter or correct the probe length.

Selection:

- not modified
- modified



Note!

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

5.4.8 Function "probe" (032)



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

Selection:

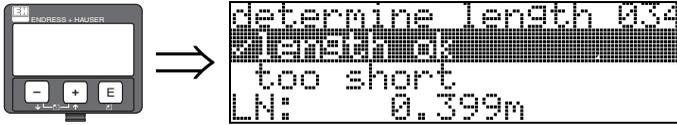
- free
- covered

5.4.9 Function "probe length" (033)



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

5.4.10 Function "determine length" (034)



Use this function, the probe length can be determined automatically.

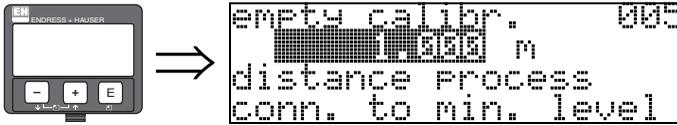
Due to the mounting conditions, the automatically determined probe length may be larger than the actual probe (typically 20 to 30 mm longer). This has no influence on the measuring accuracy. When entering the empty value for a linearisation, please use the "empty calibration" instead of the automatically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

Selection:

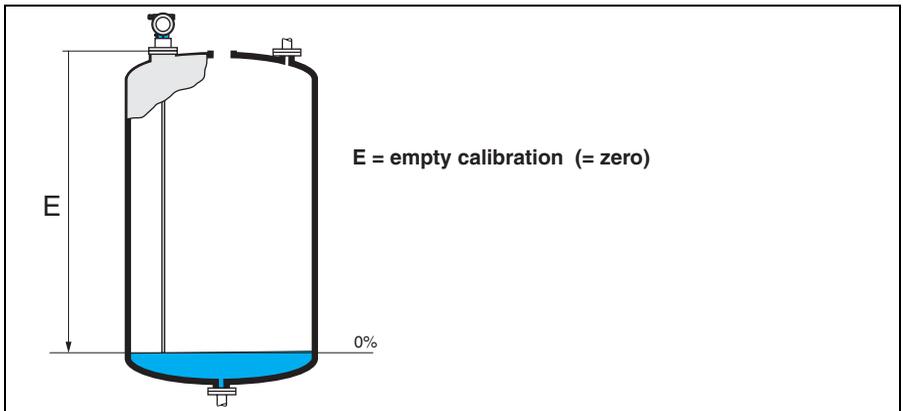
- Length ok
- too short
- too long

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

5.4.11 Function "empty calibr." (005)

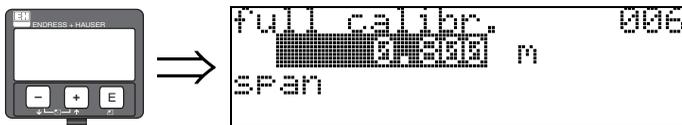


This function is used to enter the distance from the flange (reference point of the measurement) to the minimum level (= zero).

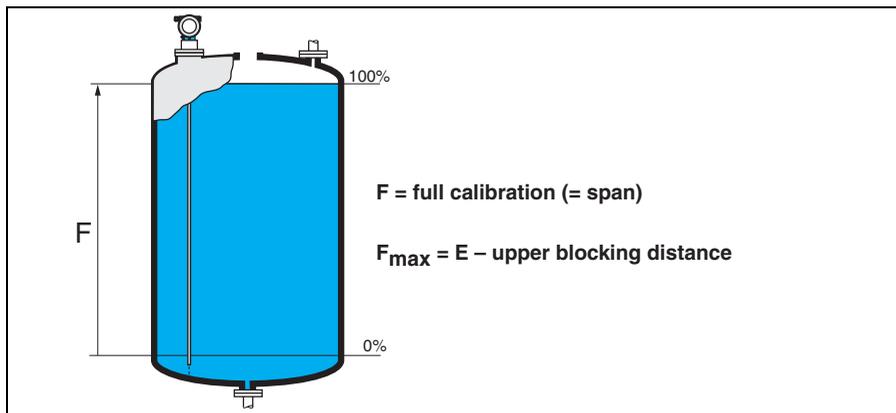


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5.4.12 Function "full calibr." (006)



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



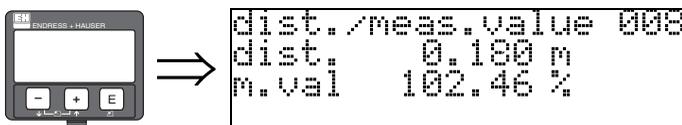
L00-FMP43xxx-14-00-06-en-009



Note!

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

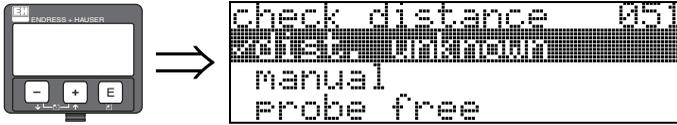
5.4.13 Function "dist./meas.value" (008)



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

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

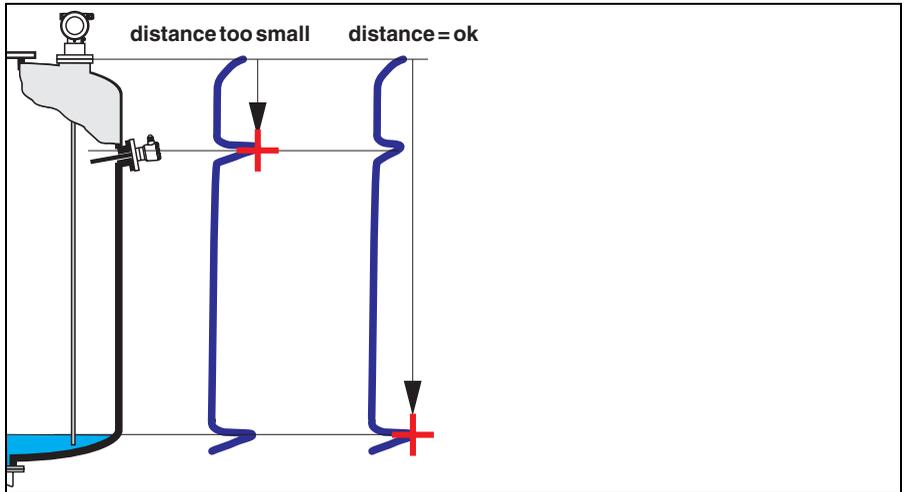
5.4.14 Function "check distance" (051)



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

Selection:

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



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distance = ok

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

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

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



Note!

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

dist. too small

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

dist. too big

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

dist.unknown

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

manual

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



Caution!

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

probe free

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



Caution!

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

5.4.15 Function "range of mapping" (052)

```
range of mapping 052
██████████ 0.3000 M
input of
mapping range
```

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (→ 22). This value can be edited by the operator. For manual mapping, the default value is 0.3 m

5.4.16 Function "start mapping" (053)

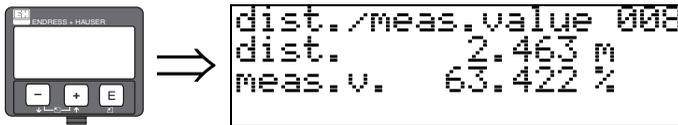


This function is used to start the interference echo mapping up to the distance given in "range of mapping" (052).

Selection:

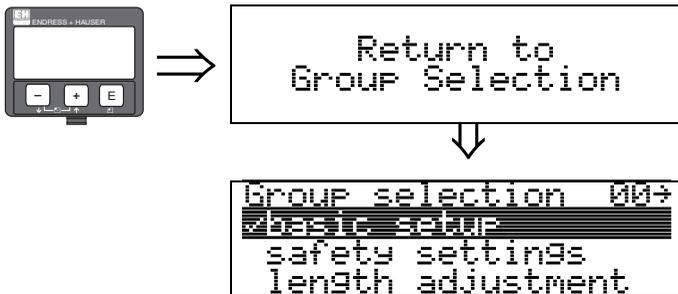
- off: no mapping is carried out
- on: mapping is started

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



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

- Distance correct – meas. value correct → basic setup completed
- Distance incorrect – meas. value incorrect → a further interference echo mapping must be carried out "check distance" (051)
- Distance correct – meas. value incorrect → check "empty calibr." (005)



After 3 s, the following message appears



Note!

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("envelope curve" (0E) function group) is recommended (→ 36).

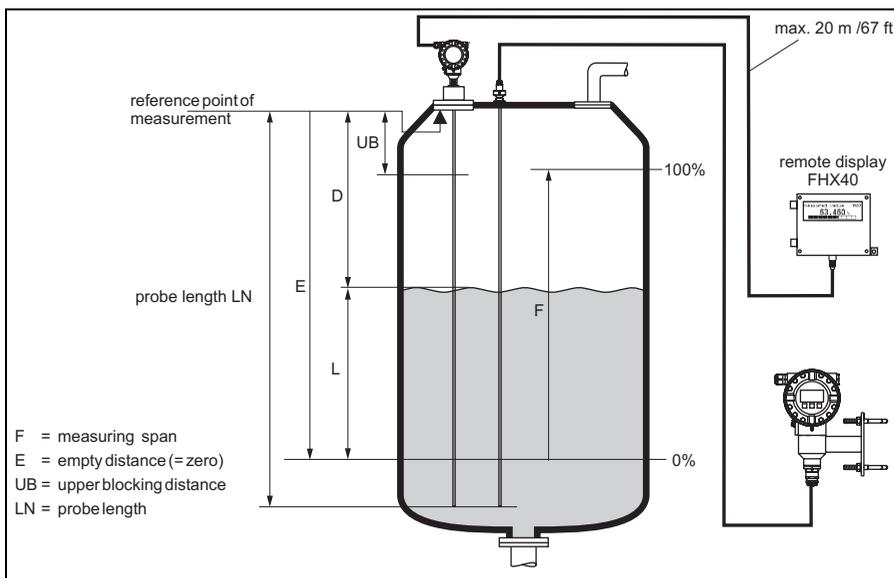
5.5 Blocking distance

Function "upper block. dist" (059)



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

The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (lower edge of the process connection) to the maximum level. At the lowest part of the probe an exact measurement is not possible "Performance characteristics" in Operating Instruction on CD-ROM.



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The blocking distance can be reduced if the probe is mounted flush with the wall or in a nozzle, max. 50 mm in height. When using a spray ball the blocking distance may not be smaller than 50 mm

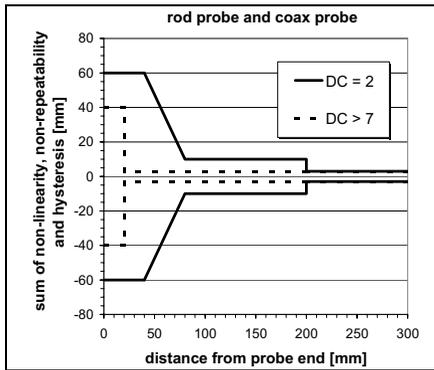
Maximum measured error

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

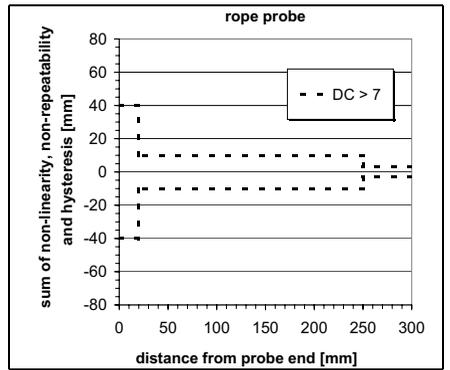
Output:	digital	analogue
sum of non-linearity, non-repeatability and hysteresis	±3 mm	± 0.06 %
Offset / Zero	±4 mm	± 0.03 %

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

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



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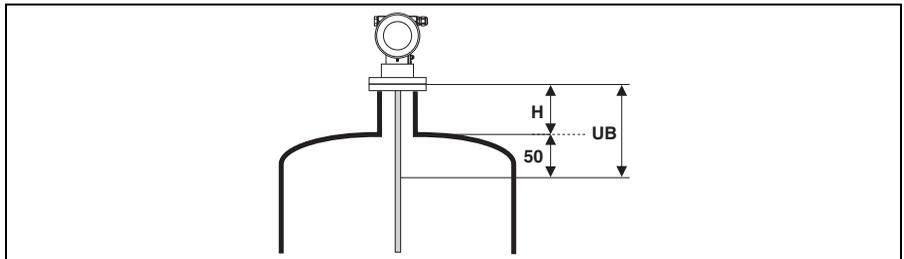


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Note!

Please reenter the blocking distance in the function group "**erweit. Abgleich**" (05) function "**Blockd. oben**" (059) when installing the device in a high nozzle:
upper blocking distance (UB) = nozzle height (H) + 50 mm.



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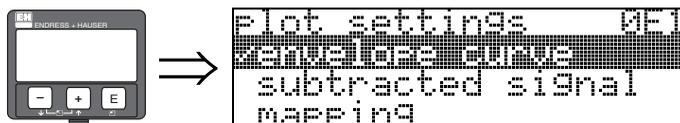
5.6 Envelope curve with device display

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

5.6.1 Function "plot settings" (OE1)

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

- **envelope curve**
- subtracted signal
- mapping

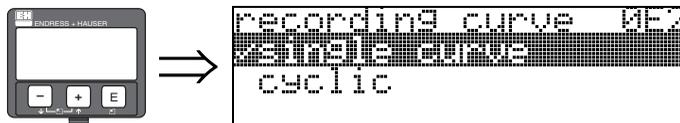


 **Note!**
The interference echo suppression (map) are explained in BA00245F/00/EN "Description of Instrument Functions".

5.6.2 Function "recording curve" (OE2)

This function determines whether the envelope curve is read as

- **single curve** or
- cyclic



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

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