



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



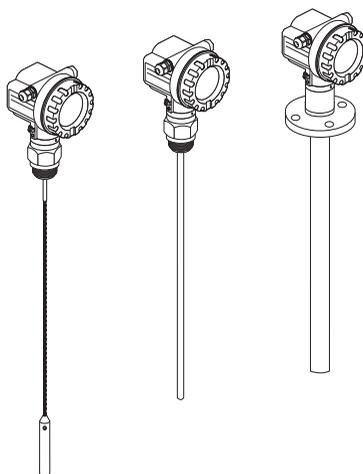
Solutions

Brief Operating Instructions

Levelflex M FMP40

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

KA01038F/00/EN/13.10
71120274

Endress+Hauser 

People for Process Automation

Table of contents

1	Safety instructions	3
1.1	Designated use	3
1.2	Installation, commissioning and operation	3
1.3	Operational safety and process safety	3
1.4	Return	3
1.5	Safety icons	4
2	Mounting	5
2.1	Quick installation guide	5
2.2	Incoming acceptance, transport, storage	5
2.3	Installation	6
2.4	Post-installation check	17
3	Wiring	18
3.1	Wiring in F12/F23 housing	18
3.2	Wiring in T12 housing	19
3.3	Terminal assignment	19
3.4	Connecting the measuring unit	20
3.5	Screening/potential matching	22
3.6	Degree of protection	22
3.7	Post-connection check	22
4	Operation	23
4.1	General structure of the operating menu	23
4.2	Display and operating elements	24
5	Commissioning	27
5.1	Function check	27
5.2	Switching on the measuring device	27
5.3	Overview Basic Setup	28
5.4	Basic Setup with the device display	30
5.5	Blocking distance	40
5.6	Envelope curve with device display	42

1 Safety instructions

1.1 Designated use

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

1.2 Installation, commissioning and operation

- The 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

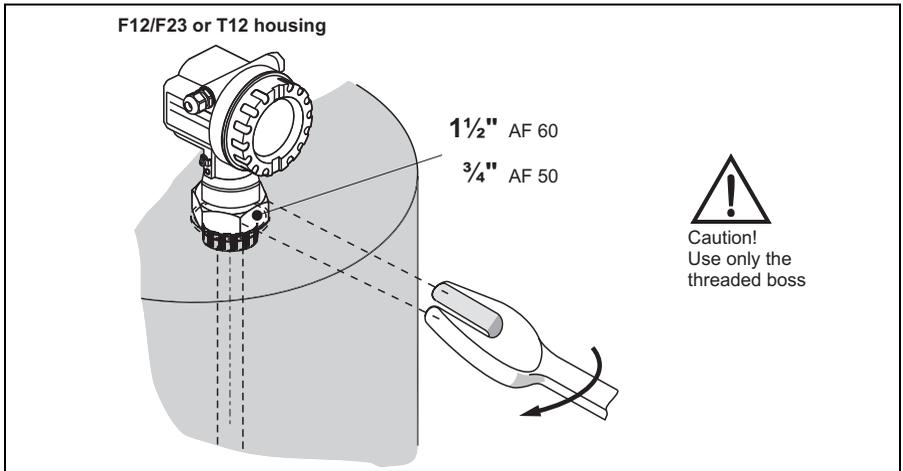
Follow the instructions on returning the device as outlined in the Operating Instructions on the CD-ROM provided.

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 Quick installation guide



2.2 Incoming acceptance, transport, storage

2.2.1 Incoming acceptance

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

2.2.2 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.

2.2.3 Storage

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

The permissible storage temperature is $-40\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$.

2.3 Installation

2.3.1 Mounting kit

For the mounting, you will require the following tool:

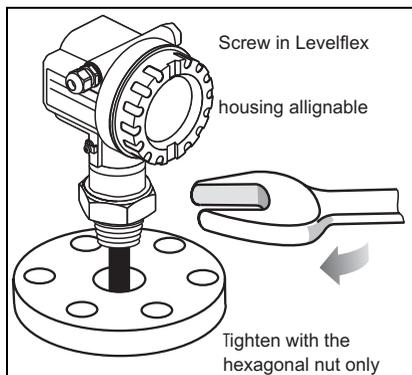
- The tool for flange mounting
- For the mounting of threaded connection:
 - 60 mm Open-end spanner for 1½", 50 mm Open-end spanner for ¾"
- 4 mm (0.1") Allen wrench for turning the housing

2.3.2 General installation instructions

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

Screw down

- Screw the Levelflex into the process connection or to flange.
- Maximum permissible torque:
 - G3/4" : 45 Nm
 - G1-1/2" : 450 Nm
 When using an aramid fibre seal and a process pressure of 40 bar:
 - G3/4" : 25 Nm
 - G1-1/2" : 140 Nm
- Levelflex functions in metal, concrete and plastic silos. When installing in metal silos, take care to ensure good metallic contact between the process connection and silo.
- For flange mounting: if a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.



L00-FMP4xxxx-17-00-00-en-057

2.3.3 Mounting rope probes

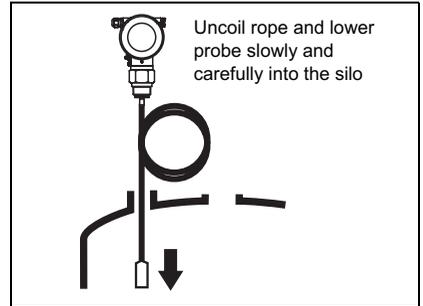


Caution!

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

Insert probe

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



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

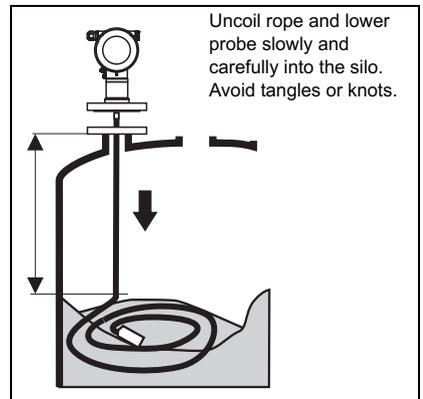
2.3.4 Mounting rope probes in a partially full silo

It is not always possible to empty a silo which is already in operation. Because the probe can be turned in the threaded boss, it can also be mounted when the silo is only partially filled. In order to avoid problems when Levelflex is mounted into a partially full silo, the following measures should be taken:

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

Insert probe

- If possible, make a visual check to see that the rope has not tangled or is lysing such that it can knot when the level falls. This is particularly important if a flange was not used. Re-insert the probe is necessary.
- Screw the flange to the counterflange on the nozzle.



L00-FMP4xxxx-17-00-00-en-059



Note!

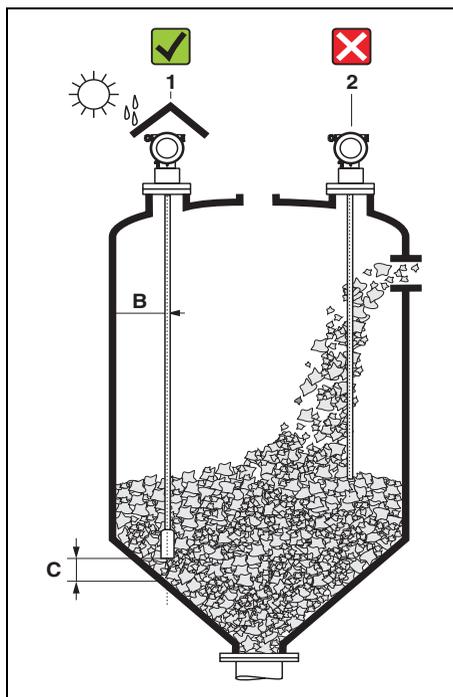
- After mounting, map must be made should the installation conditions require it.
- Before full accuracy is obtained the probe must hang fully extended.

2.3.5 Engineering hints for level measurement in bulk solids and fluids

- Normally, rope probes should be used for bulk solids, rod probes are only suitable for short measuring ranges up to approx. 2 m in bulk solids. This applies above all to applications in which the probe is installed laterally at an angle and for light and pourable bulk solids.
- Normally use rod or coax probes for liquids. Rope probes are used in liquids for measuring ranges > 4 m and with restricted ceiling clearance which does not allow the installation of rigid probes.
- Coax probes are suited to liquids with viscosities of up to approx. 500 cSt. Coax probes can measure most liquefied gases, as of dielectric constant 1.4. Moreover, installation conditions, such as nozzles, tank internal fittings etc., have no effect on the measurement when a coax probe is used. A coax probe offers maximum EMC safety when used in plastic tanks.
- In the case of large silos, the lateral pressure on the rope can be so high that a rope with plastic jacketting must be used. We recommend PA-coated ropes be used for cereal products wheat, flour etc..

Mounting location

- Do not mount rod or rope probes in the filling curtain (2).
- Mount rod and rope probes away from the wall (B) at such a distance that, in the event of build-up on the wall, there is still a minimum distance of 100 mm between the probe and the build-up.
- Mount rod and rope probes as far away as possible from installed fittings. "Mapping" must be carried out during commissioning in the event of distances < 300 mm.
- When installing rod and rope probes in plastic containers, the minimum distance of 300 mm also applies to metallic parts outside the container..
- Rod and rope probes may not, at times, contact metallic container walls or floors.
- Minimum distance of probe end to the container floor (C):
 - Rope probe: 150 mm
 - Rod probe: 50 mm
 - Coax probe: 10 mm
- When installing outdoors, it is recommended that you use a protective cover (1), see Operating instruction on CD-ROM.



100-FMP4xxxx-17-00-00-xx-003

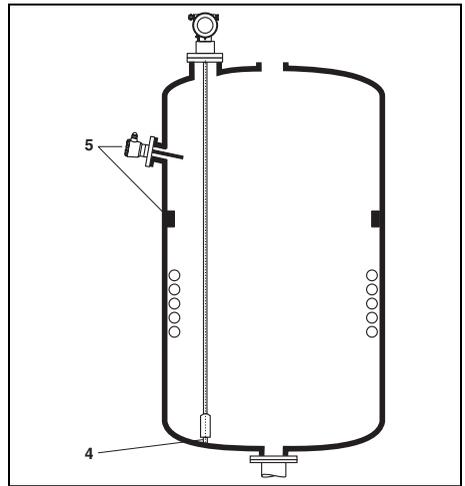
Minimum distance B of the probe to the container wall:

Wall	min. distance B
Metal	100 mm for smooth walls
Plastic	100 mm, min. 300 mm to metallic components outside of the tank
Concrete	0,5 m/20", otherwise the max. possible measuring range is reduced.

Distance to protruding internals min. 300 mm.

Other installations

- Select the mounting location such that the distance to internals (5) (e.g. limit switch, struts) is > 300 mm over the entire length of the probe, also during operation.
- Probe must within the measuring span not touch any internals during operation. If necessary: when using rope probes the probe end (4) may be fixed to ensure that (see Operating Instruction on the CD-ROM)!



L00-FMP4xxxx-17-00-00-xx-037

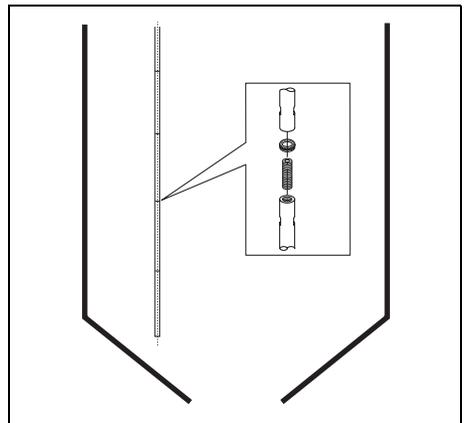
Optimization options

Interference echo suppression:
 Measurement can be optimised by electronically tuning out interference echoes.

Separable probes

If there is little mounting space (distance to the ceiling), it is advisable to use separable rod probes (Ø16 mm).

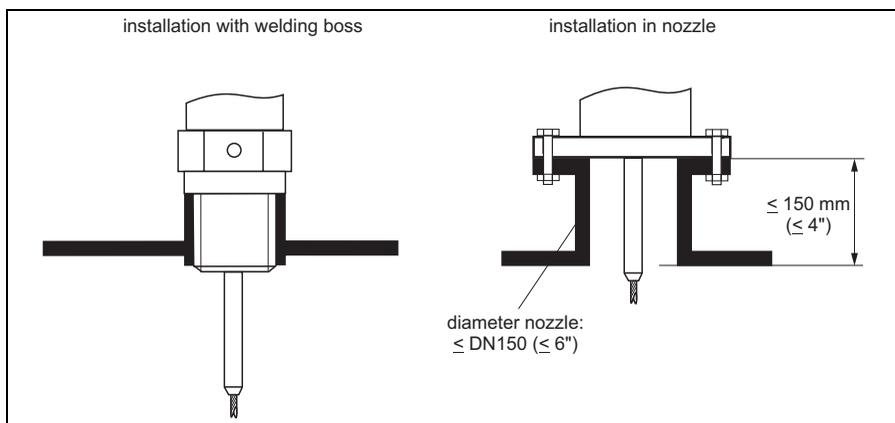
- max. probe length 10 m (394 in)
- max. sideways capacity 20 Nm
- probes are separable several times with the lengths:
 - 500 mm (19.68 in)
 - 1000 mm (39.37 in)
- torque: 15 Nm



L00-FMP4xxxx-17-00-00-xx-037

Type of probe installation

- Probes are mounted to the process connection with threaded connections or flanges and are usually also secured with these. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down. The easiest way to fix the rope probes is to screw them to the internal thread on the lower end of the weight. Thread size, see Operating Instructions on the CD-ROM.
- The ideal installation is mounting in a screw joint / screw-in sleeve which is internally flush with the container ceiling.
- If installation takes place in a nozzle, the nozzle should be 50 to 150 mm in diameter and should not be more than 150 mm high. Installation adapters are available for other dimensions, see Operating Instructions on the CD-ROM.



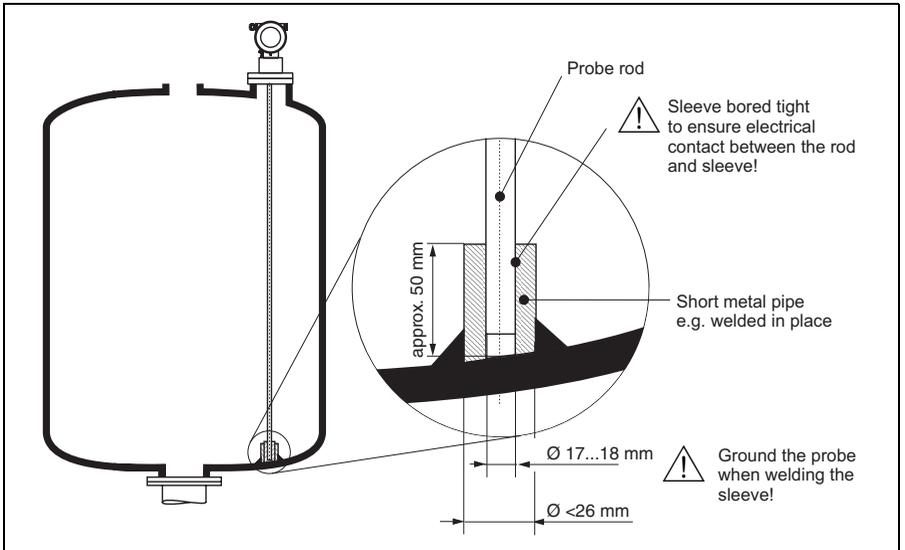
L00-FMP4xxxx-17-00-00-en-017

Welding the probe into the vessel

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

Supporting probes against warping

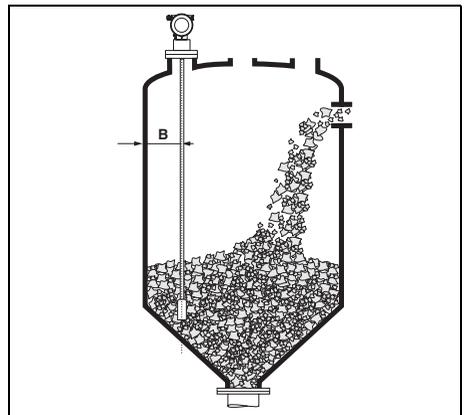
- For WHG approval:
For probe lengths ≥ 3 m a support is required (see figur).
- For GL/ABS approval:
Rof probes $\varnothing 16 \text{ mm} \leq 1$ m permissible, rod probes $\varnothing 6 \text{ mm}$ not permissible.



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

2.3.6 Special notes for bulk solids

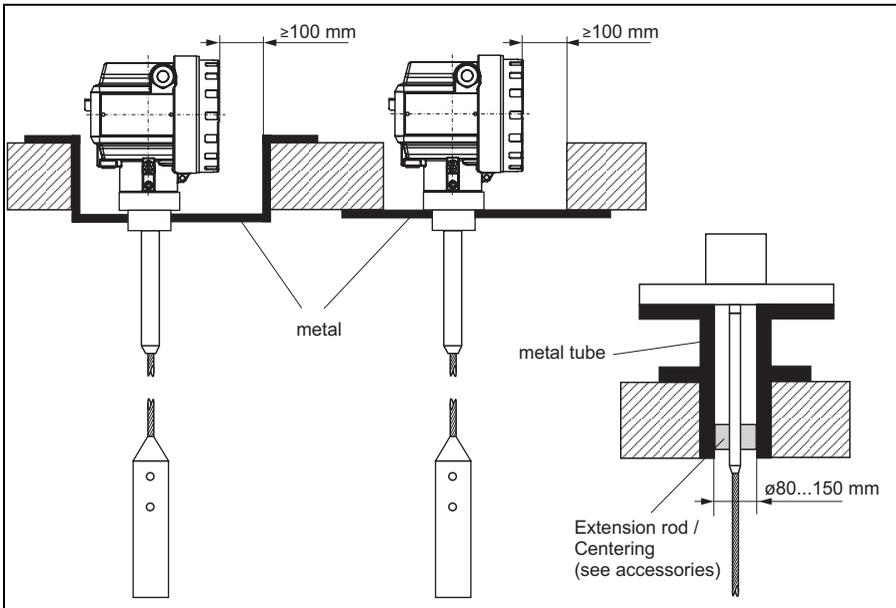
- In the case of bulk solids, as great a distance as possible from the filling curtain is especially important to avoid wear.
- In concrete silos, a **large distance** (B) should be observed between the probe and the concrete wall, if possible ≥ 1 m, but at least 0.5 m.
- The installation of rope probes must be carried out carefully. If possible, installation should be carried out when the silo is empty.
- Check the probe regularly for defect.



L00-FMP4xxxx-17-00-00-xx-005

Installation in concrete silos

Installation, for example, into a thick concrete ceiling should be made flush with the lower edge. Alternatively, the probe can also be installed into a pipe that must not protrude over the lower edge of the silo ceiling. The pipe should kept at a minimum length. Installation suggestions see diagramm.



100-FMP4xxxx-17-00-00-en-008

Strong dust generation can lead to build-up behind the center washer. This can cause an interference signal. For other installation possibilities please contact Endress+Hauser.

2.3.7 Installation in bulk solids silo

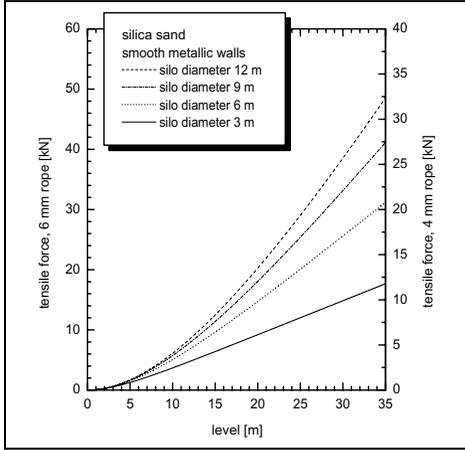
Tensile load

Bulk solids exert tensile forces on rope probes whose height increases with:

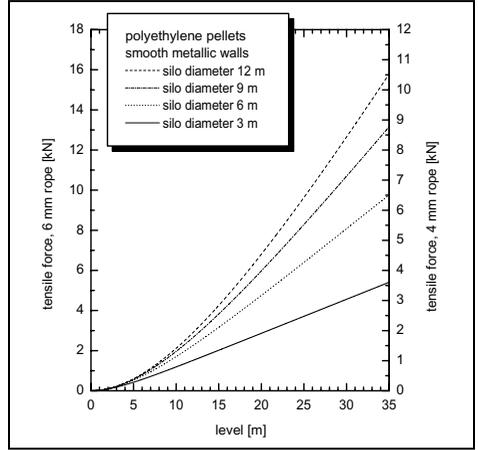
- the length of the probe, i.e. max. cover
- the bulk density of the product
- the silo diameter
- the diameter of the probe rope

The following diagrams show typical loads for frequently occurring bulk solids as reference values. The calculation is performed for the following conditions:

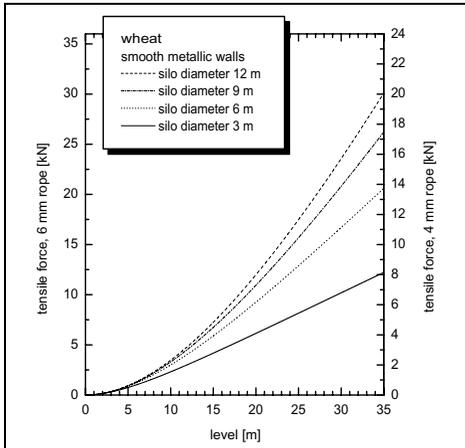
- Suspended probe (probe end not fixed at the bottom)
- Free-flowing bulk solid, i.e. mass flow. A calculation for core flow is not possible. In the event of collapsing cornices, considerably higher loads can occur.
- The specification for tensile forces contains the safety factor 2, which compensates for the normal fluctuation range in pourable bulk solids..



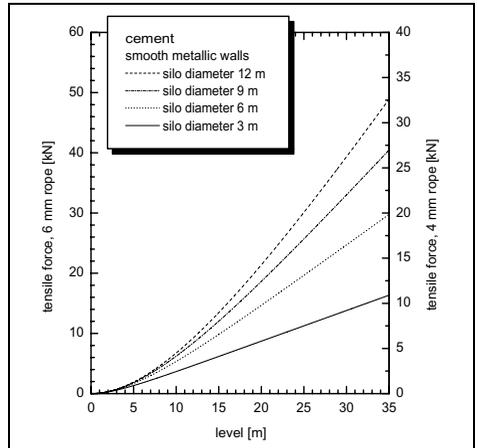
L00-FMP40xxx-05-00-00-en-007



L00-FMP40xxx-05-00-00-en-008



L00-FMP40xxx-05-00-00-en-006



L00-FMP40xxx-05-00-00-en-005

Since the tensile forces are also heavily dependent on the viscosity of the product, a higher safety factor is necessary for highly viscous products and if there is a risk of cornice build-up. In critical cases it is better to use a 6 mm rope instead of a 4 mm one.

The same forces also act on the silo cover.

On a fixed rope, the tensile forces are definitely greater, but this can not be calculated. Observe the tensile strength of the probes or ensure that the tensile strength of the probes is not exceeded.

Options for reducing the tensile forces:

- shorten the probe
- If the maximum tensile load is exceeded, check whether it would be possible to use a non-contact Ultrasonic or Level-radar device.

2.3.8 Installation in liquid tanks

- When installing in agitation units, check whether a no-contact process (ultrasonic or radar) would be better suited, especially if the agitator generates large mechanical loads on the probe.
- If Levelflex is, nevertheless, installed in tanks with agitators, it is better to use coax probes which have a greater lateral loading capacity.

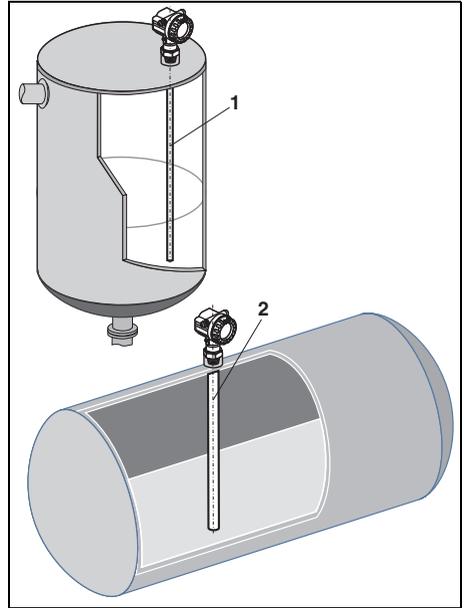
Standard installation

Using a coax probe offers great advantages when the viscosity of the product is ≤ 500 cSt and it is certain that the product does not accumulate build-up:

- Greater reliability:
As of dielectric constant=1.4, measurement functions independently of all electrical properties in all liquids.
- Internals in the tank and nozzle dimensions do not have any influence on measurement.
- Higher lateral load-bearing capacity than rod probes.
- For higher viscosity a rod probe is recommended, or using a non-contact measuring principle with the Level-Radar Micropilot M.

Installation in horizontal and upright cylindrical tanks

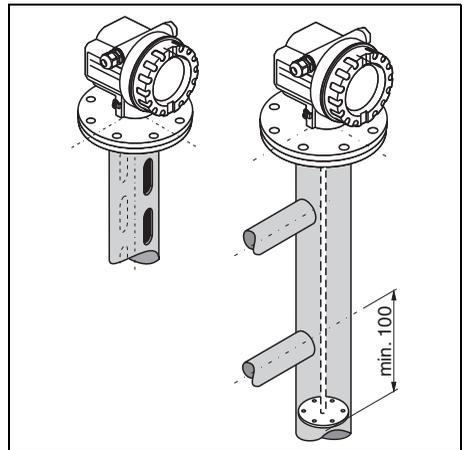
- Use the following types of probe for measuring ranges
 - up to 4 m (13 ft): rod probe (1) or coax probe (2)
 - up to 10 m (33 ft): separable probe
 - above 10 m (33 ft): 4 mm rope probe
- Installation and possible fixing as with bulk solids.
- Any distance from wall, as long as occasional contact is prevented.
- When installing in tanks with a lot of internals or internals situated close to the probe, or in connection with large \varnothing : Use a coax probe!



L00-FMP4xxxx-17-00-00-yy-021

Installation in stilling well or bypass

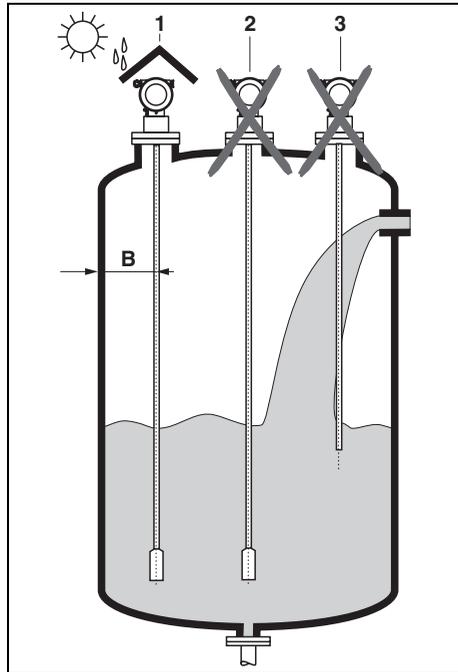
- A rod probe can be used for pipe diameters bigger than 40 mm.
- When installing a rod probe into a metallic pipe with internal diameter of up to 150 mm, you have all the advantages of a coax probe.
- Welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence measurement.
- If a rod probe is used, the probe length must be 100 mm longer than the lower disposal.
- It must be ensured that the probe does not come into contact with the side wall. Where necessary, use a centering disk at the lower end of the probe (see Operating instruction on the CD-ROM).



L00-FMP4xxxx-17-00-00-xx-024

Mounting Location

- Recommended distance B wall-mounted rope probe: $\sim 1/6$ to $1/4$ of the container diameter.
- Not central (2) in metallic tanks.
- Not in the filling curtain (3).
- Please order the probe length such that it ends approx 30 mm above the floor of the tank.
- Temperature conditions must be met.
- It is recommended that a protective cover (1) be used, in order to protect the transmitter against direct sunlight or rain. Mounting and demounting are carried out simply with a clamp (see Operating instruction on the CD-ROM).

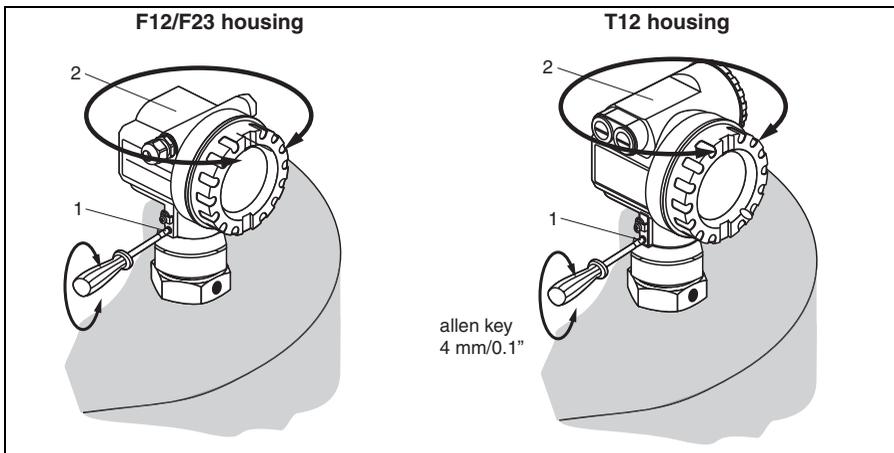


100-FMP4xxxx-17-00-00-xx-001

2.3.9 Turn housing

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

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



L00-FMP4xxxx-17-00-00-en-028

2.4 Post-installation check

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

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

3 Wiring

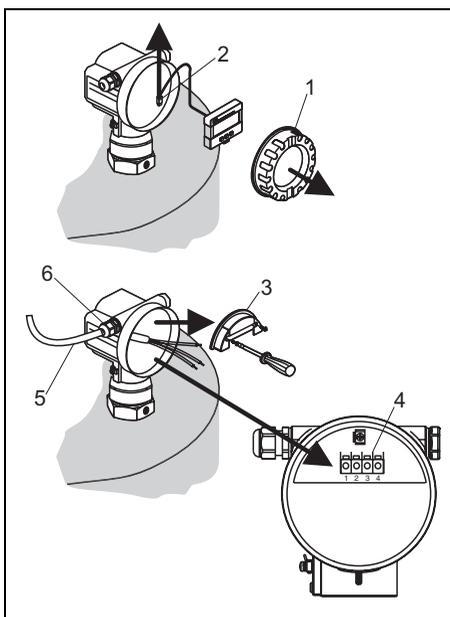
 **Warning!**
When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.

 **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

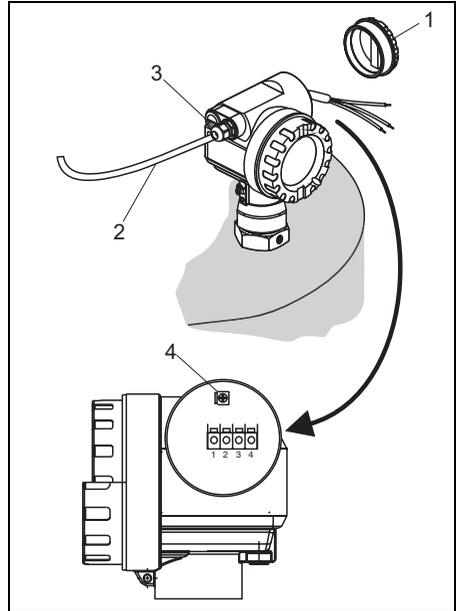
1. Unscrew housing cover (1).
2. Remove any display (2) if fitted.
3. Remove cover plate from terminal compartment (3).
4. Pull out terminal module (4) slightly using "pulling loop" (only 2-wire).
5. Insert cable (5) through gland (6).
6. Make connection (see terminal assignment).
7. Re-insert terminal 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.



100-FMP40xxx-04-00-00-xx-001

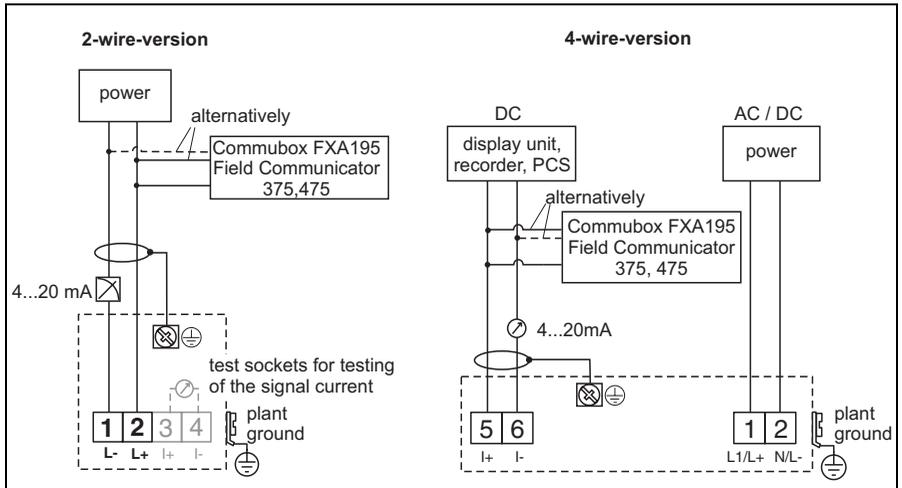
3.2 Wiring in T12 housing

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.



L00-FMP40xxxx-04-00-00-xx-002

3.3 Terminal assignment



L00-FMP4xxxx-04-00-00-en-006

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 gland

- Cable gland: M20x1.5
- Cable entry: G $\frac{1}{2}$ or $\frac{1}{2}$ NPT

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

HART, 4-wire active

Version	Voltage	Max. load
DC	10.5 V to 32 V	600 Ω
AC, 50/60 Hz	90 V to 253 V	600 Ω

HART residual ripple, 4-wire, DC version: $U_{ss} = 2 \text{ V}$, voltage incl. ripple within the permitted voltage (10.5 to 32 V).

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:
 - IP68, NEMA6P (24 h at 1.83 m under water surface)
 - IP66, NEMA4X
- 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 (→  19)?
- 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):**

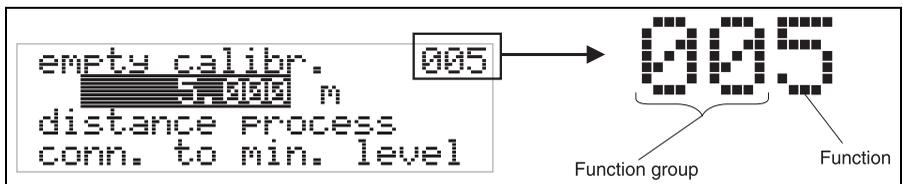
Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the device. Numerical values can be entered here and parameters can be selected and saved. The available functions of the "**basic setup**" (00) function group include, e.g.: "**tank 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:

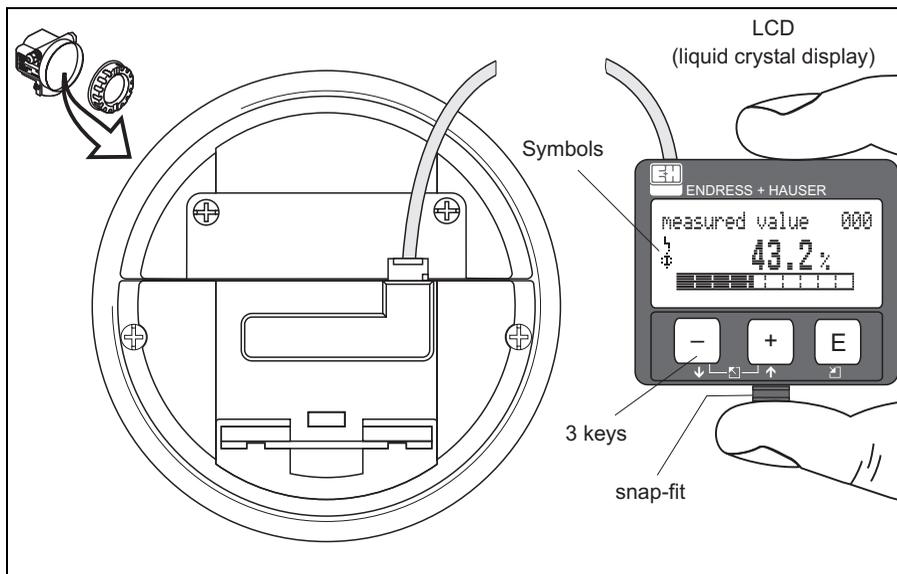
■ basic setup	00	→	■ tank properties	002
			■ medium properties	003
			■ process cond.	004
			...	

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)

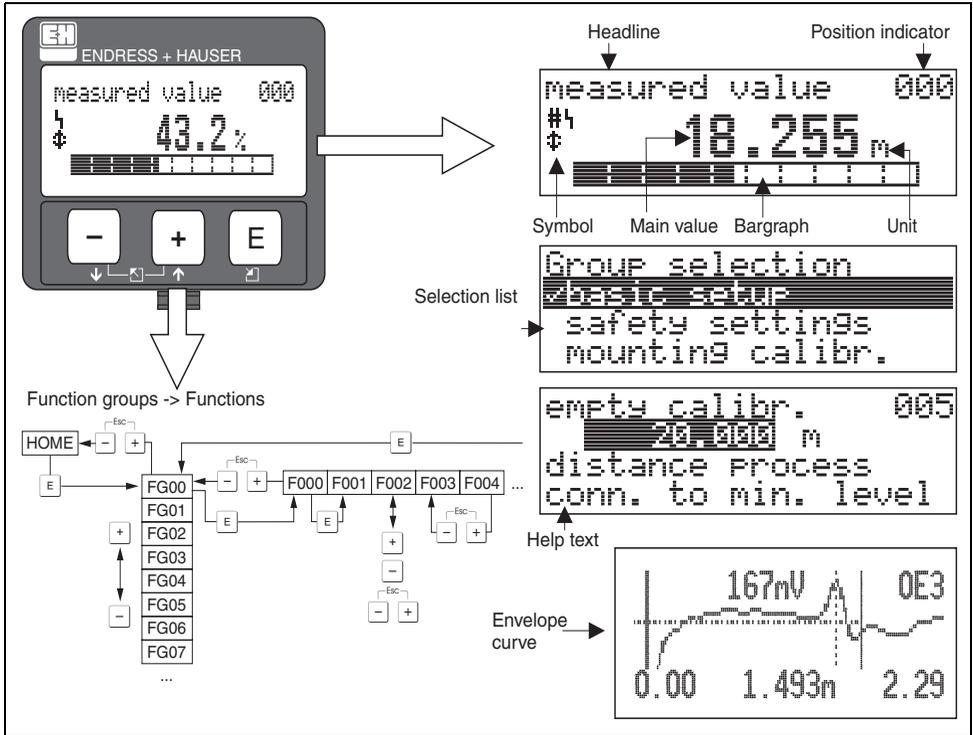
Four lines with 20 characters each. Display contrast adjustable through key combination.



L00-FMxxxxxx-07-00-00-en-001

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

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

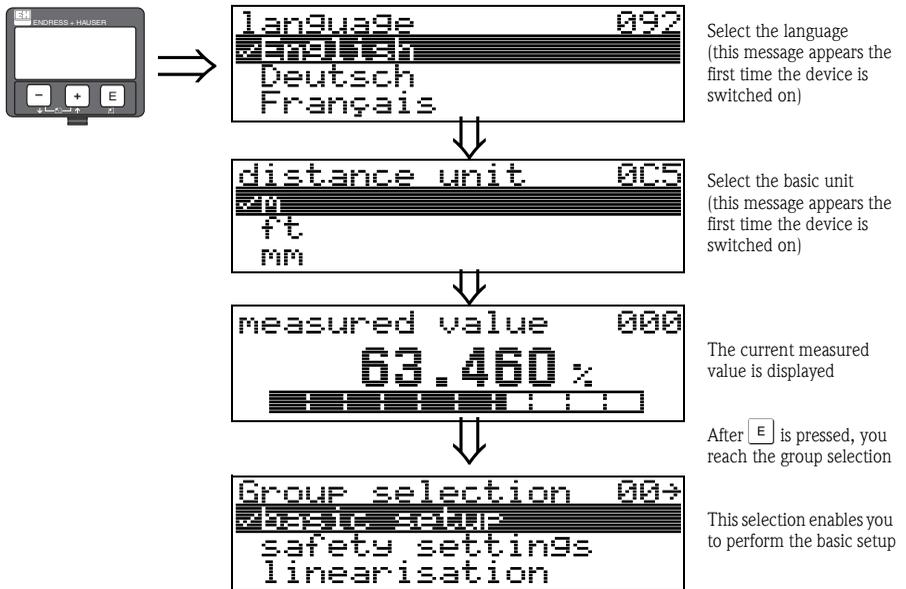
5.1 Function check

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

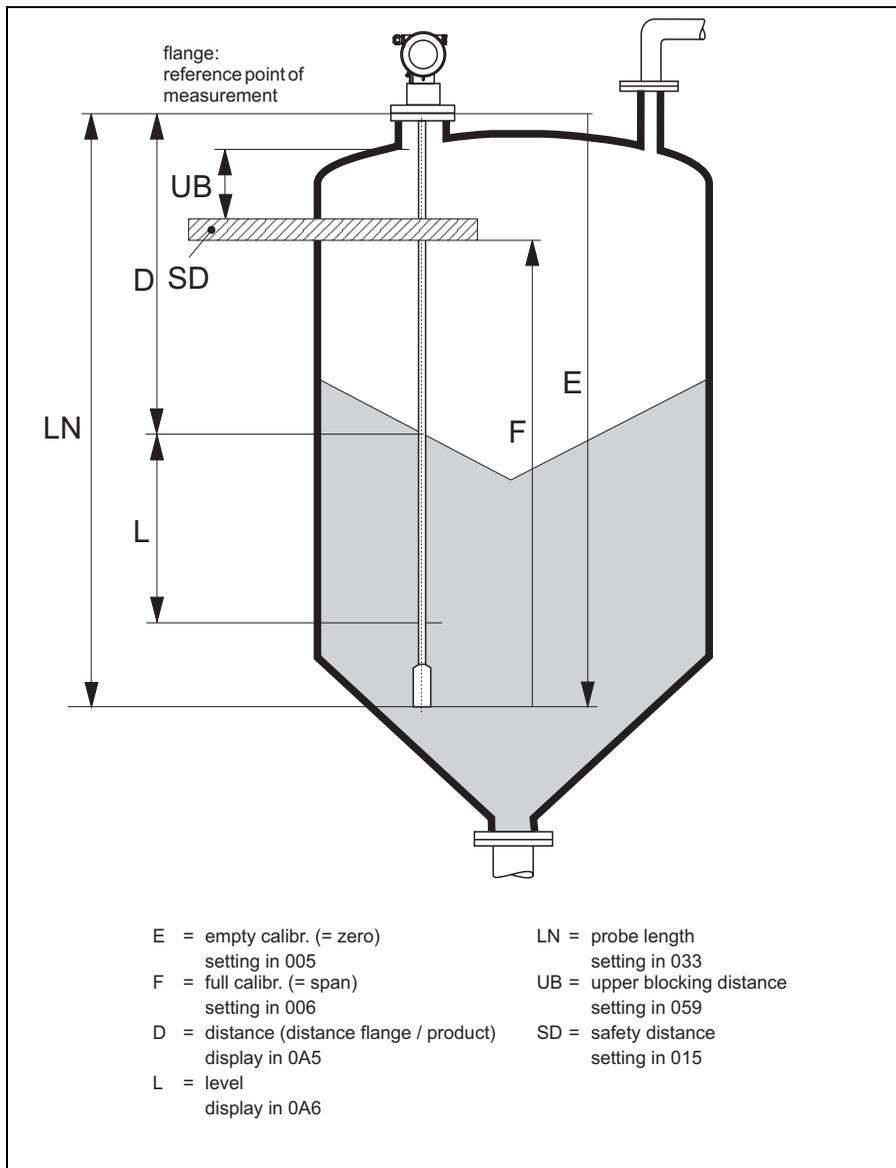
- Checklist "Post-installation check", → 17.
- Checklist "Post-connection check", → 22.

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



L100-FMP4xxxx-19-00-00-en-031

**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 is "F" 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, → 23.
- 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 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.

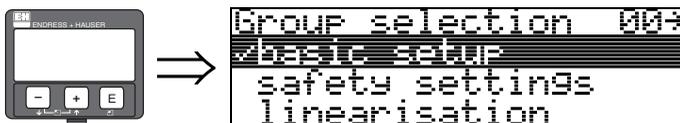
5.4 Basic Setup with the device display

5.4.1 Function "measured value" (000)

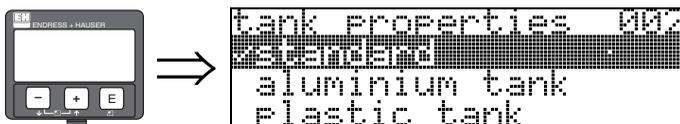


This function displays the current measured value in the selected unit (see "**customer unit**" (042) function). The number of digits after decimal point can be selected in the "**no.of decimals**" (095) function.

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.

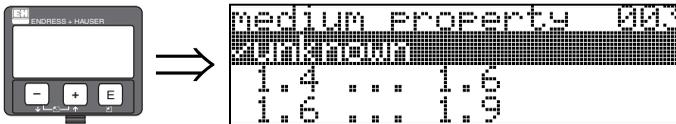
coax probe

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 ≤ DN150)
- 1.6 ... 1.9
- 1.9 ... 2.5
- 2.5 ... 4.0
- 4.0 ... 7.0
- > 7.0

Media group	DC (Gr)	Typical bulk solids	Typical liquids	Measuring range	
				bare metallic probes	PA-coated rope probes
1	1.4 to 1.6		– Condensed gases, e.g. N ₂ , CO ₂	4 m (157"), only coax probe	—
2	1.6 to 1.9	– Plastic granulate – White lime, special cement – Sugar	– Liquefied gas, e.g. Propane – Solvent – Frigen / Freon – Palm oi	25 m to 30 m (984" to 1181")	12,5 m to 15 m (492" to 590")
3	1.9 to 2.5	– Portland cement, plaster	– Mineral oils, fuels	30 m to 35 m (1181" to 1378")	—
		– Flour	—	—	15 m to 25 m (590" to 984")
4	2.5 to 4	– Grain, seeds	—	—	25 m to 30 m (984" to 1181")
		– Ground stones – Sand	– Benzene, styrene, toluene – Furan – Naphthalene	35 m (1378")	25 m to 30 m (984" to 1181")
5	4 to 7	– Naturally moist (ground) stones, ores – Sal	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline	35 m (1378")	35 m (1378")
6	> 7	– Metallic powder – Carbon black – Coa	– Aqueous solutions – Alcohols – Ammonia	35 m (1378")	35 m (1378")

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

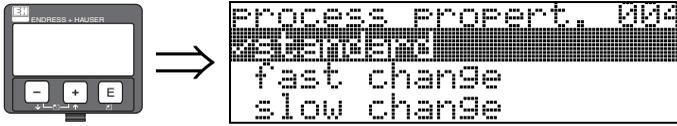
- Extremely loose surfaces of bulk solids, e.g. bulk solids with low piled density when filled pneumatically.
- Build-up, primarily of moist products.



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)



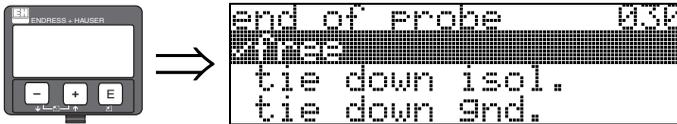
Use this function to adapt the device reaction to the filling speed in the tank. The setting impacts on an intelligent filter.

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)

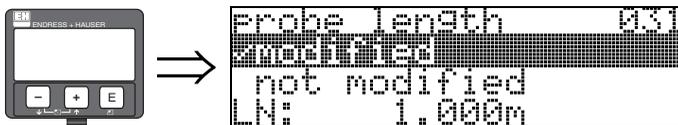


Use this function to select the polarity of the probe end signal. If the probe end is uncovered or in an insulated attachment, there is a negative probe end signal. The signal from the probe end is positive if the attachment is grounded.

Selection:

- **free**
- tie down isol.
- tie down gnd. (If using a metallic centering of probe end)

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 "determine length" (034) function. If the probe is covered, a correct entry is required in the "probe length" (033) function.

Selection:

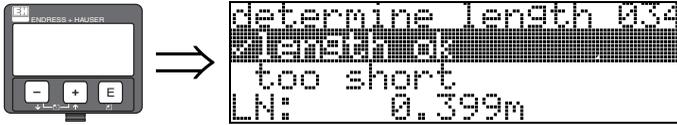
- free
- covered

5.4.9 Function "probe length" (033)



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

5.4.10 Function "determine length" (034)



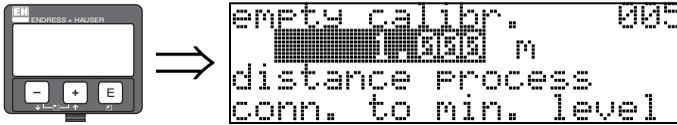
Use this function, the probe length can be determined automatically. Due to the mounting conditions, the automatically determined probe length may be larger than the actual probe (typically 20 to 30 mm longer). This has no influence on the measuring accuracy. When entering the empty value for a linearisation,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

Selection:

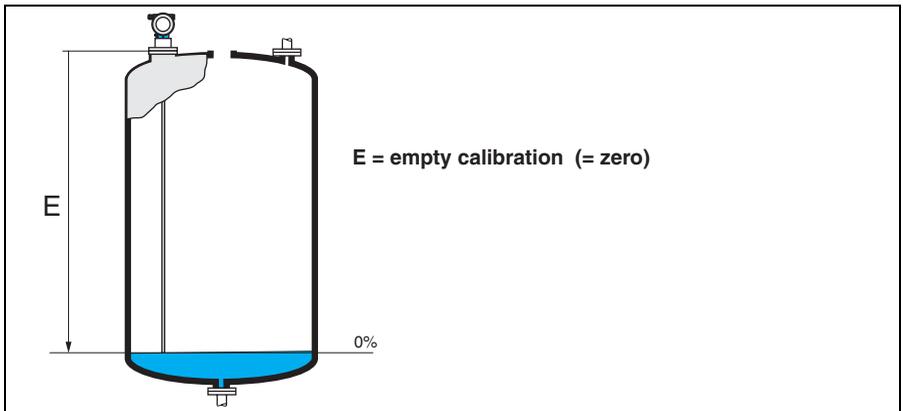
- Length ok
- too short
- too long

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).

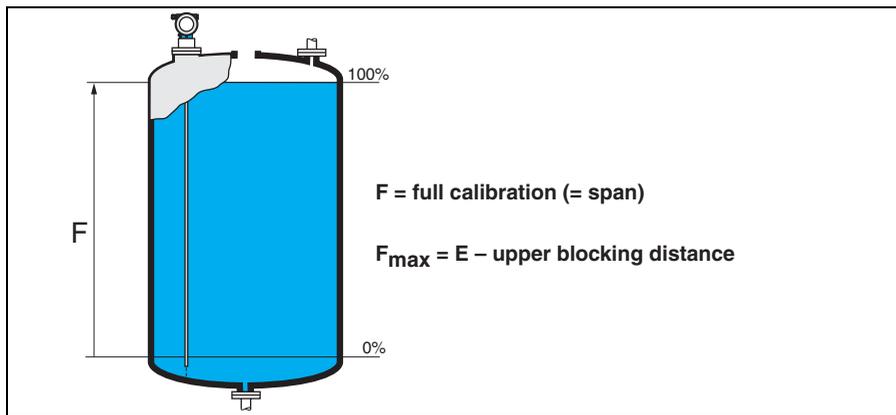


L00-FMP4xxxx-14-00-06-en-008

5.4.12 Function "full calibr." (006)



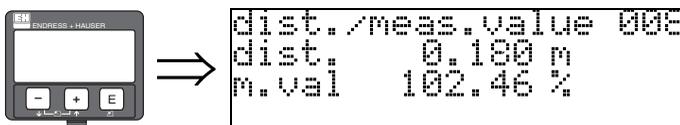
This function is used to enter the distance from the minimum level to the maximum level (= span).



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.

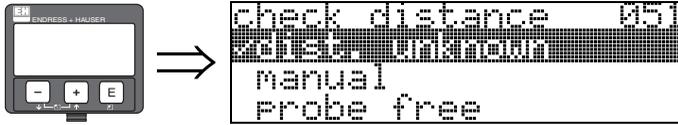
5.4.13 Function "dist./meas.value" (008)



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)

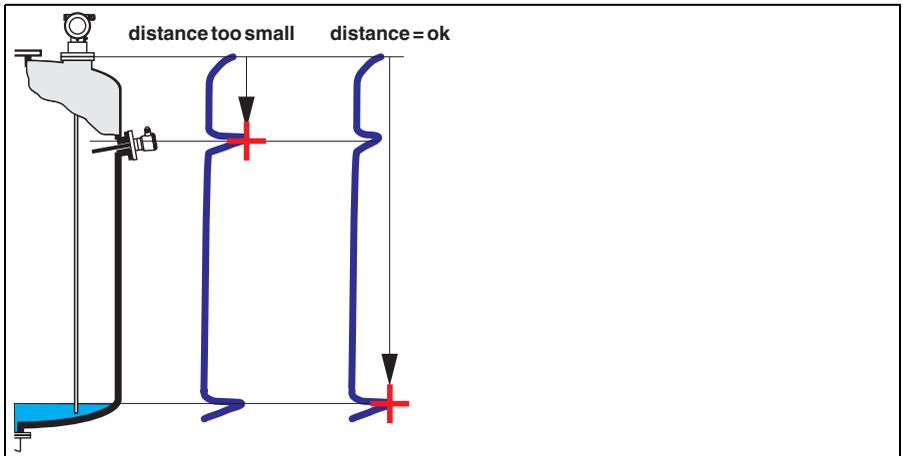


This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface.

The following options are available for selection:

Selection:

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



L00-FMP40xxxx-14-00-06-en-010

distance = ok

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

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

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



Note!

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

dist. too small

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

dist. too big

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

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (→  28). 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)

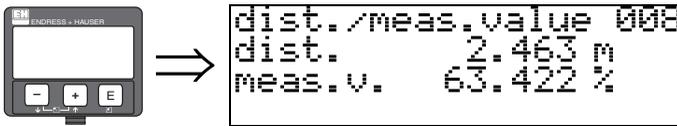


This function is used to start the interference echo mapping up to the distance given in "range of mapping" (052).

Selection:

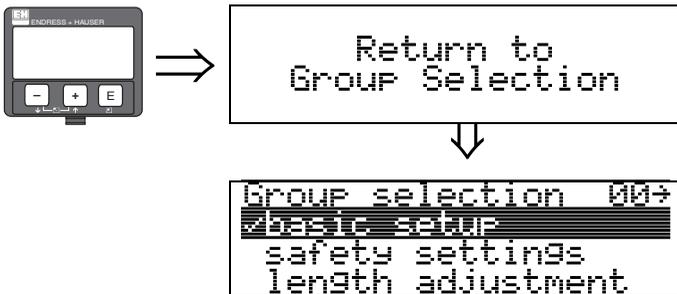
- off: no mapping is carried out
- on: mapping is started

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



After 3 s, the following message appears

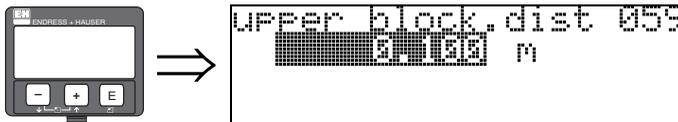


Note!

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("envelope curve" (0E) function group) is recommended, → 42.

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

Blocking distance and measuring range

At the lower end of the probe there is no blocking distance but a transition region with reduced accuracy, see section "Maximum measured error", → 41.

FMP40	LN [m] min	LN [m] max	UB [m] min
Rope probe	1	35 ¹⁾	0,2 ²⁾
6 mm rod probe	0,3	2	0,2 ²⁾
16 mm rod probe	0,3	4	0,2 ²⁾
Coax probe	0,3	4	0

- 1) Larger measuring range available on request.
- 2) The indicated blocking distances are preset. At media with $DC > 7$, the upper blocking distance UB can be reduced to 0.1 m for rod and rope probes. The upper blocking distance UB can be entered manually.



Note!

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

For stilling well applications

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

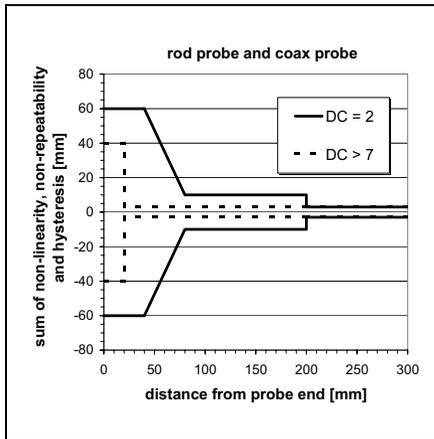
Maximum measured error

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

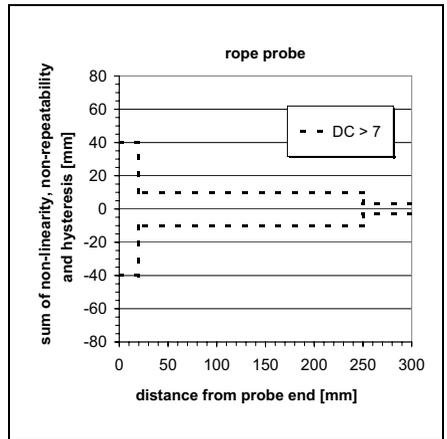
Output:	digital	analog
sum of non-linearity, non-repeatability and hysteresis	measuring range: - up to 10 m: ± 3 mm - > 10 m: ± 0.03 % for PA coated rope measuring range: - up to 5 m: ± 5 mm - > 5 m: ± 0.1 %	± 0.06 %
Offset / Zero	± 4 mm	± 0.03 %

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

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



L00-FMP4xxxx-05-00-00-en-001

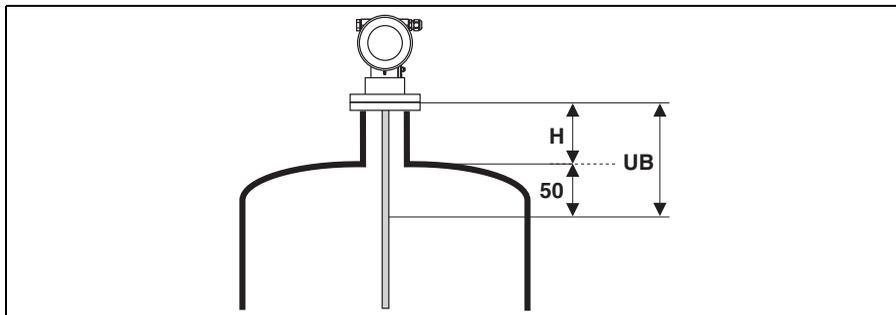


L00-FMP4xxxx-05-00-00-en-002



Note!

Please reenter the blocking distance in the function group "**extended calibr.**" (05) funktion "**upper block dist.**" (059) when installing the device in a high nozzle:
upper blocking distance (UB) = nozzle height (H) + 50 mm.



100-FMP4xxxx-14-00-06-xx-001

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" (0E) function group) is recommended.

5.6.1 Function "plot settings" (0E1)

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

- envelope curve
- subtracted signal
- mapping



```

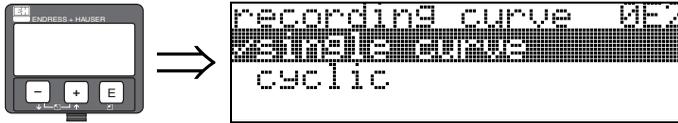
Plot settings ME1
envelope curve
subtracted signal
mapping
  
```

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

5.6.2 Function "recording curve" (0E2)

This function determines whether the envelope curve is read as

- **single curve** or
- cyclic



Note!

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

www.endress.com/worldwide

Endress+Hauser 

People for Process Automation

KA01038F/00/EN/13.10
71120274
CCS/FM+SGML 6.0

