Füllstand Druck Durchfluss Temperatur Flüssigkeits-analyse Registrierung Systeme Komponenten Services Solutions

Description of Instrument Functions

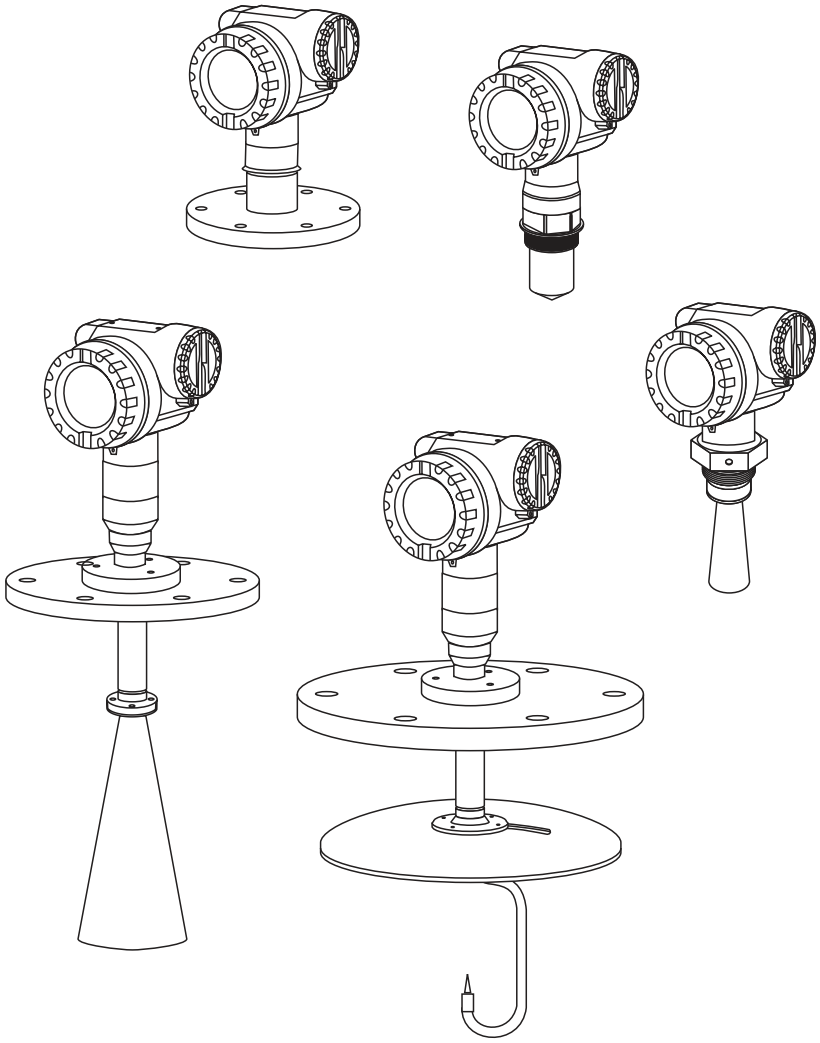
Micropilot M
FMR240, FMR244, FMR245, FMR250

Level-Radar

HART® FIELD COMMUNICATION PROTOCOL

PROFIBUS® PROCESS FIELD BUS

Fieldbus™ Foundation



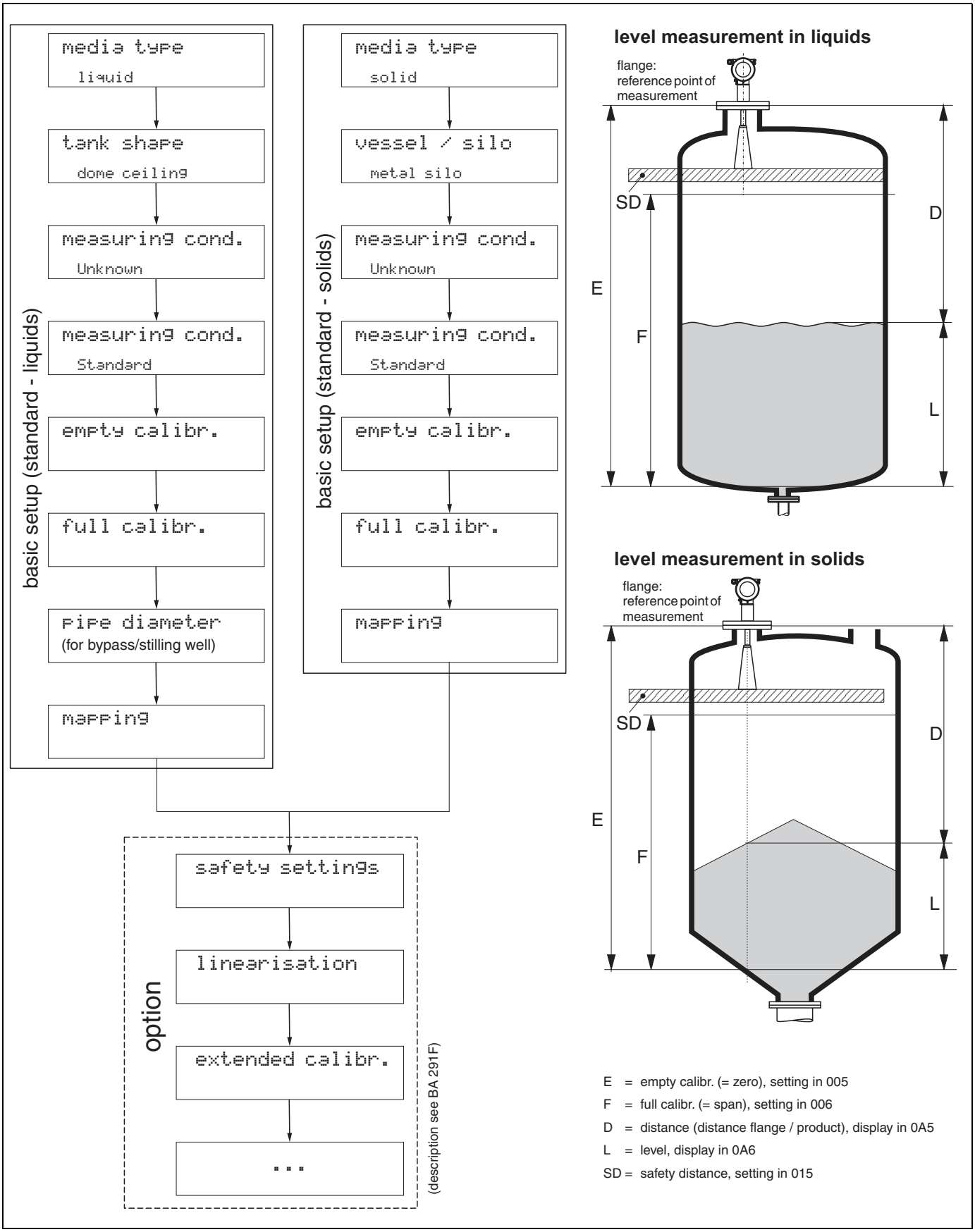
BA291F/00/en/08.06
71030727

Valid as of software version:
01.05.00

Endress+Hauser

People for Process Automation

Basic Setup


basic setup (standard - liquids)
media type
liquid
tank shape
dome ceiling
measuring cond.
Unknown
measuring cond.
Standard
empty calibr.
full calibr.
pipe diameter
(for bypass/stilling well)
mapping
basic setup (standard - solids)
media type
solid
vessel / silo
metal silo
measuring cond.
Unknown
measuring cond.
Standard
empty calibr.
full calibr.
mapping
option
safety settings
linearisation
extended calibr.
...
(description see BA 291F)
level measurement in liquids
flange:
reference point of
measurement
SD
D
E
F
L
level measurement in solids
flange:
reference point of
measurement
SD
D
E
F
L
E = empty calibr. (= zero), setting in 005
F = full calibr. (= span), setting in 006
D = distance (distance flange / product), display in 0A5
L = level, display in 0A6
SD = safety distance, setting in 015

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1 Notes on use

You have various options for accessing the descriptions of instrument functions or how to enter parameters.

1.1 Using the table of contents to locate a function description

All the functions are listed in the table of contents sorted by function group (e.g. basic setup, safety settings, etc.). You can access a more detailed description of a function by using a page reference / link.
The table of contents is on page 3.

1.2 Using the graphic of the function menu to locate a function description

This guides you step by step from the highest level, the function groups, to the exact function description you require.

All the available function groups and instrument functions are listed in the table (see page 11). Select your required function group or function. You can access an exact description of the function group or function by using a page reference / link.

1.3 Using the index of the function menu to locate a function description

To simply navigation within the function menu, each function has a position which is shown in the display. You can access each function via a page reference/link in the function menu index (see page 91) which lists all the function names alphabetically and numerically.



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

1.4 General structure of the operating menu

The operating menu is made up of two levels:

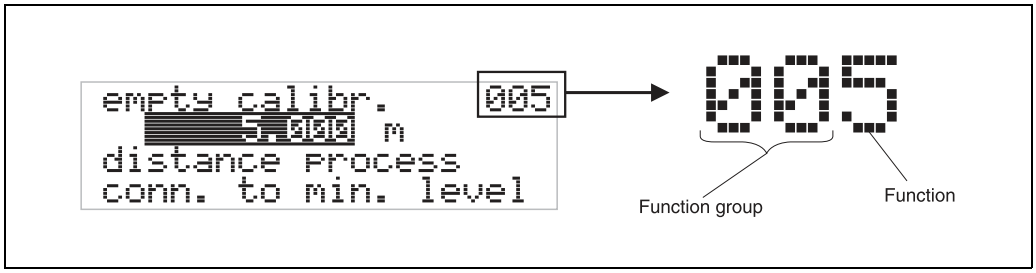
- **Function groups (00, 01, 03, …, 0C, 0D):**
  The individual operating Selection of the instrument are split up roughly into different function groups. The function groups that are available include, e.g.: "**basic setup**", "**safety settings**", "**output**", "**display**", etc.
- **Functions (001, 002, 003, …, 0D8, 0D9):**
  Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the instrument. 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 shape (002)**",
  "**medium property (003)**", "**process cond. (004)**", "**empty calibr. (005)**", etc.

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

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

1.4.1 Identifying the functions

For simple orientation within the function menus (see Page 11 ff.), for each function a position is shown on the display.



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 shape** **002**
  - **medium property** **003**
  - **process cond.** **004**

  …

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

1.5 Display and operating elements

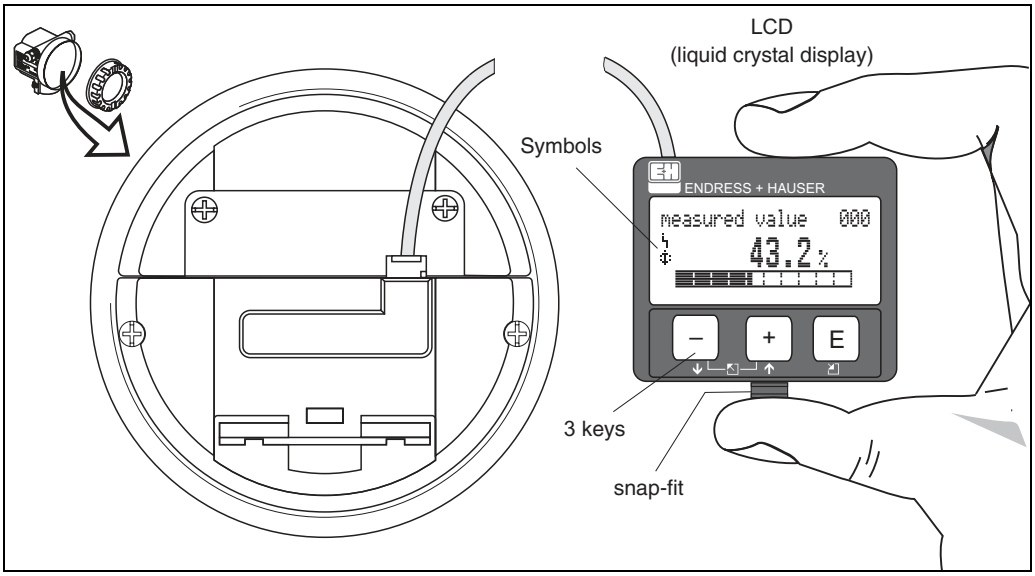


Fig. 1: Layout of the display and operating elements

1.5.1 Display

Liquid crystal display (LCD):
Four lines with 20 characters each. Display contrast adjustable through key combination.

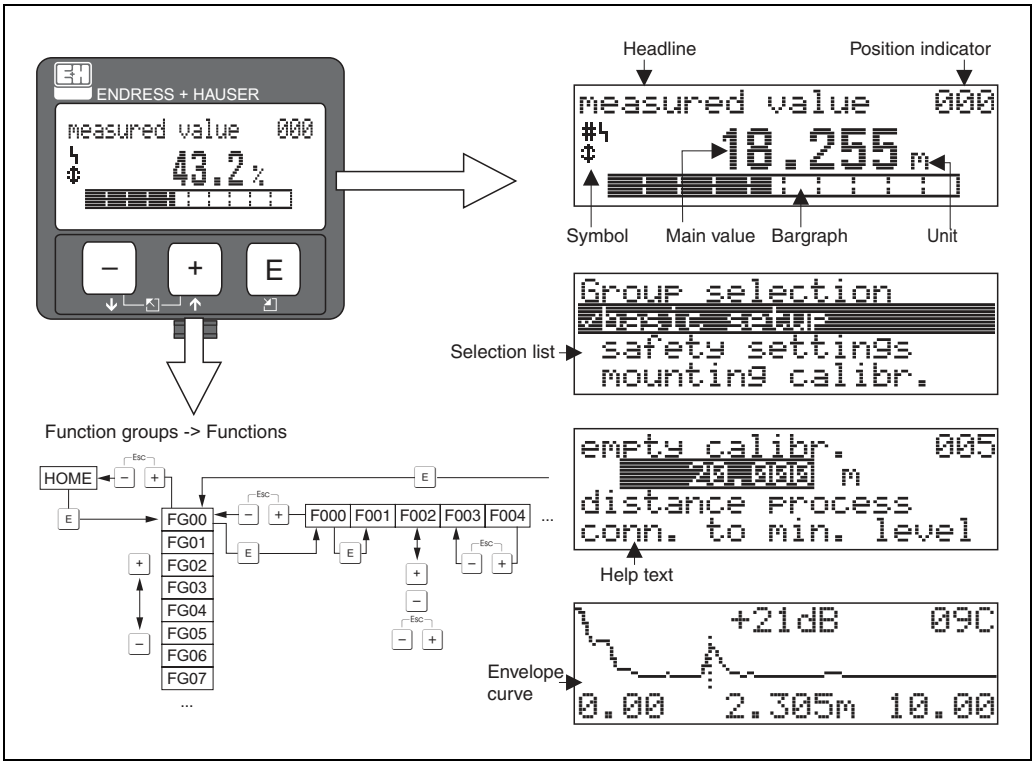


Fig. 2: Display

1.5.2 Display symbols

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

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

Tab. 1-1Meaning of Symbols

1.5.3 Key assignment

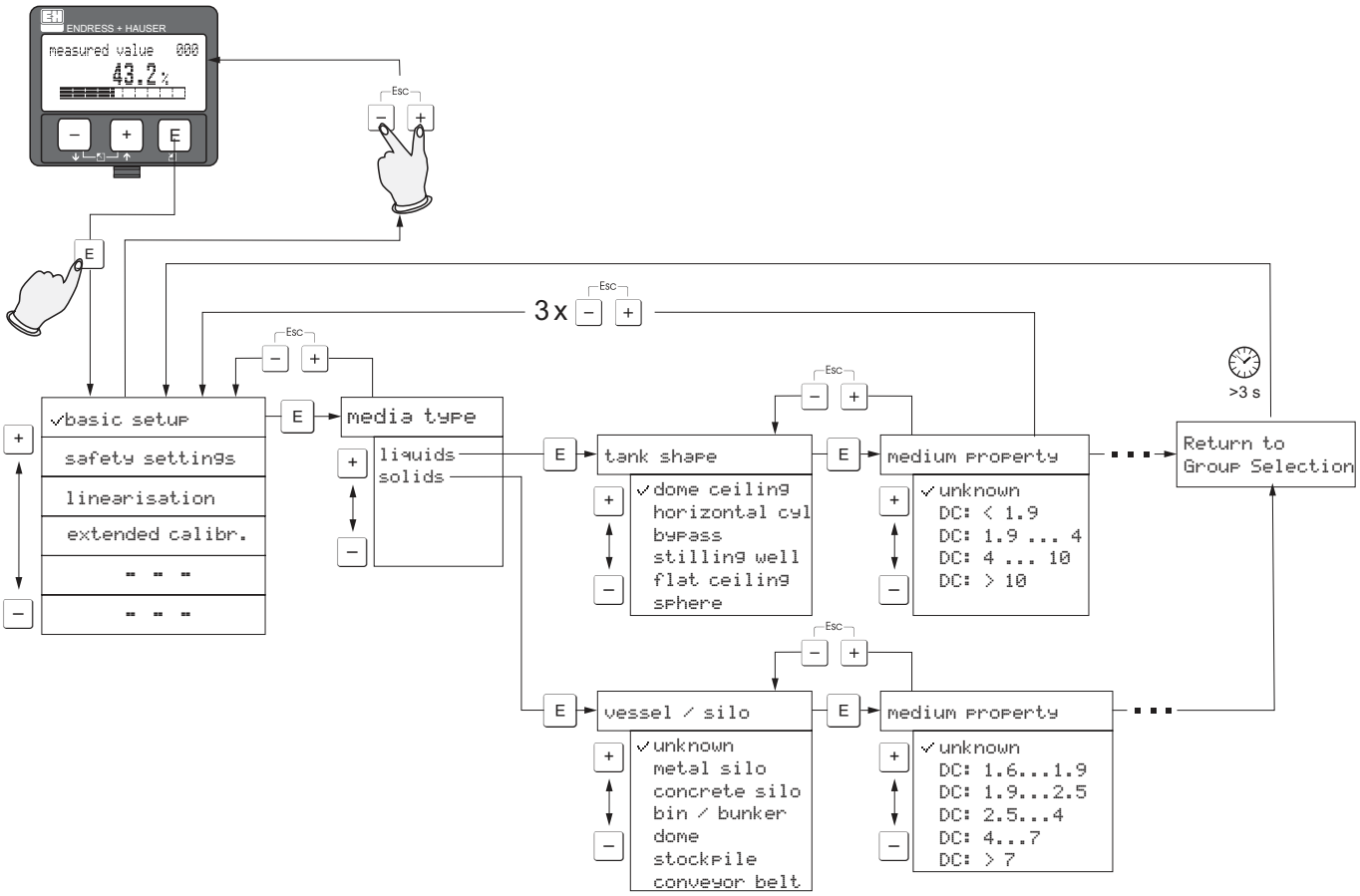
The operating elements are located inside the housing and are accessible for operation by opening the lid of the housing.

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
Esc − + or ←	Navigate to the left within a function group
E or → E	Navigate to the right within a function group, confirmation.
+ and E or − and E	Contrast settings of the LCD
+ and − and E	Hardware lock / unlock After a hardware lock, an operation of the instrument 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.

Tab. 1-2Function of the keys

1.5.4 Operation with the VU 331



Example - Selection and configuration in Operation menu:

1.) Change from Measured Value Display to **Group Selection** by pressing E

2.) Press − or + to select the required **Function Group** (e.g.. "basic setup (00)") and confirm by pressing E ➜ First **function** (e.g. "tank shape (002)") is selected.

Note!
The active selection is marked by a ⋰ in front of the menu text.

3.) Activate Edit mode with + or −.

Selection menus:

a) Select the required **Parameter** in selected **function** (e.g. "tank shape (002)") with − or +.
b) E confirms selection ➜ ⋰ appears in front of the selected parameter
c) E confirms the edited value ➜ system quits Edit mode
d) + + − (= Esc) interrupts selection ➜ system quits Edit mode

Typing in numerals and text:

a) Press + or − to edit the first character of the **numeral / text** (e.g. "empty calibr. (005)")
b) E positions the cursor at the next character ➜ continue with (a) until you have completed your input
c) if a ↵ symbol appears at the cursor, press E to accept the value entered ➜ system quits Edit mode
d) + + − (= Esc) interrupts the input, system quits Edit mode

4) Press E to select the next **function** (e.g. "medium property (003)")

5) Press + + − (= Esc) once ➜ return to previous **function** (e.g. "tank shape (002)")
Press + + − (= Esc) twice ➜ return to **Group selection**

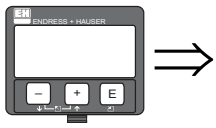
6) Press + + − (= Esc) to return to **Measured value display**

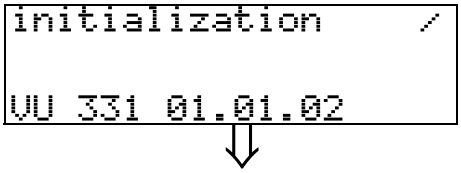
Fig. 3: Selection and configuration in operation menu

1.6 Commissioning

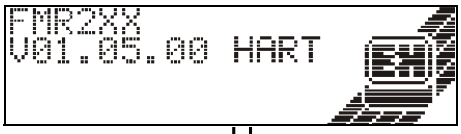
1.6.1 Switching on the measuring device

When the instrument is switched on for the first time, the following messages appear on the display:





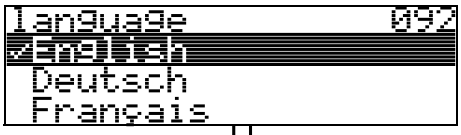
After 5 s, the following message appears



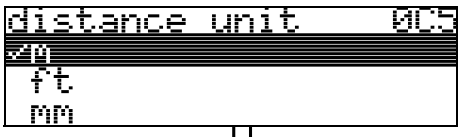
After 5 s, the following message appears



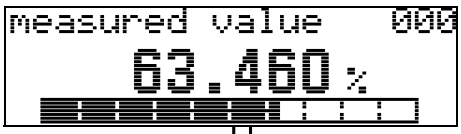
After 5 s or after you have pressed [E] the following message appears



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



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



The current measured value is displayed

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



This selection enables you to perform the basic setup

2 Function menu Micropilot M

Basic Setup in liquids

Function group		Function			Description
basic setup	**00**	measured value	000	→	Page 14
(see page 14)		media type → liquid	001	→	Page 14
⇓		tank shape	002	→	Page 15
		medium property	003	→	Page 18
		process cond.	004	→	Page 19
		empty calibr.	005	→	Page 20
		full calibr.	006	→	Page 21
		pipe diameter	007	→	Page 22
		check distance	051	→	Page 23
		range of mapping	052	→	Page 24
		start mapping	053	→	Page 24

Basic Setup in solids

Function group		Function			Description
basic setup	**00**	measured value	000	→	Page 14
(see page 14)		media type → solid	001	→	Page 14
⇓		vessel / silo	00A	→	Page 18
		medium property	00B	→	Page 18
		process cond.	00C	→	Page 19
		empty calibr.	005	→	Page 20
		full calibr.	006	→	Page 21
		check distance	051	→	Page 23
		range of mapping	052	→	Page 24
		start mapping	053	→	Page 24

Further Functions

Function group		Function			Description
safety settings	**01**	output on alarm	010	→	Page 26
(see page 26)		output on alarm (HART only)	011	→	Page 28
⇓		outp. echo loss	012	→	Page 28
		ramp %span/min	013	→	Page 29
		delay time	014	→	Page 30
		safety distance	015	→	Page 30
		in safety dist.	016	→	Page 30
		ackn. alarm	017	→	Page 32
		overspill prot.	018	→	Page 32
linearisation	**04**	level/ullage	040	→	Page 33
(see page 33)		linearisation	041	→	Page 34
⇓		customer unit	042	→	Page 38
		table no.	043	→	Page 39
		input level	044	→	Page 39
		input volume	045	→	Page 40
		max. scale	046	→	Page 40
		diameter vessel	047	→	Page 40

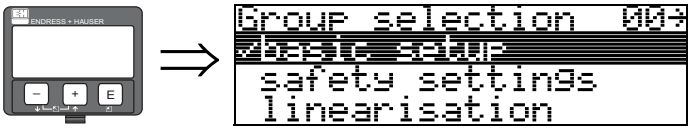
Further Functions

Function group			Function			Description
extended calibr.	**05**	⇒	selection	050	→	Page 41
(see page 41)			check distance	051	→	Page 41
⇓			range of mapping	052	→	Page 42
			start mapping	053	→	Page 43
			pres. map dist.	054	→	Page 43
			cust. tank map	055	→	Page 43
			echo quality	056	→	Page 44
			offset	057	→	Page 45
			antenna extens.	0C9	→	Page 45
			output damping	058	→	Page 45
			blocking dist.	059	→	Page 46
output	**06**	⇒	commun. address (HART only)	060	→	Page 47
Profibus Param.	**06**		instrument addr. (PROFIBUS PA only)	060		Page 47
nur PROFIBUS PA			no. of preambels (HART only)	061	→	Page 48
(see page 47)			ident number (PROFIBUS PA only)	061		Page 48
⇓			low output limit (HART only)	062	→	Page 49
			set unit to bus (PROFIBUS PA only)	062		Page 49
			curr.output mode (HART only)	063	→	Page 50
			out value (PROFIBUS PA only)	063		Page 50
			fixed cur. value (HART only)	064	→	Page 51
			out status (PROFIBUS PA only)	064		Page 51
			simulation	065	→	Page 52
			simulation value	066	→	Page 52
			output current (HART only)	067	→	Page 52
			2nd cyclic value (PROFIBUS PA only)	067		Page 54
			4mA value (HART only)	068	→	Page 55
			select v0h0 (PROFIBUS PA only)	068		Page 55
			20mA value (HART only)	069	→	Page 56
			display value (PROFIBUS PA only)	069		Page 56
envelope curve	**0E**	⇒	plot settings	0E1	→	Page 57
(see page 57)			recording curve	0E2	→	Page 57
⇓			envelope curve display	0E3	→	Page 58
display	**09**	⇒	language	092	→	Page 60
(see page 60)			back to home	093	→	Page 60
⇓			format display	094	→	Page 61
			no.of decimals	095	→	Page 61
			sep. character	096	→	Page 61
			display test	097	→	Page 62

Further Functions

Function group			Function			Description
diagnostics	**0A**	⇒	present error	0A0	→	Page 64
(see page 63)			previous error	0A1	→	Page 64
⇓			clear last error	0A2	→	Page 64
			reset	0A3	→	Page 65
			unlock parameter	0A4	→	Page 66
			measured dist.	0A5	→	Page 67
			measured level	0A6	→	Page 68
			detection window	0A7		Page 68
			application par.	0A8	→	Page 69
system parameters	**0C**	⇒	tag no.	0C0	→	Page 70
(see page 70)			device tag (FOUNDATION Fieldbus only)	0C0	→	Page 70
⇓			Profile Version (PROFIBUS PA only)	0C1	→	Page 70
			protocol+sw-no.	0C2	→	Page 70
			serial no.	0C4	→	Page 71
			device id (FOUNDATION Fieldbus only)	0C4	→	Page 71
			distance unit	0C5	→	Page 71
			download mode	0C8	→	Page 72
			antenna extens.	0C9	→	Page 45
service	**D00**	⇒	service level	D00		Page 73

3 Function group "basic setup" (00)

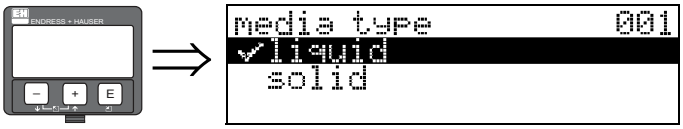


3.1 Function "measured value" (000)



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.

3.2 Function "media type" (001)



This function is used to select the media type.

Selection:
- liquid
- **solid**

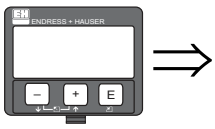
With the selection "liquid" only the following functions can be adjusted:

■ tank shape	002
■ medium property	003
■ process cond.	004
■ empty calibr.	005
■ full calibr.	006
■ pipe diameter	007
■ check distance	051
■ range of mapping	052
■ start mapping	053
■ …	

With the selection "solid" only the following functions can be adjusted:

■ vessel / silo	00A
■ medium property	00B
■ process cond.	00C
■ empty calibr.	005
■ full calibr.	006
■ check distance	051
■ range of mapping	052
■ start mapping	053
■ …	

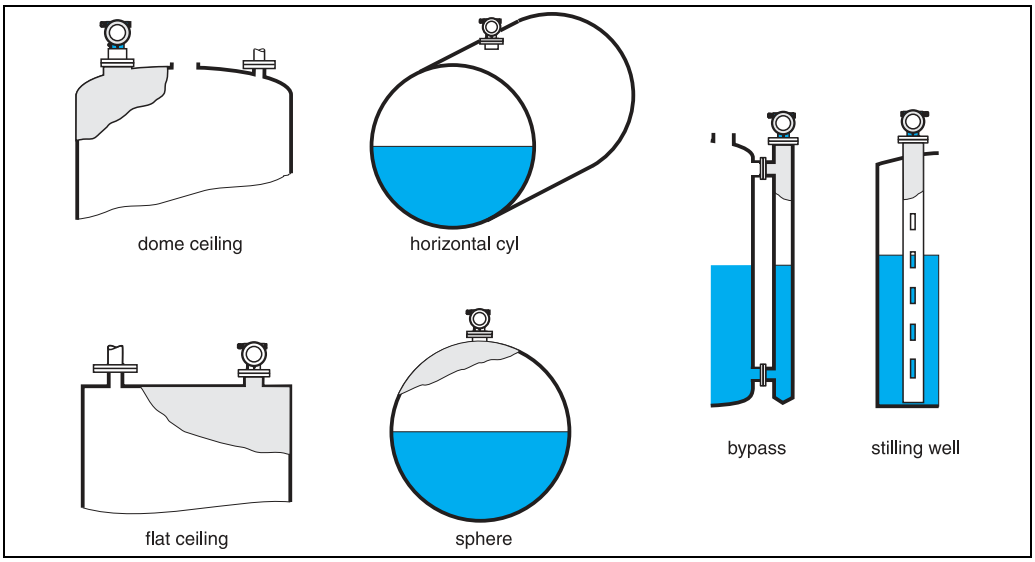
3.3 Function "tank shape" (002), liquids only



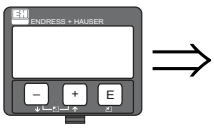


This function is used to select the tank shape.

Selection:
- **dome ceiling**
- horizontal cyl
- bypass
- stilling well
- flat ceiling
- sphere



3.4 Function "medium property" (003), liquids only





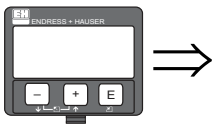
This function is used to select the dielectric constant.

Selection:
- **unknown**
- DC: < 1.9
- DC: 1.9 ... 4
- DC: 4 ... 10
- DC: > 10

Product class	DC (Εr)	Examples
A	1,4 … 1,9	non-conducting liquids, e.g. liquefied gas [1)]
B	1,9 … 4	non-conducting liquids, e.g. benzene, oil, toluene, …
C	4 … 10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, …
D	> 10	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis

1) Treat Ammonia NH3 as a medium of group A, i.e. use FMR230 in a stilling well.

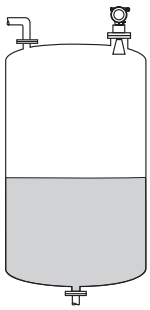
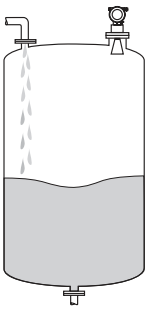
3.5 Function "process cond." (004), liquids only

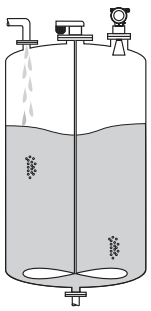
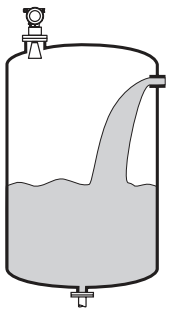




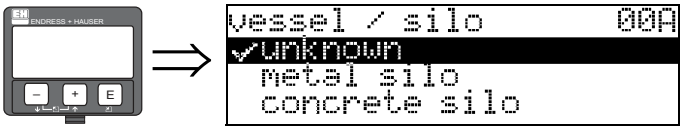
This function is used to select the process conditions.

Selection:
- **standard**
- calm surface
- turb. surface
- add. agitator
- fast change
- test:no filter

standard	calm surface	turb. surface
For all applications that do not fit into any of the following groups.	Storage tanks with immersion tube or bottom filling	Storage / buffer tanks with rough surface due to free filling or mixer nozzles
		
The filter and output damping are set to average values.	The averaging filters and output damping are set to high values. -> steady meas. value -> precise measurement -> slower reaction time	Special filters to smooth the input signals are emphasised. -> smoothed meas. value -> medium fast reaction time

add. agitator	fast change	test:no filter
Agitated surfaces (with possible vortex) due to agitators	Fast change of level, particularly in small tanks	All filters can be switched off for service / diagnostic purposes.
		
Special filters to smooth the input signals are set to high values. ->smoothed meas. value ->medium fast reaction time ->minimization of effects by agitator blades	The averaging filters are set to low values. The output damping is set to 0. -> rapid reaction time -> possibly unsteady meas. value	All filters off.

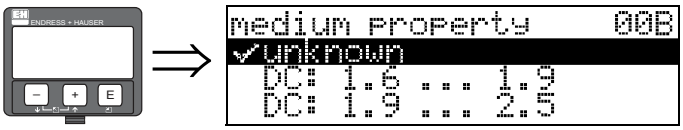
3.6 Function "vessel / silo" (00A), solids only



This function is used to select the vessel / silo.

Selection:
- **unknown**
- metal silo
- concrete silo
- bin / bunker
- dome
- stockpile
- conveyor belt

3.7 Function "medium property" (00B), solids only



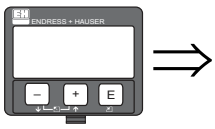
This function is used to select the dielectric constant.

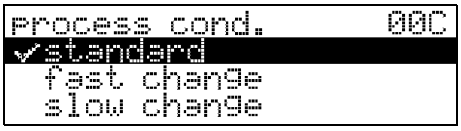
Selection:
- **unknown**
- DC: 1.6 ... 1.9
- DC: 1.9 ... 2.5
- DC: 2.5 ... 4
- DC: 4 ... 7
- DC: > 7

Product class	DC (Er)	Examples
A	1.6 … 1.9	– Plastic granulate – White lime, special cement – Sugar
B	1.9 … 2.5	– Portland cement, plaster
C	2.5 … 4	– Grain, seeds – Ground stones – Sand
D	4 ... 7	– Naturally moist (ground) stones, ores – Salt
E	> 7	– Metallic powder – Carbon black – Coal

The respective lower group applies for very loose or loosened bulk solids.

3.8 Function "process cond." (00C), solids only

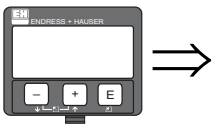




This function is used to select the process conditions.

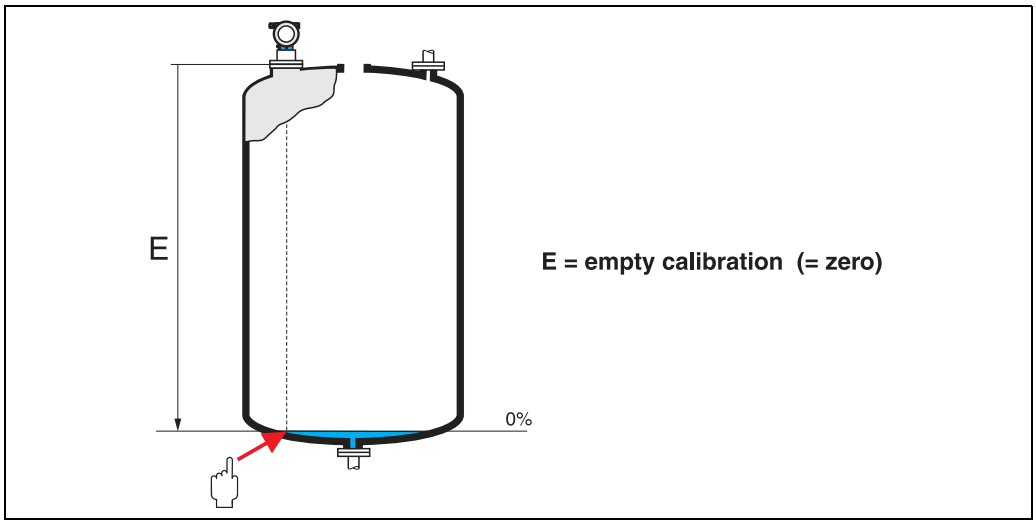
Selection:
- **standard**
- fast change
- slow change
- test: no filter

3.9 Function "empty calibr." (005)



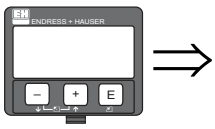


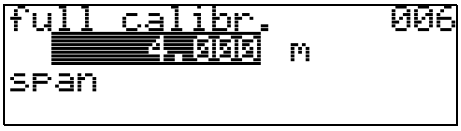
This function is used to enter the distance from the flange (reference point of the measurement) to the minimum level (=zero).



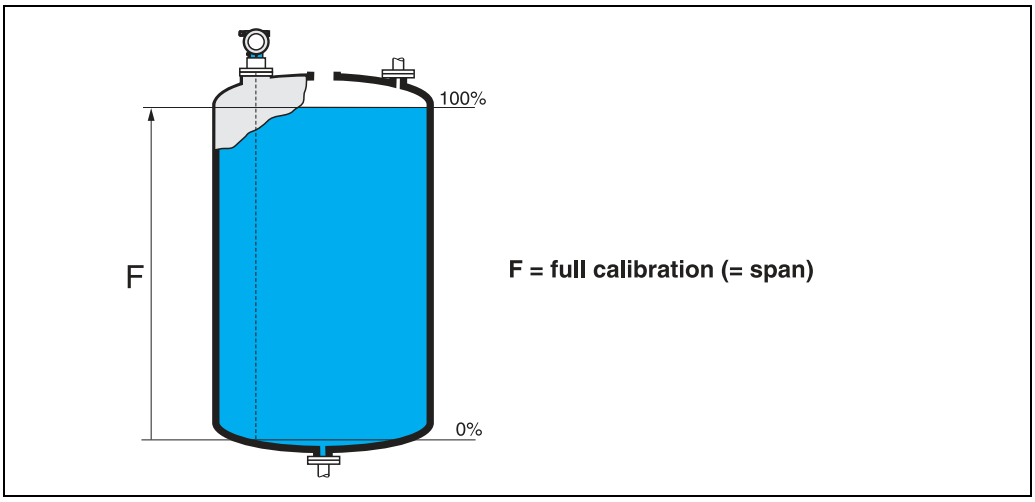
Caution!
For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the vessel.

3.10 Function "full calibr." (006)





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



In principle, it is possible to measure up to the tip of the antenna. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than 50 mm (2") to the tip of the antenna (FMR244: 150 mm / 6", FMR245: 200 mm / 8").

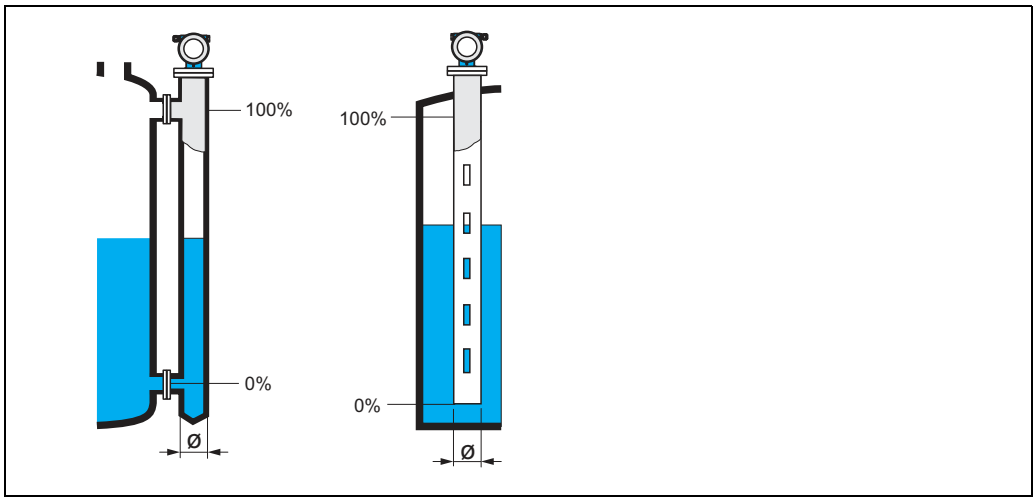
Note!
If **bypass** or **stilling well** was selected in the "**tank shape**" **(002)** function, the pipe diameter is requested in the following step.

3.11 Function "pipe diameter" (007), liquids only





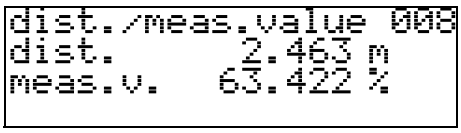
This function is used to enter the pipe diameter of the stilling well or bypass pipe.



Microwaves propagate more slowly in pipes than in free space. This effect depends on the inside diameter of the pipe and is automatically taken into account by the Micropilot. It is only necessary to enter the pipe diameter for applications in a bypass or stilling well.

3.12 Display (008)

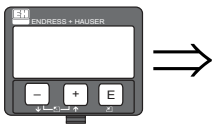


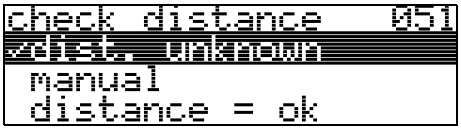


The **distance** measured from the reference point to the product surface and the **level** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual level or the actual distance. The following cases can occur:

- Distance correct – level correct -> continue with the next function, "**check distance**" **(051)**
- Distance correct – level incorrect -> Check "**empty calibr.**" **(005)**
- Distance incorrect – level incorrect -> continue with the next function, "**check distance**" **(051)**

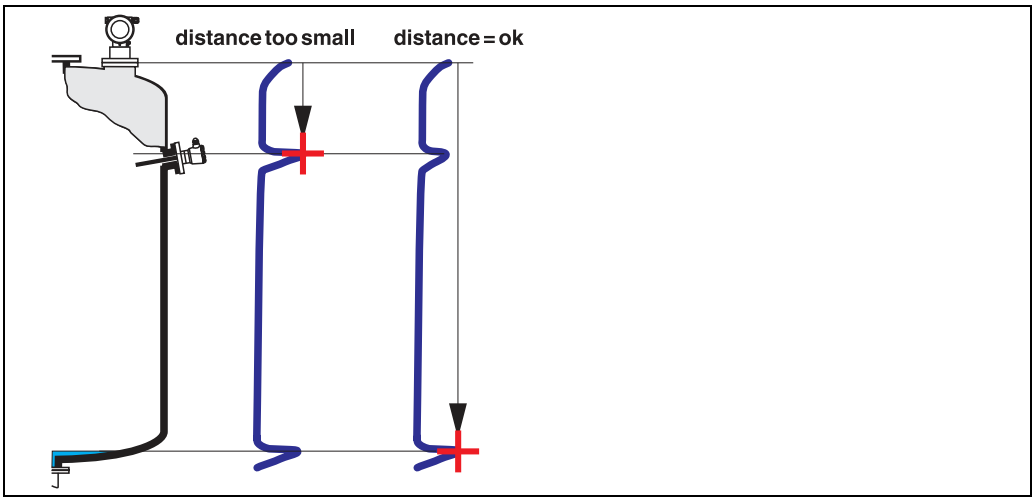
3.13 Function "check distance" (051)





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



distance = ok
- 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 suggested to carry out a mapping in this case as well.

dist. too small
- At the moment, an interference is being evaluated.
- Therefore, a mapping is carried out including the presently measured interference echoe.
- 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.

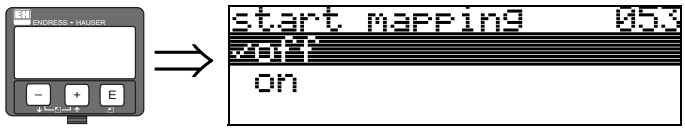
Caution!
The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty vessel, do not enter E, but E – 0.5 m (20").
If a mapping already exists, it is overwriten up to the distance specified in "**range of mapping**" **(052)**. Beyond this value the existing mapping remains unchanged.

3.14 Function "range of mapping" (052)



This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (see Page 2 ff.). This value can be edited by the operator.
For manual mapping, the default value is 0 m.

3.15 Function "start mapping" (053)



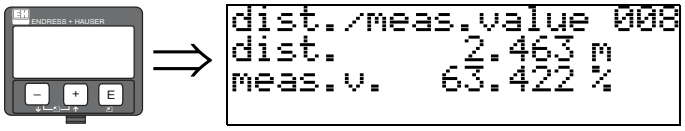
This function is used to start the interference echo mapping up to the distance given in "**range of mapping**" **(052)**.

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

During the mapping process the message "**record mapping**" is displayed.

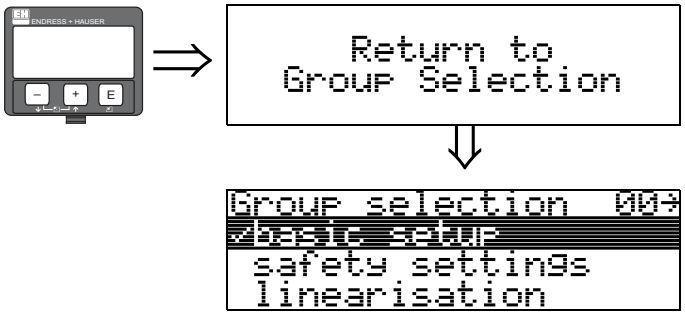
Caution!
A mapping will be recorded only, if the device is not in error state.

3.16 Display (008)



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

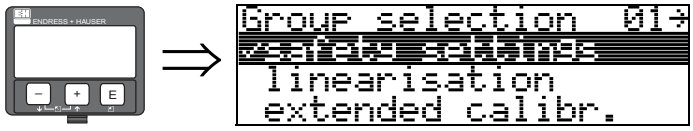
- Distance correct – level correct -> basic setup completed
- Distance incorrect – level incorrect -> a further interference echo mapping must be carried out "**check distance**" (**051**).
- Distance correct – level incorrect -> check "**empty calibr.**" **(005)**



After 3 s, the following message appears

Note!
After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("**display**" **(09)** function group) is recommended.

4 Function group "safety settings" (01)



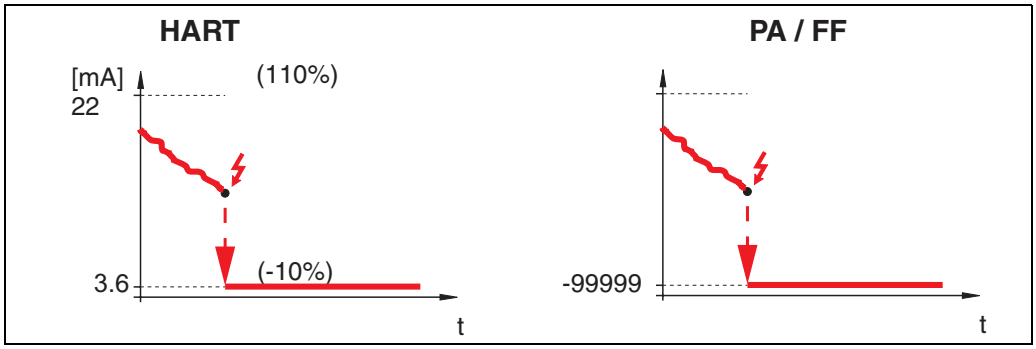
4.1 Function "output on alarm" (010)



This function is used to select the reaction of the output on an alarm.

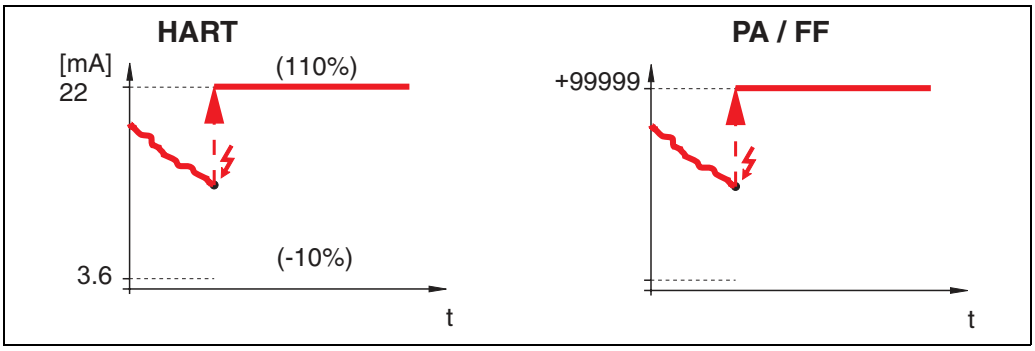
Selection:
- MIN (<= 3.6mA)
- **MAX (22mA)**
- hold
- user specific

MIN (<= 3.6mA)



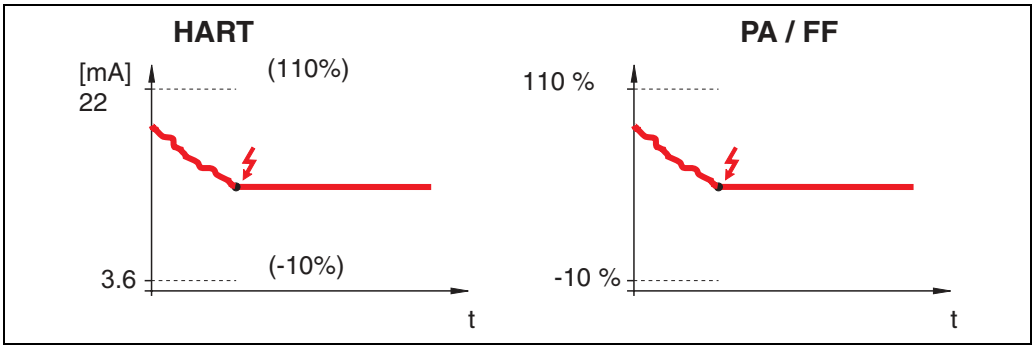
If the instrument is in alarm state, the output changes as follows:
- HART: MIN-Alarm 3.6 mA
- PROFIBUS PA: MIN-Alarm -99999
- FOUNDATION Fieldbus: MIN-Alarm -99999

MAX (22mA)



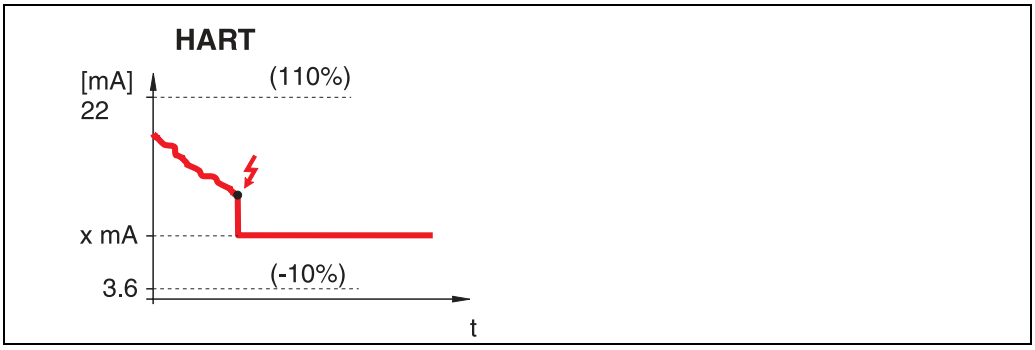
If the instrument is in alarm state, the output changes as follows:
- HART: MAX-Alarm 22 mA
- PROFIBUS PA: MAX-Alarm +99999
- FOUNDATION Fieldbus: MAX-Alarm +99999

hold



If the instrument is in alarm state, the last measured value is held.

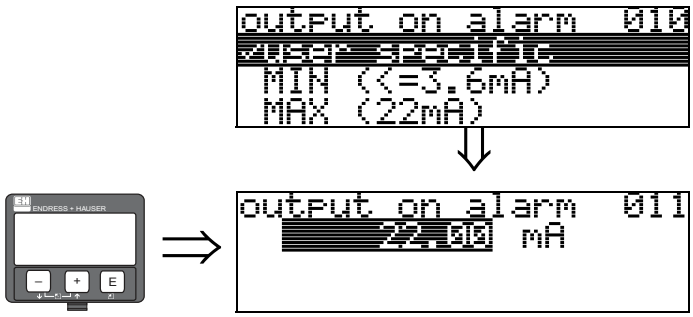
user specific



If the instrument is in alarm state, the output is set to the value configured in "**output on alarm**" **(011)** (x mA).

Caution!
This selection is available for HART devices only!

4.2 Function "output on alarm" (011), HART only



On alarm, the output current is set to the entered value in mA. This function is active when you selected "**user specific**" in the "**output on alarm**" **(010)** function.

Caution!
This function is available for HART devices only!

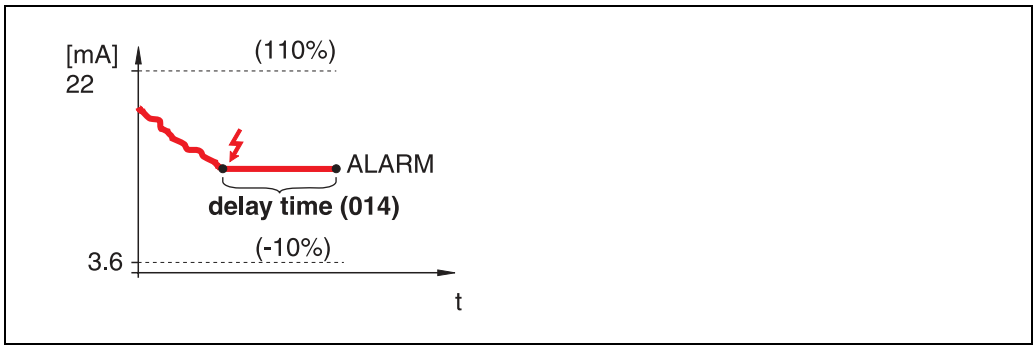
4.3 Function "outp. echo loss" (012)



Use this function to set the output response on echo loss.

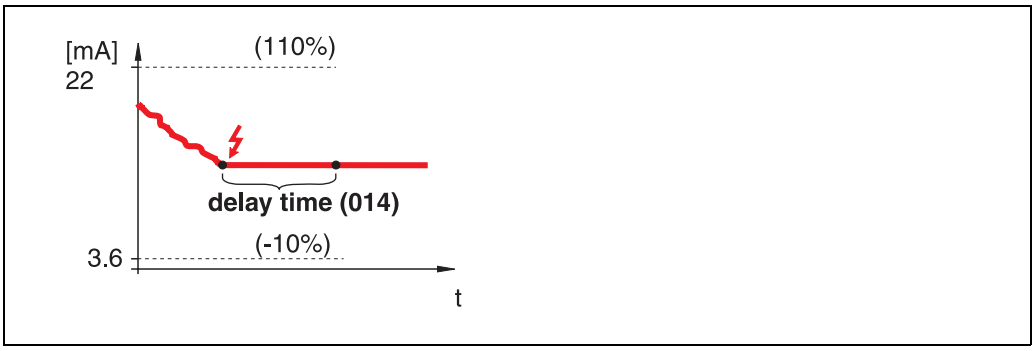
Selection:
- alarm
- **hold**
- ramp %/min

alarm



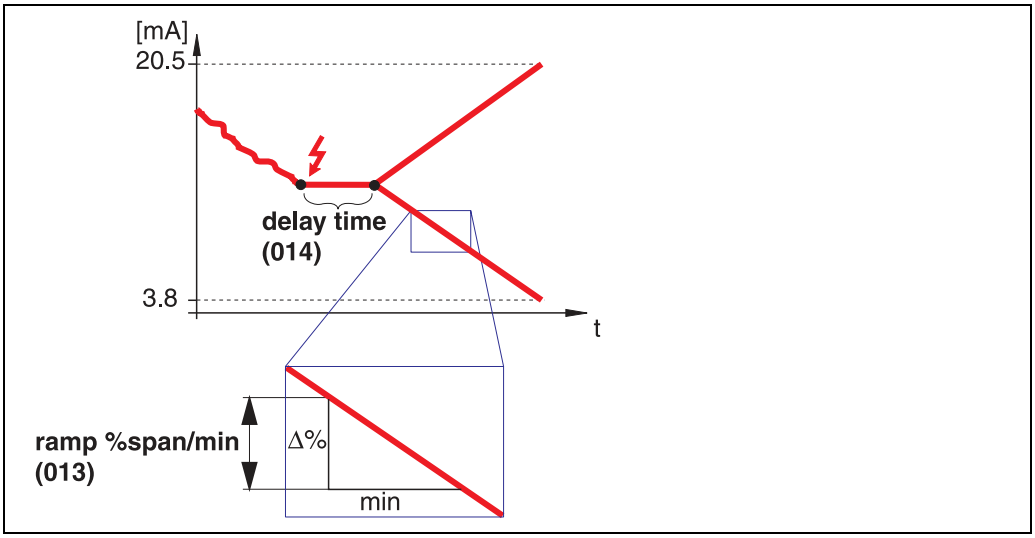
On echo loss, the instrument switches to alarm state after an adjustable "**delay time**" **(014)**. The output response depends on the configuration set in "**output on alarm**" **(010)**.

hold



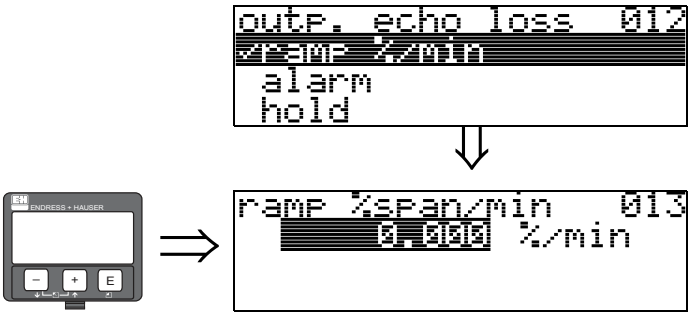
On echo loss, a warning is generated after a definable "**delay time**" **(014)**. Output is held.

ramp %/min



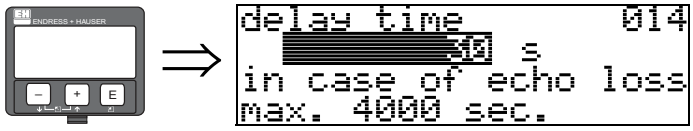
On echo loss, a warning is generated after a definable "**delay time**" **(014)**. The output is changed towards 0% or 100% depending on the slope defined in "**ramp %span/min**" **(013)**.

4.4 Function "ramp %span/min" (013)



Ramp slope which defines the output value on echo loss. This value is used if "**ramp %span/min**" is selected in "**outp. echo loss**" **(012)**. The slope is given in % of the measuring range per minute.

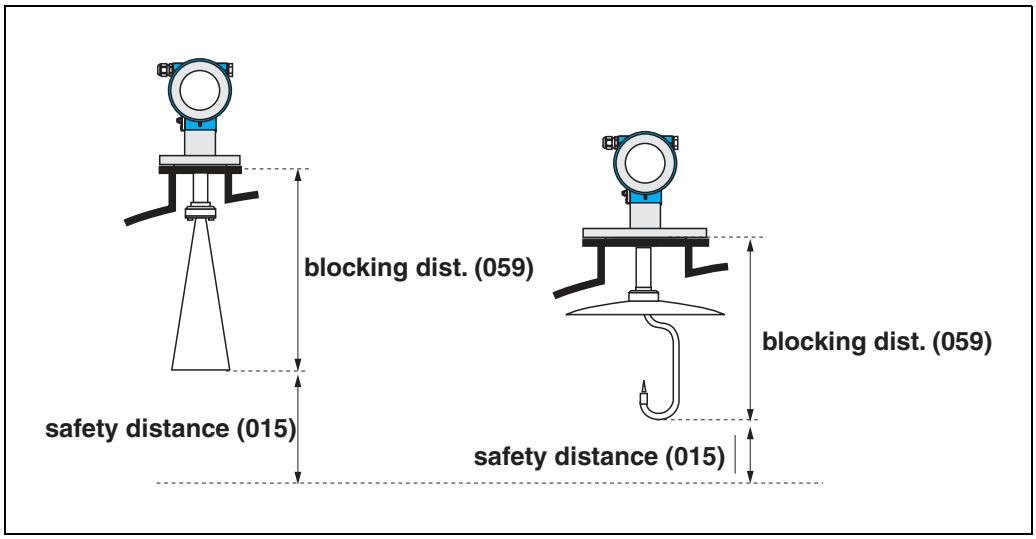
4.5 Function "delay time" (014)



Use this function to enter the delay time (Default = 30 s) after which a warning is generated on echo loss, or after which the instrument switches to alarm state.

4.6 Function "safety distance" (015)

A configurable safety distance is placed before the "**blocking dist.**" **(059)** (see page 46). This distance warns you that any further level increase would make the measurement invalid, for example, when touching the antenna area.





Enter the size of the safety distance here. The default value is 0.1 m.

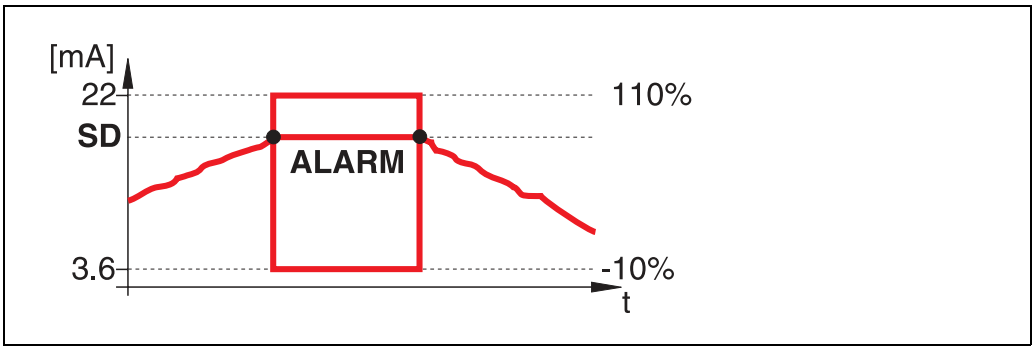
4.7 Function "in safety dist." (016)



This function defines the response when the level enters the safety distance .

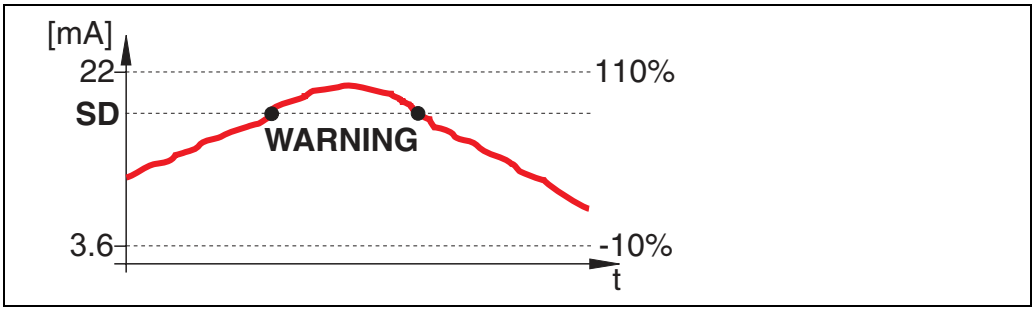
Selection:
- alarm
- **warning**
- self holding

alarm



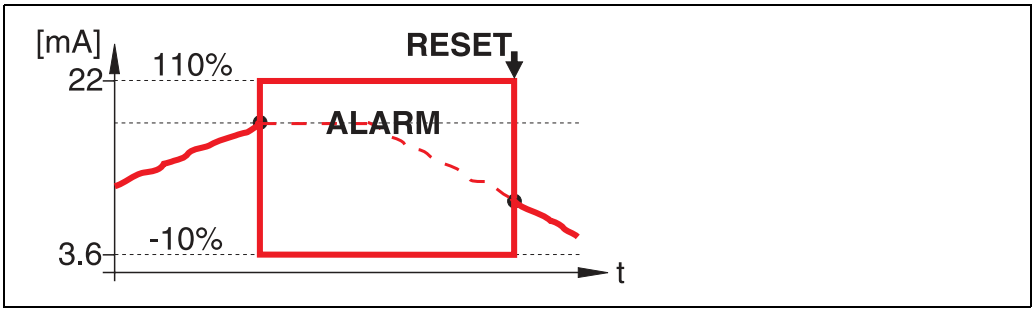
Instrument enters the defined alarm state ("**output on alarm**" **(011)**). The alarm message **E651** - "**level in safety distance - risk of overspill**" is displayed.
If the level drops out of the safety distance, the alarm warning disappears and the instrument starts to measure again.

warning



Instrument displays a warning **E651** - "**level in safety distance - risk of overspill**", but continues to measure. If the level leaves the safety distance, the warning disappears.

self holding



Instrument switches to defined alarm state ("**output on alarm**" **(011)**). The alarm message **E651** - "**level in safety distance - risk of overspill**" is displayed.
If the level leaves the safety distance, the measurement continues only after a reset of the self holding (function: "**ackn. alarm**" **(017)**).

4.8 Function "ackn. alarm" (017)



This function acknowledges an alarm in case of "**self holding**".

Selection:
- **no**
- yes

no
The alarm is not acknowledged.

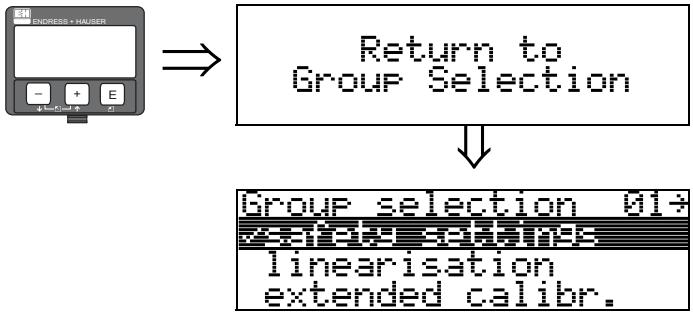
yes
Acknowledgement takes place.

4.9 Function "overspill prot." (018)



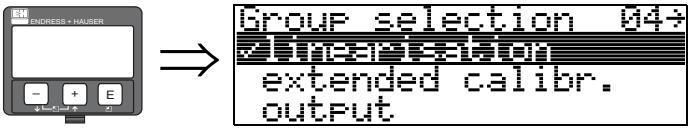
When "**german WHG**" is selected, various parameters relating to WHG overspill protection/SIL are modified and the instrument is locked against further operation. Select "**Standard**" to unlock. Thereby the WHG parameter adjustment is preserved. In order to reset the WHG-specific parameters it is recommended to carry out a reset of the instrument (see Page 65).

Caution!
The FMR250 must not be used for applications requiring an approval according WHG/SIL!



After 3 s, the following message appears

5 Function group "linearisation" (04)



5.1 Function "level/ullage" (040)



Selection:
- **level CU**
- level DU
- ullage CU
- ullage DU

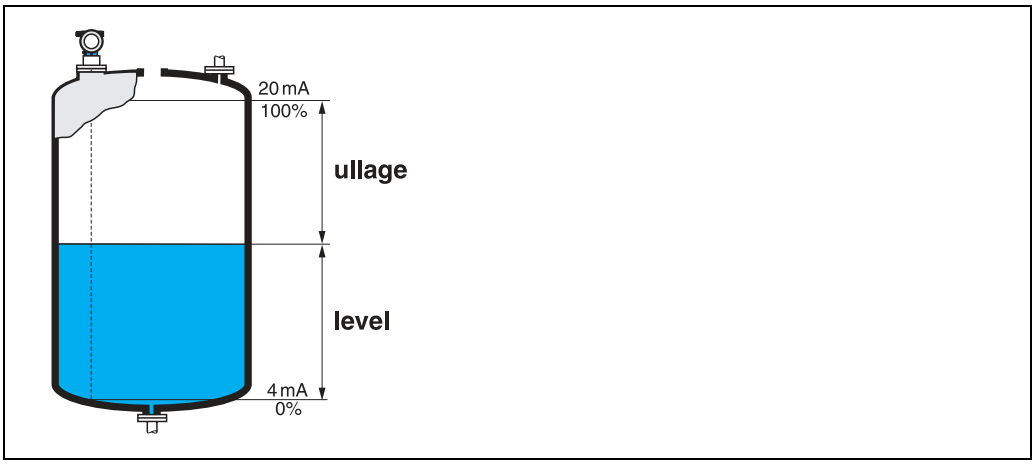
level CU
Level in customer units. The measured value can be linearised.
The "**linearisation**" **(041)** default value is set to a linear 0...100%.

level DU
Level in the selected "**distance unit**" **(0C5)**.

ullage CU
Ullage in customer units. The value can be linearised.
The "**linearisation**" **(041)** default value is set to a linear 0...100%.

ullage DU
Ullage in the selected "**distance unit**" **(0C5)**.

✎ Note!
Reference point for the ullage is "full calibr." (=span).



5.2 Function "linearisation" (041)

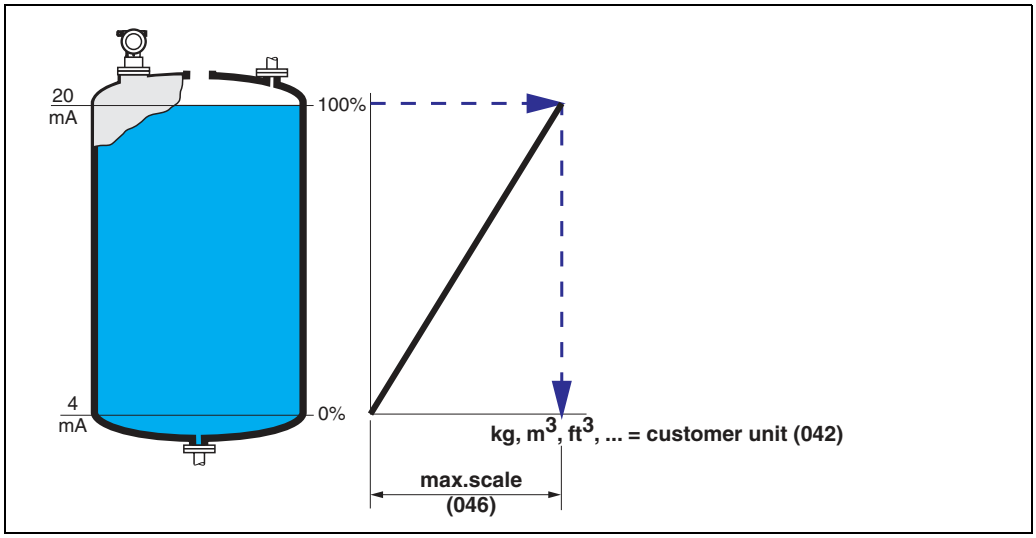
Linearisation defines the ratio of level to container volume or product weight and allows a measurement in customer units, e.g. metres, hectolitres etc. The measured value in (000) is then displayed in the selected unit.



This function is used to select the linearisation modes.

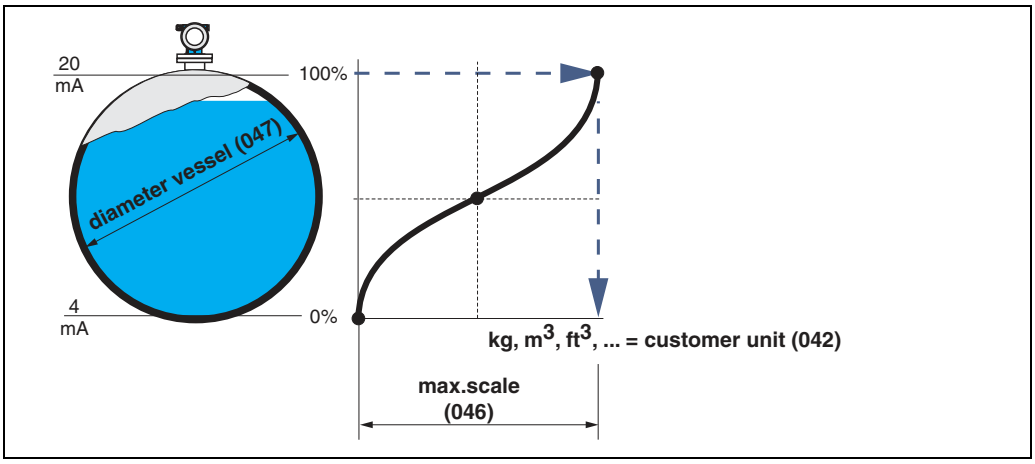
Selection:
- **linear**
- horizontal cyl
- manual
- semi-automatic
- table on
- clear table

linear
The vessel is linear e.g. a cylindrical vertical vessel. You can measure in customer units by entering a maximum volume/weight.
You can select the "**customer unit**" **(042)**. Define the volume value corresponding to the calibration in "**max. scale**" **(046)**. This value corresponds to an output of 100% (= 20 mA for HART).



horizontal cyl

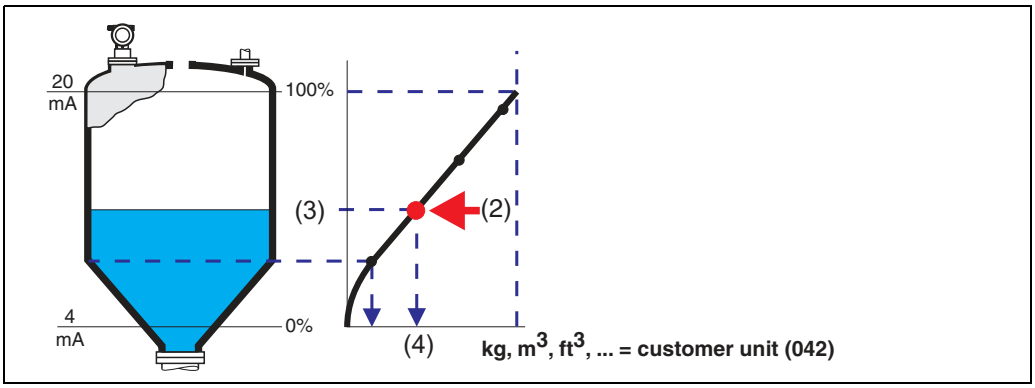
The volume, mass etc. are calculated automatically in cylindrical horizontal vessels by entering the "**diameter vessel**" **(047)**, the "**customer unit**" **(042)** and the "**max. scale**" **(046)**. The "**max. scale**" **(046)** corresponds to an output of 100% (= 20 mA for HART).



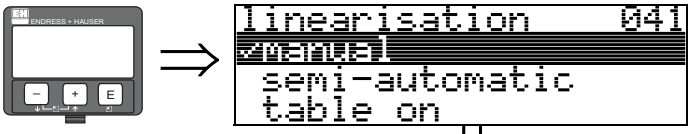
manual

If the level is not proportional to the volume or weight within the set measuring range, you can enter a linearisation table in order to measure in customer units. The requirements are as follows:

- The 32 (max.) value pairs for the linearisation curve points are known.
- The level values must be given in ascending order. The curve is monotonously increasing.
- The level heights for the first and last points on the linearisation curve correspond to empty and full calibration respectively.
- The linearisation takes place in the basic setup unit ("**distance unit**" **(0C5)**).



Each point (2) in the table is described by a value pair: level (3) and, for example, volume (4). The last value pair defines the 100% output (= 20 mA for HART).

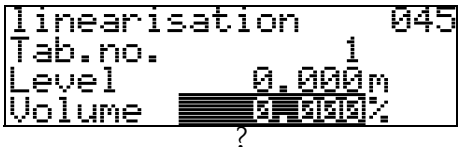




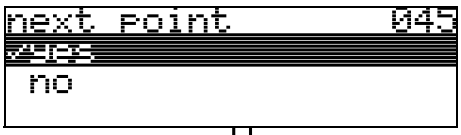
Select the table point (Point 1).



Enter the level belonging to Point 1.



Enter the corresponding volume.



Enter a further table point?



Next table point.

...

Continue until "**next point**" **(045)** is answered with no.

Note!
After making entries into the table, activate it with "**table on**".
The 100% value (=20 mA for HART) is defined by the last point in the table.

Note!
Before confirming 0.00 m as the level or 0.00% as the volume, activate the Edit mode with + or −.

Entries can be made into the linearisation table in ToF Tool using the table editor.
You can also display the contents graphically.
Linearization curves for any vessel forms can be calculated additionally.

semi-automatic
The vessel is filled in stages when the linearisation curve is entered semi-automatically. The Micropilot automatically detects the level and the corresponding volume/weight has to be entered. The procedure is similar to manual table entry, where the level value for each table point is given automatically by the instrument.

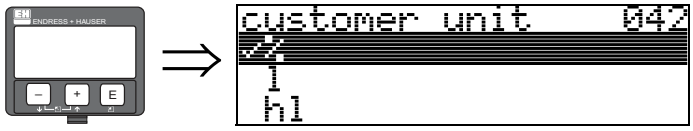
✎ Note!
If the vessel is emptied, pay attention to the following points:
- The number of points must be known in advance.
- The first table number = (32 – number of points).
- Entries in "**Tab. no.**" **(043)** are made in reverse order (last entry = 1).

table on
An entered linearisation table only becomes effective when activated.

clear table
Before making entries into the linearisation table, any existing tables must be deleted. The linearisation mode automatically switches to linear.

✎ Note!
A linearisation table can be deactivated by selecting "**linear**" or "**horizontal cyl**" (or the "**level/ullage**" **(040)** function = "**level DU**", "**ullage DU**"). It is not deleted and can be reactivated at any time by selecting "**table on**".

5.3 Function "customer unit" (042)

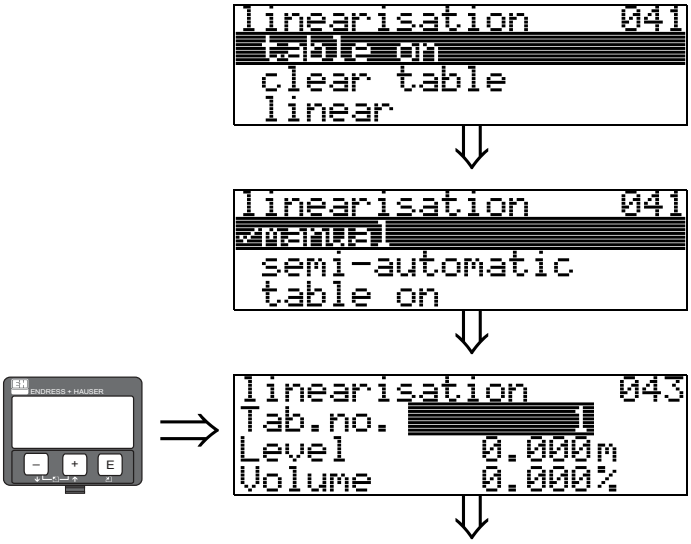


You can select the customer unit with this function.

Selection:
- %
- l
- hl
- m3
- dm3
- cm3
- ft3
- usgal
- i gal
- kg
- t
- lb
- ton
- m
- ft
- mm
- inch

Dependence
The units of the following parameters are changed:
- measured value (000)
- input volume (045)
- max. scale (046)
- simulation value (066)

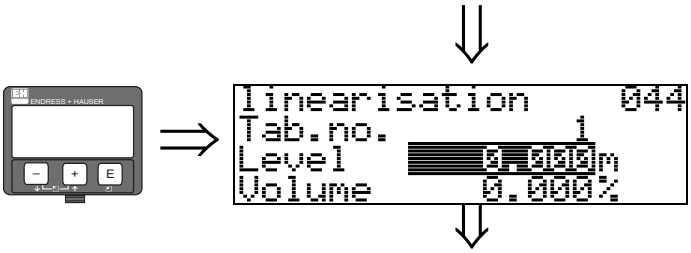
5.4 Function "table no." (043)



Position of the value pair in the linearisation table.

Dependence
Updates "**input level**" **(044)** , "**input volume**" **(045)**.

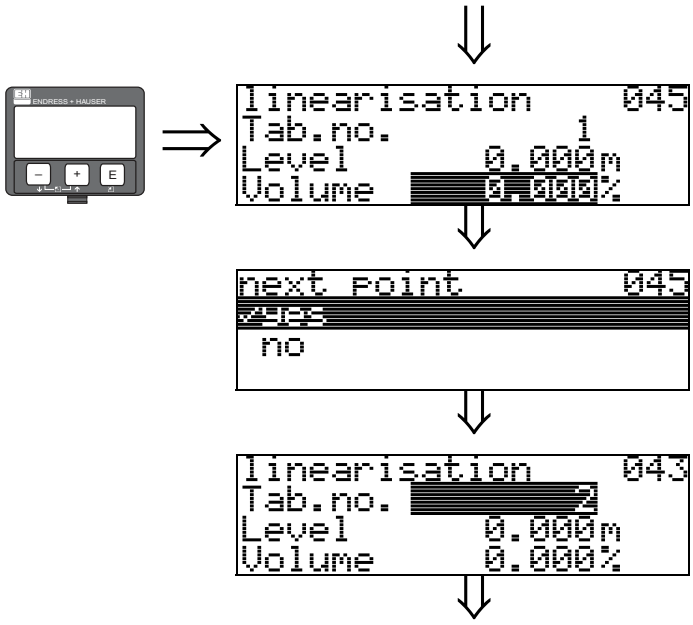
5.5 Function "input level" (044)



You can enter the level for each point of the linearisation curve with this function. When the linearisation curve is entered semi-automatically, Micropilot detects the level automatically.

User input:
Level in "**distance unit**" **(0C5)**.

5.6 Function "input volume" (045)



Specify the volume for each point of the linearisation curve with this function.

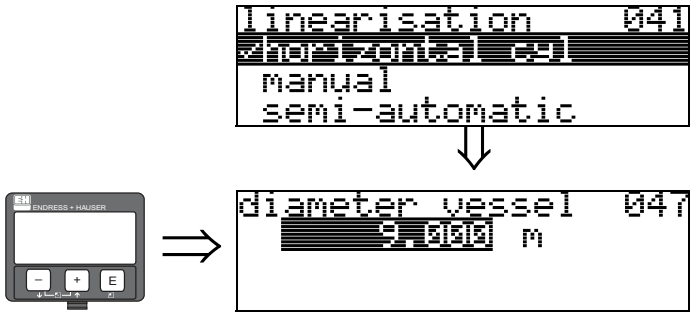
User input:
Volume in "**customer unit**" **(042)**.

5.7 Function "max. scale" (046)



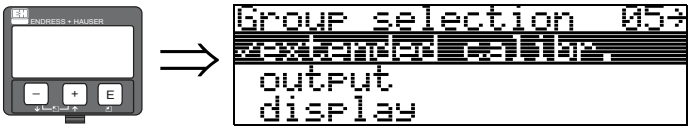
You can enter the end value of the measuring range with this function. This input is necessary if you selected "**linear**" or "**horizontal cyl**" in the "**linearisation**" **(041)** function.

5.8 Function "diameter vessel" (047)



Enter the vessel diameter with this function. This entry is necessary if you selected "**horizontal cyl**" in the "**linearisation**" **(041)** function.

6 Function group "extended calibr." (05)



6.1 Function "selection" (050)



Select the function of the extended calibration.

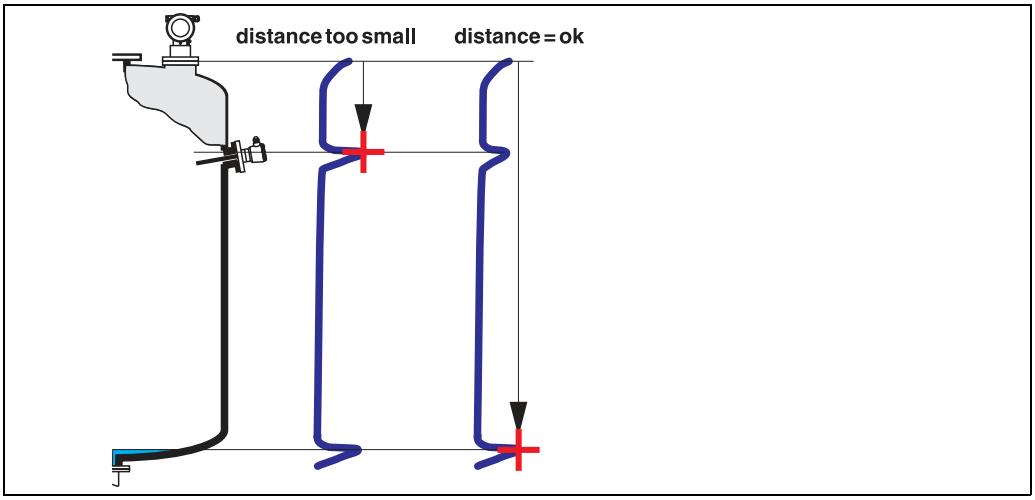
Selection:
- **common** (e.g. "Level correction", "Output damping", "Antenna extension", ...)
- mapping
- extended map.

6.2 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



distance = ok
- 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.

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

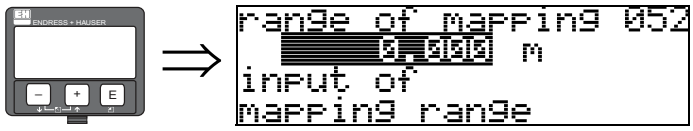
dist. too big
- This error cannot be remedied by interference echo mapping
- Check the application parameters **(002), (003), (004)** and "**empty calibr.**" **(005)**

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.

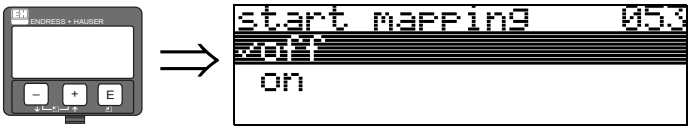
Caution!
The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty vessel, do not enter E, but E – 0.5 m (20").
If a mapping already exists, it is overwriten up to the distance specified in "**range of mapping**" **(052)**. Beyond this value the existing mapping remains unchanged.

6.3 Function "range of mapping" (052)



This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (see Page 2 ff.). This value can be edited by the operator.
For manual mapping, the default value is 0 m.

6.4 Function "start mapping" (053)



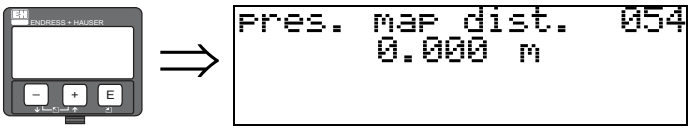
This function is used to start the interference echo mapping up to the distance given in "**range of mapping**" **(052)**.

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

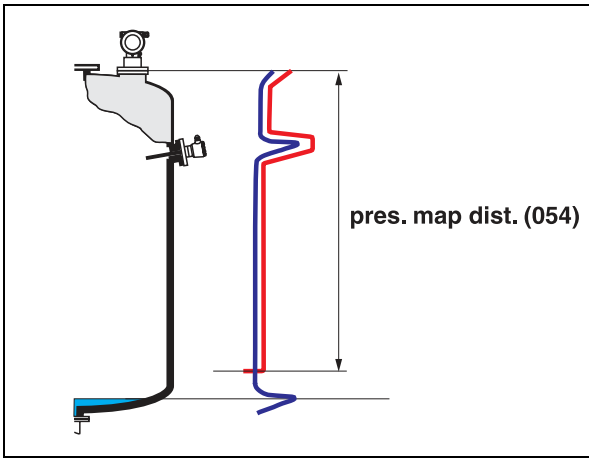
During the mapping process the message "**record mapping**" is displayed.

Caution!
A mapping will be recorded only, if the device is not in error state.

6.5 Function "pres. map dist." (054)



Displays the distance up to which a mapping has been recorded.
A value of 0 indicates that no mapping was recorded so far.



6.6 Function "cust. tank map" (055)



This function displays the evaluation mode using the customer tank map.

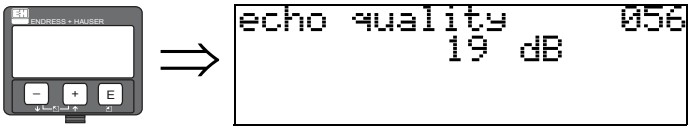
Selection:
- inactive
- active
- reset

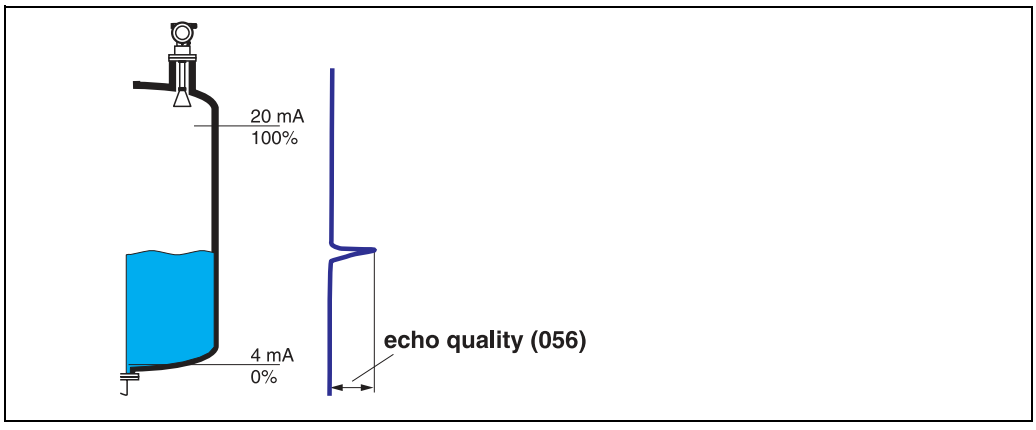
inactive
No tank mapping has been recorded, or map is switched off. Evaluation is only using FAC (see page 77).

active
Evaluation is using the customer tank map (see page 76).

reset
Deletes the complete tank map.

6.7 Function "echo quality" (056)





The echo quality is the benchmark for measurement reliability. It describes the amount of reflected energy and depends primarily on the following conditions:
- Dielectric constant of the medium
- Surface characteristics (waves, foam etc.)
- Distance between sensor and product

Low values increase the probability that the echo is lost through a change in measurement conditions, e.g. turbulent surface, foam, large measuring distance.

Caution!
Echo quality can be improved by orientation of the Micropilot (see page 86).

6.8 Function "offset" (057)



This function corrects the measured level by a constant value. The entered value is added to the measured level.

6.9 Function "antenna extens." (0C9)



Caution!
Not relevat for FMR250!

With this function, the length of the antenna extension FAR10 can be entered (FMR230 only). The influence of slower speed of propagation of the microwaves within the FAR10 is corrected automatically.

6.10 Function "output damping" (058)



Influences the time an output requires to react to a sudden level jump (63% of steady state). A high value attenuates, for example, the influences of rapid changes on the measured variable.

User input:
0...255 s

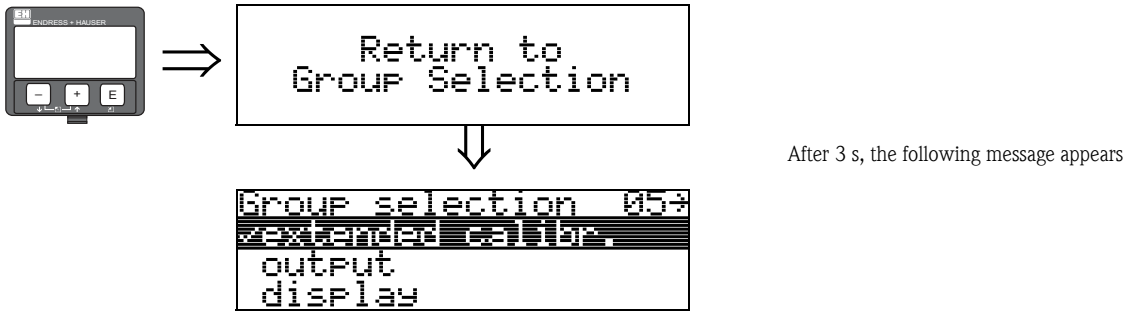
The default value depends on the selected application parameters "**tank shape**" **(002)**, "**medium property**" **(003)** and "**process cond.**" **(004)**.

6.11 Function "blocking dist." (059)



A window below the antenna tip can be suppressed when there are strong reflections of structures, welding joints or struts near the antenna.

- The blocking distance is measured from the bottom edge of the process connection. Usually, the suppression reaches up to the tip of the antenna (see diagram on page 30).
- For FMR244 and FMR245, the blocking distance is 20 cm by default.
- All echos are suppressed within this blocking distance.
- As the level echo could possibly be suppressed (and there is no guarantee that no other significant echo is available), a 10 cm long safety distance is placed in front of the suppression (see "**safety distance**" **(015)** function on page 30).
- The customer can set the Micropilot to respond to circumstances when the product is within this zone (safety distance) (see page 30).

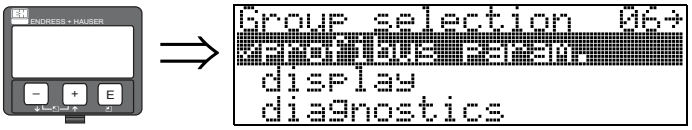


After 3 s, the following message appears

7 Function group "output" (06), - "profibus param." (06), PROFIBUS PA only



Display at HART and FOUNDATION Fieldbus instrument



Display at PROFIBUS PA instrument

7.1 Function "commun. address" (060), HART only

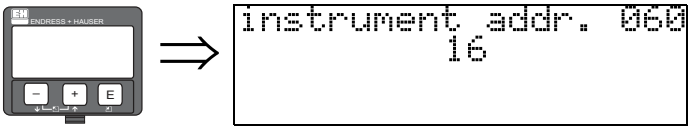


Enter the communication address for the instrument with this function.
- Standard: 0
- Multidrop: 1-15

In multidrop mode the default value of the output current is 4 mA. It can be modified in the function "**fixed cur. value**" **(064)**.

Caution!
This function is available for HART devices only!

7.2 Function "instrument addr." (060), PROFIBUS PA only



The PA bus address is displayed in this field. The address is set either directly on the instrument using DIP switches (see instrument operating instructions) or using a special SetSlaveAddress command via the bus, e.g. by the ToF Tool.

Caution!
This function is available for PROFIBUS PA devices only!

7.3 Function "no. of preambels" (061), HART only



Enter the number of preambles for the HART protocol with this function.
An increase in the value is advisable for "bad" lines with communications problems.

Caution!
This user input is available for HART devices only!

7.4 Function "ident number" (061), PROFIBUS PA only



- manufacturer
- profile

manufacturer
Set to1522 hex according to manufacturer (PNO registered).

profile
Setting defined as in PA Profile 3.0: 9700 hex – instrument with one AI block.

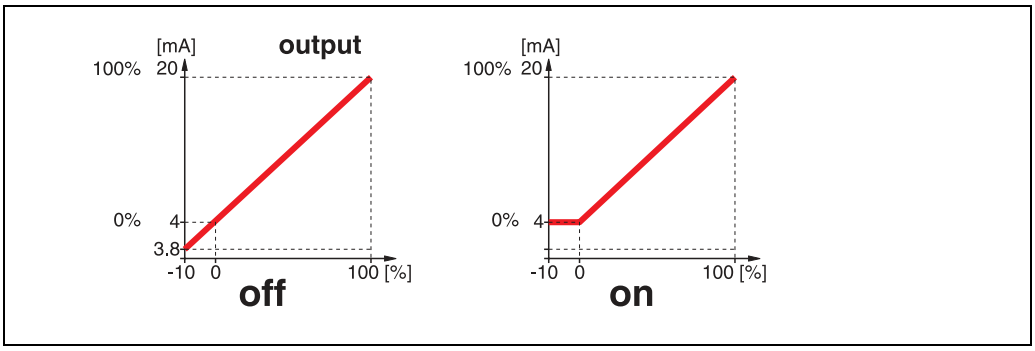
Caution!
This function is available for PROFIBUS PA devices only!

7.5 Function "low output limit" (062), HART only



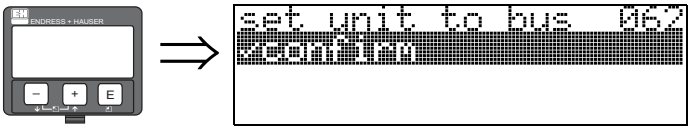
The output of negative level values can be suppressed with this function.

Selection:
- offminimum output -10% (3.8 mA for HART)
- onminimum output 0% (4 mA for HART)



Caution!
This user input is available for HART devices only!

7.6 Function "set unit to bus" (062), PROFIBUS PA only

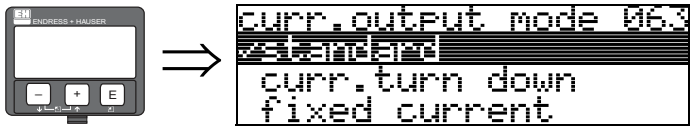


- confirm

After confirming this function, the unit of the measured variable is taken over in the AI block (PV scale -> Out scale).
This function must always be executed after changing the unit.

Caution!
This function is available for PROFIBUS PA devices only!

7.7 Funktion "curr.output mode" (063), HART only



With this function you specify the mode of the current output with HART devices.

Selection:
- **standard**
- curr.turn down
- fixed current

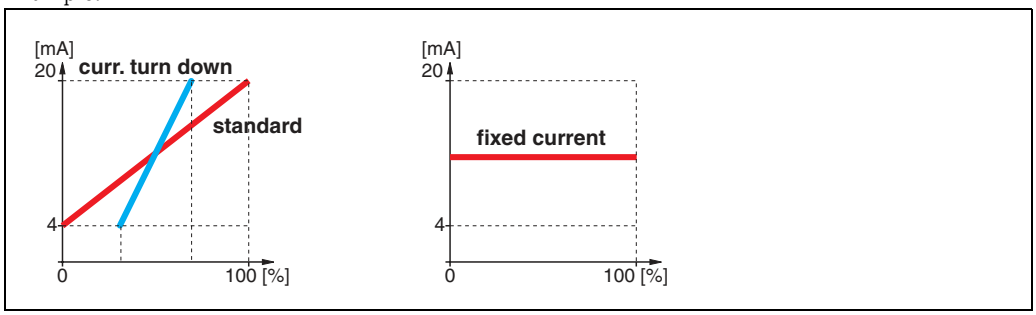
standard
The total measuring range (0 ... 100%) will be mapped to the current intervall (4 ... 20 mA).

curr.turn down
Only a part of the measuring range will be mapped to the current intervall (4 ... 20 mA). Use the functions **"4mA value" (068)** and **"20mA value" (069)** to define the concerning range.

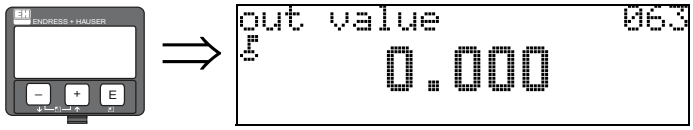
fixed current
The current is fixed. The actual measured value is transmitted by the HART signal only. The value of the current is defined in the **"fixed current" (064)** function.

Caution!
This function is available for HART devices only!

Example:



7.8 Function "out value" (063), PROFIBUS PA only



This displays the AI block output.

Caution!
This function is available for PROFIBUS PA devices only!

7.9 Function "fixed cur. value" (064), HART only

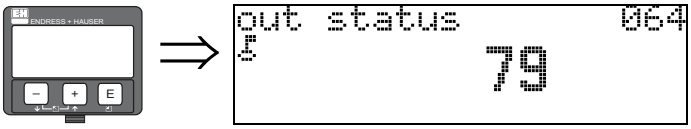


Set the fixed current value with this function. This entry is necessary when you have switched on the "**fixed current**" **(063)** function.

User input:
3,8...20,5 mA

Caution!
This user input is available for HART devices only!

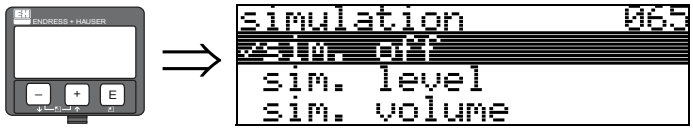
7.10 Function "out status" (064), PROFIBUS PA only



Displays the current output status (for value, see operating instructions of relevant instrument).

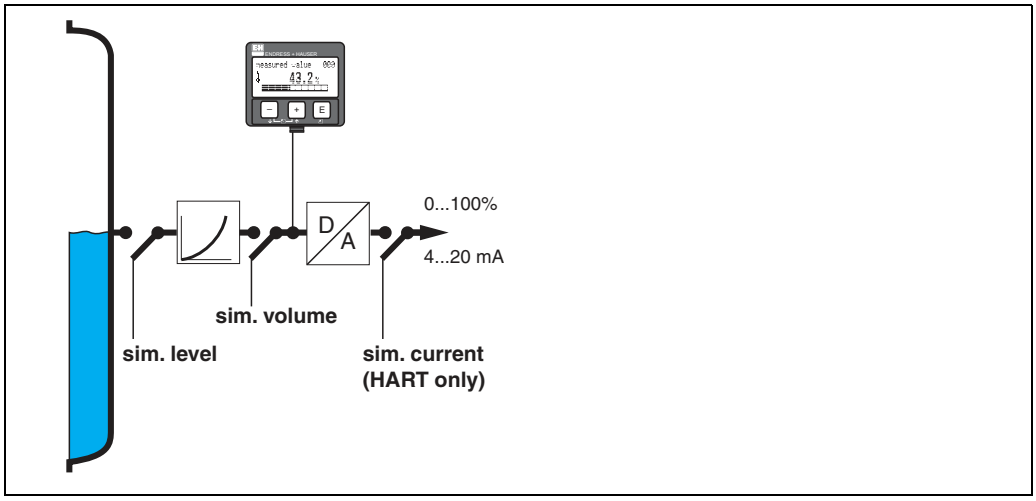
Caution!
This function is available for PROFIBUS PA devices only!

7.11 Function "simulation" (065)



If necessary, linearisation, the output signal and the current output can be tested with the simulation function. You have the following simulation options:

Selection:
- **sim. off**
- sim. level
- sim. volume
- sim. current



sim. off
Simulation is switched off.

sim. level
Enter the level value in "**simulation value**" **(066)**.
The functions
- measured value (000)
- measured level (0A6)
- output current" (067)

follow the entered values.

sim. volume
Enter the volume value in "**simulation value**" **(066)**.
The functions
- measured value (000)
- output current" (067)

follow the entered values.

sim. current (HART only)
Enter the current value in "**simulation value**" **(066)**.
The function
- output current" (067)

follows the entered values.

7.12 Function "simulation value" (066)

After selecting the "**sim. level**" option in the "**simulation**" **(065)** function, the following message appears in the display:



The level can be entered.

After selecting the "**sim. volume**" option in the "**simulation**" **(065)** function, the following message appears in the display:



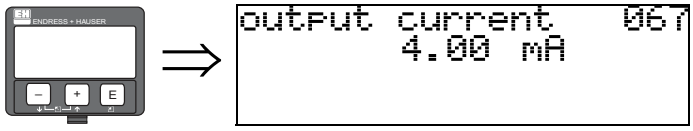
The volume can be entered.

After selecting the "**sim. current**" option in the "**simulation**" **(065)** function, the following message appears in the display:



Enter the output current (only for HART instruments).

7.13 Function "output current" (067), HART only



Displays the output current in mA.

Caution!
This function is available for HART devices only!

7.14 Function "2nd cyclic value" (067), PROFIBUS PA only



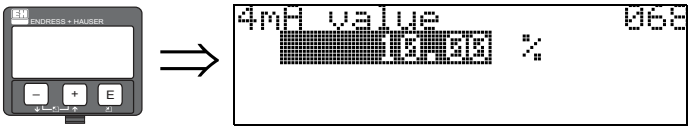
Selects the second cyclical value.

- height/dist.

Micropilot always transmits the distance as the second cyclical value.

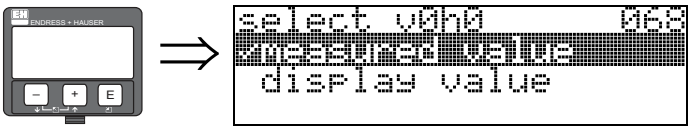
Caution!
This function is available for PROFIBUS PA devices only!

7.15 Function "4mA value" (068), HART only



In this function specify the level (or volume, weight, flow resp.), at which the output current should be 4 mA. This value will be used if you choose the option "curr. turn down" in the **"current output mode" (063)** function.

7.16 Function "select v0h0" (068), PROFIBUS PA only



Selects the value displayed in "**measured value**" **(000)**.

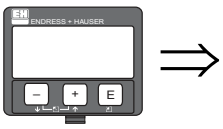
Selection:
- **measured value**
- display value

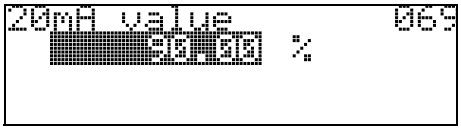
measured value
The configured measured value is displayed in the "**measured value**" **(000)** function.

display value
The value in "**display value**" **(069)** is displayed in the "**measured value**" **(000)** function.

Caution!
This function is available for PROFIBUS PA devices only!

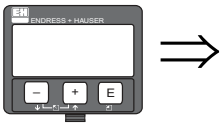
7.17 Function "20mA value" (069), HART only

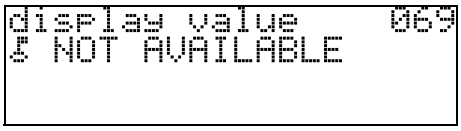




In this function specify the level (or volume, weight, flow resp.), at which the output current should be 20 mA. This value will be used if you choose the option "curr. turn down" in the **"current output mode" (063)** function.

7.18 Function "display value" (069), PROFIBUS PA only

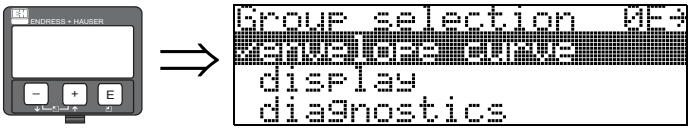




This field can be set externally, e.g. from a PLC. The value is then displayed as the main measured variable in the display by selecting the "**select v0h0**" **(068)** = "**display value**" function.

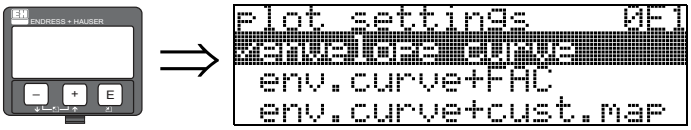
Caution!
This function is available for PROFIBUS PA devices only!

8 Function group "envelope curve" (0E)



Caution!
This function can be performed on the display only!

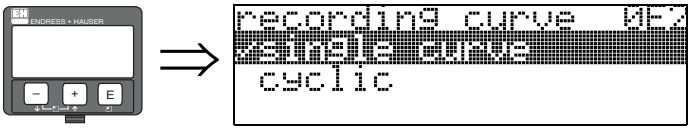
8.1 Function "plot settings" (0E1)



Select which information will be displayed in the LCD:
- **envelope curve**
- env.curve+FAC (on FAC see page 77)
- env.curve+cust.map (i.e. customer tank map is also displayed)

8.2 Function "recording curve" (0E2)

This function defines whether the envelope curve is read as a
- **single curve**
  or
- cyclic.

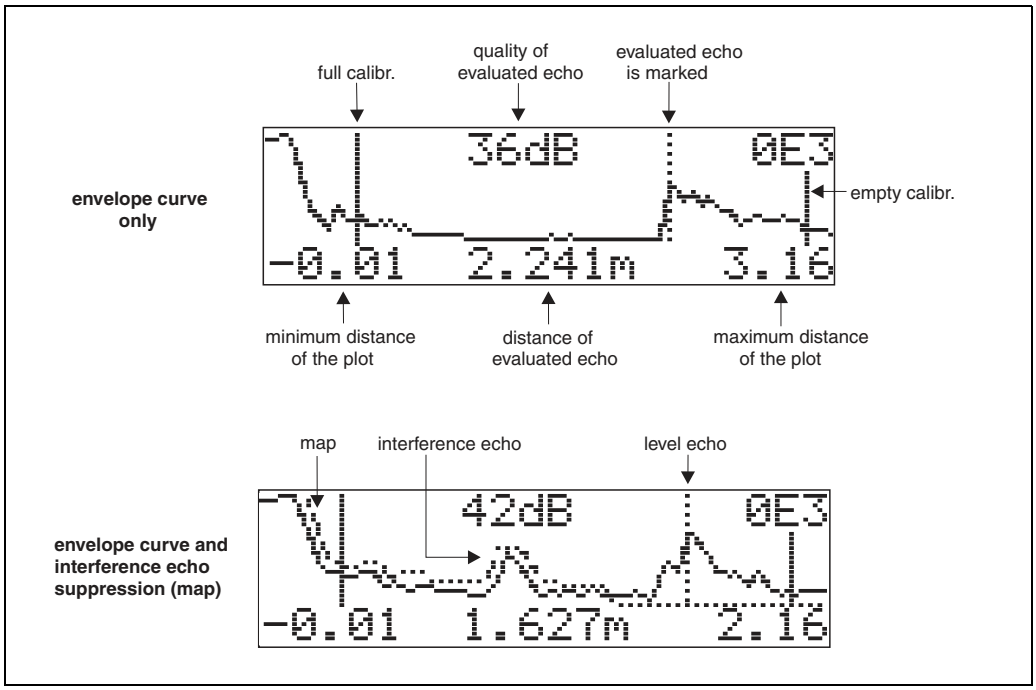


Note!
If the cyclical envelope curve is active in the display, the measured variable is refreshed in a slower cycle time. It is therefore recommended to exit the envelope curve display after optimising the measuring point.

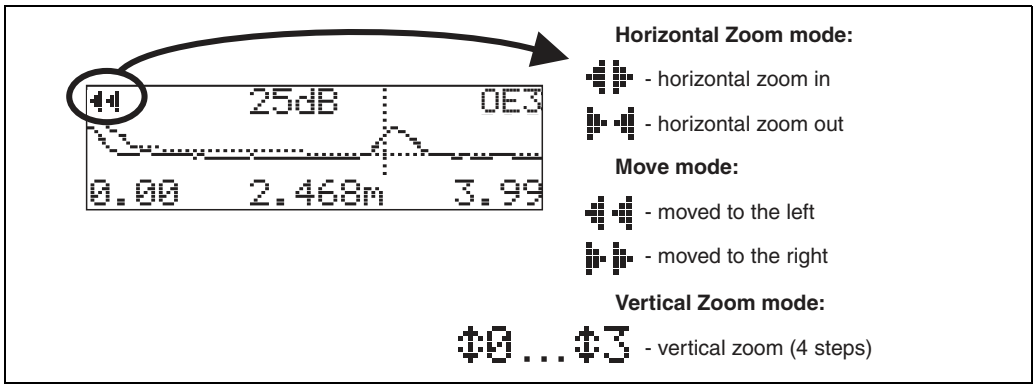
Note!
An **orientation** of the Micropilot can help to optimise measurement in applications with very weak level echos or strong interference echos by increasing the useful echo/reducing the interference echo (see»Orientation of the Micropilot« on page 86).

8.3 Function "envelope curve display" (0E3)

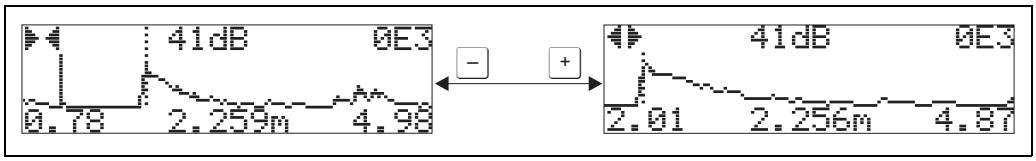
The envelope curve is displayed in this function. You can use it to obtain the following information:



Navigating in the envelope curve display
Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.



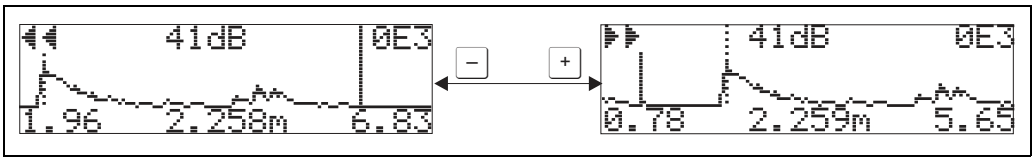
Horizontal Zoom mode
Firstly, go into the envelope curve display. Then press [+] or [−] to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either or is displayed.
You now have the following options:
- [+] increases the horizontal scale.
- [−] reduces the horizontal scale.



Move mode

Then press E to switch to Move mode. Either ▶▶ or ◀◀ is displayed.
You now have the following options:

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

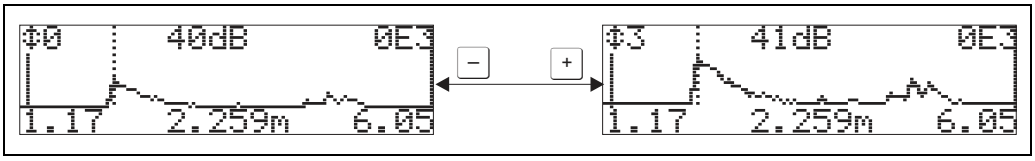


Vertical Zoom mode

Press E once more to switch to Vertical Zoom mode. ⇕i is displayed.
You now have the following options:

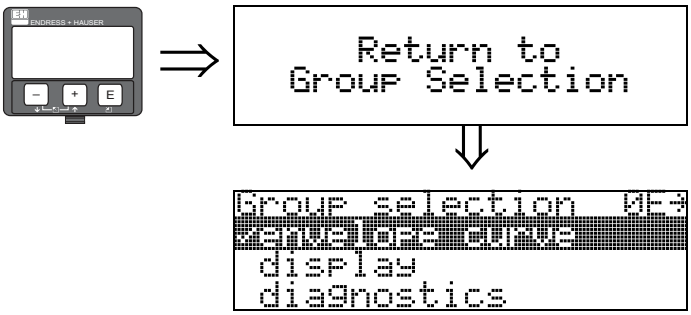
- + increases the vertical scale.
- − reduces the vertical scale.

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



Exiting the navigation

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

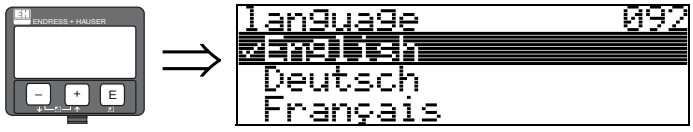


After 3 s, the following message appears

9 Function group "display" (09)



9.1 Function "language" (092)



Selects the display language.

Selection:
- English
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- ｺﾝﾆﾁﾊ (Katakana, Japanese)

Note!
When using tools on operating systems without Japanese language support "????." will be displayed only.

Dependence
All texts will be changed.

Caution!
This function is not visualised in Commuwin II!

9.2 Function "back to home" (093)



If no entry is made using the display during the specified time period, the display returns to the measured value display.
9999 s means that there is no return.

User input:
3...9999 s

Caution!
This function is not visualised in Commuwin II!

9.3 Function "format display" (094)



Selects the display format.

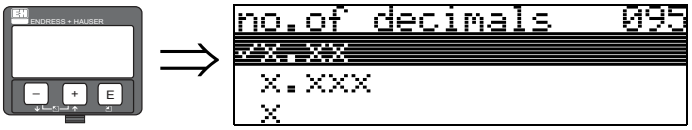
Selection:
- **decimal**
- ft-in-1/16"

decimal
The measured value is given in decimal form in the display (e.g. 10.70%).

ft-in-1/16"
The measured value is displayed in the following format (e.g 5'05-14/16").
This option is only possible for "**distance unit**" **(0C5)** - "**ft**" and "**in**"!

Caution!
This function is not visualised in Commuwin II!

9.4 Function "no.of decimals" (095)



Selection:
- x
- x.x
- **x.xx**
- x.xxx

9.5 Function "sep. character" (096)



Selection:
- **.**
- ,

.
The decimal place is separated by a point.

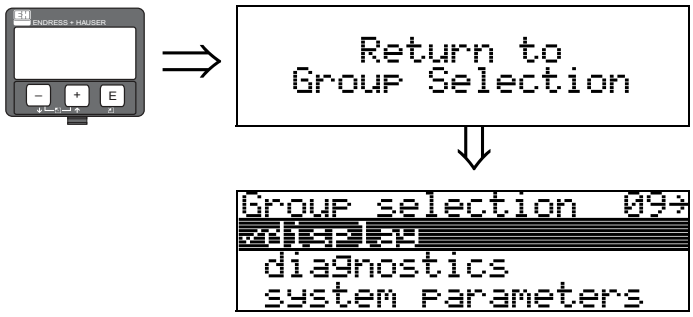
,
The decimal place is separated by a comma.

9.6 Function "display test" (097)



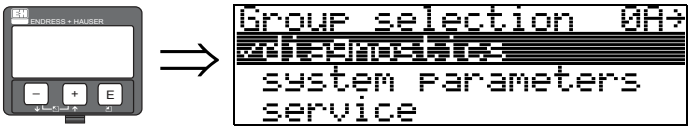
All display pixels are switched on. If the whole LCD is dark, it is working correctly.

Caution!
This function can be performed on the display only!



After 3 s, the following message appears

10 Function group "diagnostics" (0A)



In the "**diagnostics**" function group, you can display and confirm error messages.

Type of error
Errors that occur during commissioning or measuring are displayed immediately on the local display. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.
The measuring system distinguishes between two types of error:
- **A (Alarm):**
  Instrument goes into a defined state (e.g. MAX)
  Indicated by a constant ϟ symbol.
  (For a description of the codes, see Table 14.2 on Page 80)
- **W (Warning):**
  Instrument continue measuring, error message is displayed.
  Indicated by a flashing ϟ symbol.
  (For a description of the codes, see Table 14.2 on Page 80)
- **E (Alarm / Warning):**
  Configurable (e.g. loss of echo, level within the safety distance)
  Indicated by a constant/flashing ϟ symbol.
  (For a description of the codes, see Table 14.2 on Page 80)

Error messages
Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of the error codes is given on Page 80.
- The "**diagnostics (0A)**" function group can display current errors as well as the last errors that occurred.
- If several current errors occur, use [+] or [−] to page through the error messages.
- The last occurring error can be deleted in the "**diagnostics (0A)**" function group with the funktion"**clear last error**" **(0A2)**.

10.1 Function "present error" (0A0)



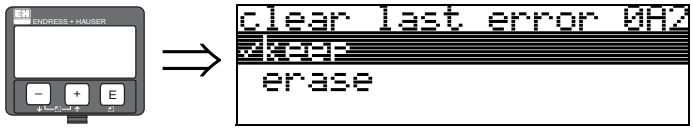
The present error is shown using this function.
If several current errors occur, use [+] or [–] to page through the error messages.

10.2 Function "previous error" (0A1)



The last error presented is shown with this function.

10.3 Function "clear last error" (0A2)



Selection:
- **keep**
- erase

10.4 Function "reset" (0A3)

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

A reset is only necessary:
- if the instrument no longer functions
- if the instrument must be moved from one measuring point to another
- if the instrument is being de-installed /put into storage/installed



Entry ("reset" (0A3)):
333 = customer parameters (HART)
- 33333 = customer parameters (PROFIBUS PA and FOUNDATION Fieldbus)

333 = reset customer parameters for HART
33333 = reset customer parameters for PROFIBUS PA and FOUNDATION Fieldbus
This reset is recommended whenever an instrument with an unknown 'history' is to be used in an application:
- The Micropilot is reset to the default values.
- The customer specific tank map is not deleted.
- A linearisation is switched to "**linear**" although the table values are retained. The table can be reactivated in the "**linearisation**" **(04)** function group.

List of functions that are affected by a reset:

- tank shape (002) – liquids only
- vessel / silo (00A) – solids only
- empty calibr. (005)
- full calibr. (006)
- pipe diameter (007) – liquids only
- output on alarm (010)
- output on alarm (011)
- outp. echo loss (012)
- ramp %span/min (013)
- delay time (014)
- safety distance (015)
- in safety dist. (016)
- level/ullage (040)
- linearisation (041)
- customer unit (042)
- diameter vessel (047)
- range of mapping (052)
- pres. Map dist (054)
- offset (057)
- low output limit (062)
- fixed current (063)
- fixed cur. value (064)
- simulation (065)
- simulation value (066)
- 4mA value (068)
- 20mA value (069)
- format display (094)
- distance unit (0C5)
- download mode (0C8)

The tank map can also be reset in the "**cust. tank map**" **(055)** function of the "**extended calibr.**" **(05)** function group.

This reset is recommended whenever an instrument with an unknown 'history' is to be used in an application or if a faulty mapping was started:
- The tank map is deleted. The mapping must be recommenced.

10.5 Function "unlock parameter" (0A4)



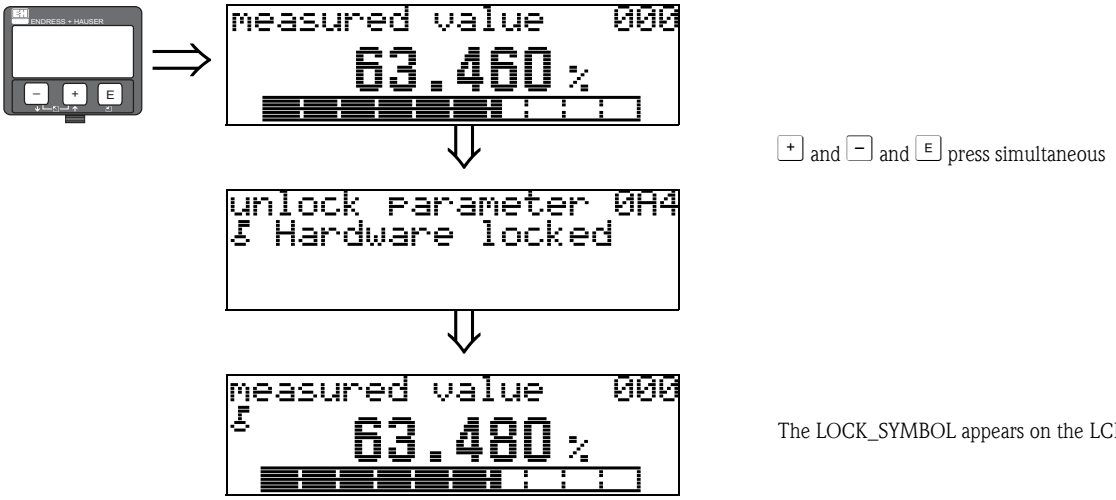
Set-up can be locked and unlocked with this function.

10.5.1 Locking of the configuration mode

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

"**unlock parameter**" **(0A4):**
A value **<> 100 for HART** (e.g. 99) or **<> 2457 for PROFIBUS PA and FOUNDATION Fieldbus** (e.g. 2456) must be entered in "**unlock parameter**" **(0A4)** in the "**diagnostics**" **(0A)** function group. The lock is shown on the display by the symbol and can be released again either via the display or by communication.

Hardware lock:
The instrument is locked by pressing the [+] and [−] and [E] keys at the same time.
The lock is shown on the display by the symbol and can **only** be unlocked again via the display by pressing the [+] and [−] and [E] keys at the same time again. It is **not** possible to unlock the hardware by communication.
All parameters can de displayed even if the instrument is locked.



10.5.2 Unlocking of configuration mode

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

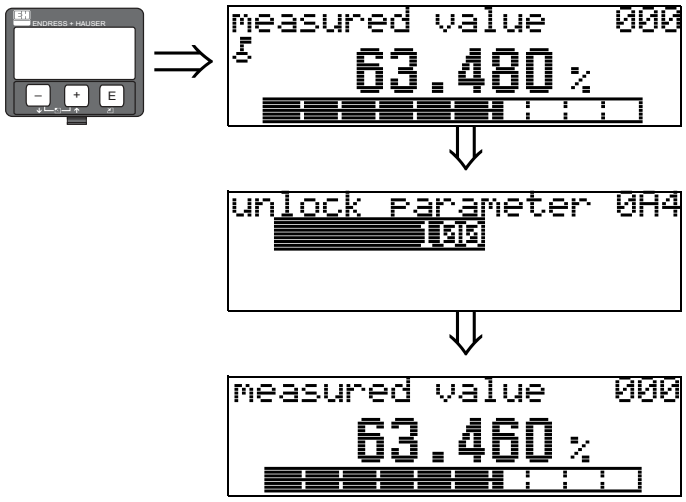
"**unlock parameter**" **(0A4):**
By entering the unlock parameter (on the display or via communication)

100 = for HART devices
2457 = for PROFIBUS PA and FOUNDATION Fieldbus devices

the Micropilot is released for operation.

Hardware-Verriegelung:
After pressing the [+] and [−] and [E] keys at the same time, the user is asked to enter the unlock parameter

100 = for HART devices
2457 = for PROFIBUS PA and FOUNDATION Fieldbus devices

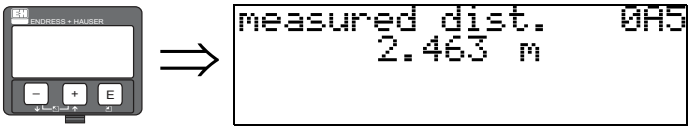


[+] and [−] and [E] press simultaneous

Please enter unlock code and confirm with [E].

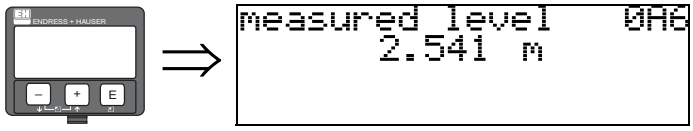
Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special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

10.6 Function "measured dist." (0A5)

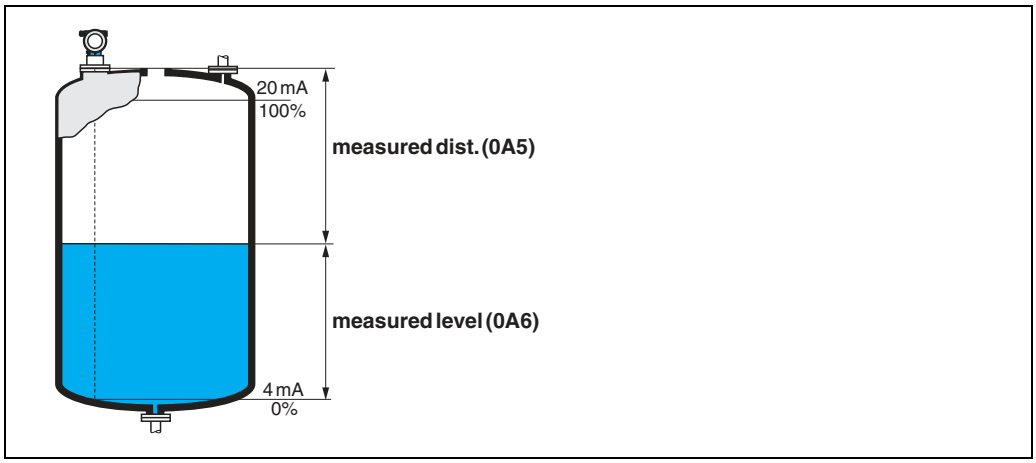


Display of measured distance in the selected "**distance unit**" **(0C5)**.

10.7 Function "measured level" (0A6)



Display of measured level in the selected "**distance unit**" **(0C5)**.



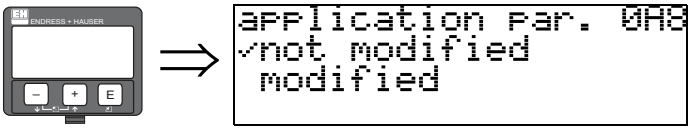
10.8 Function "detection window" (0A7)



Is used to switch the detection window on and off and to reset an existing detection window.
If this function is switched on, a window is defined surrounding the current level echo (typical width: 1 to 2.5 m; depending on the application parameters).
The window always moves togehter with a rising a falling echo.
Echos beyond the limits of the window are ignored for a certain time.

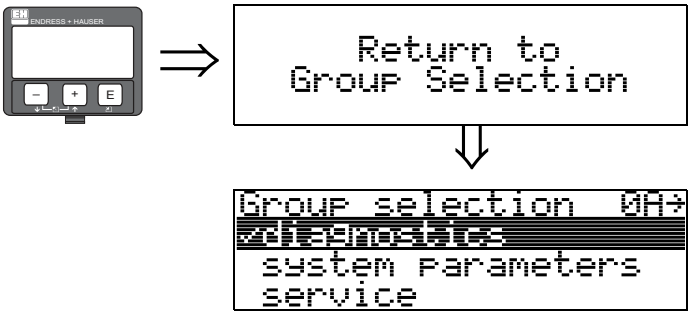
Selection:
- **off**
- on
- reset
  After selection of this option, the current window is reset, the level echo is looked for in the complete measuring range and a new window is defined surrounding the current level echo.

10.9 Function "application par." (0A8)



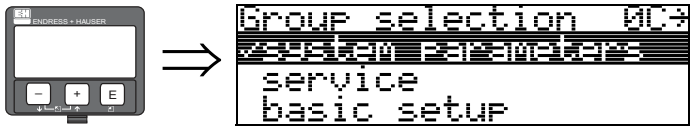
Displays whether or not one of the settings dependent on the "**tank shape**" **(002)**, "**medium property**" **(003)** and "**process cond.**" **(004)** application parameters has been changed. If, for example, the "**output damping**" **(058)** is changed, the "**application par.**" shows "**modified**".

Selection:
- **not modified**
- modified



After 3 s, the following message appears

11 Function group "system parameters" (0C)



11.1 Function "tag no." (0C0)



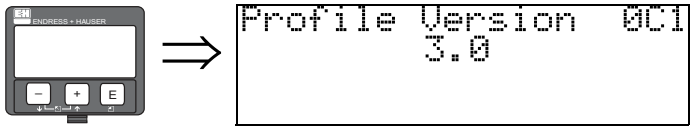
You can define the tag number with this function.

User input:
- 16 alphanumeric characters for HART instruments (8 using the HART universal command)
- 32 alphanumeric characteristics for PROFIBUS PA instruments

11.2 Function "device tag" (0C0), FOUNDATION Fieldbus only

This function displays the tag number.

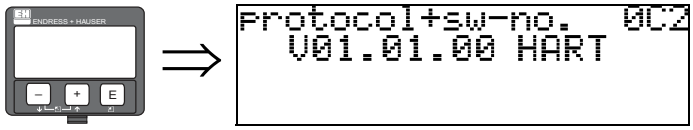
11.3 Function "Profile Version" (0C1), PROFIBUS PA only



The PA Profile version is shown using this function (Profile 3.0).

Caution!
This function is available for PROFIBUS PA devices only!

11.4 Function "protocol+sw-no." (0C2)



This function shows the protocol and the hardware and software version: Vxx.yy.zz.prot.

Display:
xx: hw-version
yy: sw-version
zz: sw-revision
prot: protocoll type (e.g. HART)

11.5 Function "serial no." (0C4)



This function displays the instrument serial number.

11.6 Function "device id" (0C4), FOUNDATION Fieldbus only

This function displays the instrument serial number.

11.7 Function "distance unit" (0C5)



You can select the basic distance unit with this function.

Selection:
- **m**
- ft
- mm
- inch

Dependence
m, mm: "**format display**" **(094)** can only be "**decimal**".

The units are changed for the following parameters:
- empty calibr. (005)
- full calibr. (006)
- pipe diameter (007) – liquids only
- safety distance (015)
- input level (044)
- diameter vessel (047)
- range of mapping (052)
- cust. tank map (055)
- offset (057)
- simulation value (066)
- measured dist. (0A5)
- measured level (0A6)

11.8 Function "download mode" (0C8)



This parameter defines which values are written to the instrument during a ToF Tool or Commuwinn II configuration download.

Selection:
- **parameter only**
- param+cust.map
- mapping only

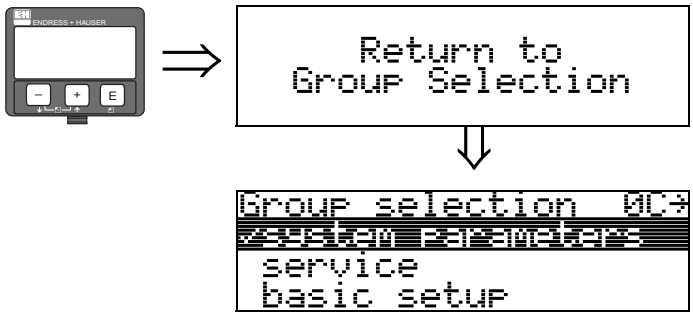
Note!
This parameter must not be set explicitly in ToF Tool. The various possibilities can be selected from the download dialog.

11.9 Function "antenna extens." (0C9)



Caution!
Not relevat for FMR250!

With this function, the length of the antenna extension FAR10 can be entered (FMR230 only). The influence of slower speed of propagation of the microwaves within the FAR10 is corrected automatically.



After 3 s, the following message appears

12 Function group "service" (0D)

You can find a detailed description of the "Service" function group as well as a detailed overview of the function menu in the Service Manual: SM 07F for Micropilot M.

12.1 Software history

Micropilot M FMR240, FMR244, FMR245

Date	Software version	Changes to software	Documentation
12.2000	01.01.00	Original software. Operated via: – ToF Tool from version 1.5 – Commuwin II (from version 2.07-3) – HART communicator DXR275 (from OS 4.6) withRev. 1, DD 1.	BA221F/00/en/01.01 52006323
05.2002 03.2003	01.02.00 01.02.02	■ Function group: envelope curve display ■ Katakana (japanese) ■ current turn down (HART only) ■ the customer tank map can be edited ■ length of antenna extension FAR10 can be entered directly Operated via: – ToF Tool from version 3.1 – Commuwin II (from version 2.08-1) – HART communicator DXR375 with Rev. 1, DD 1.	BA221F/00/en/03.03 52006323
01.2005	01.02.04	Function "echo lost" improved	
03.2006	01.04.00	■ Function: detection windowg Operated via: – ToF Tool from version 4.2 – FieldCare from version 2.02.00 – HART-Communicator DXR375 with Rev. 1, DD 1.	BA221F/00/en/12.05 52006322
10.2006	01.05.00	Support of additional HF modules integrated. ■ Function: media type	BA291F/00/en/08.06 71030727

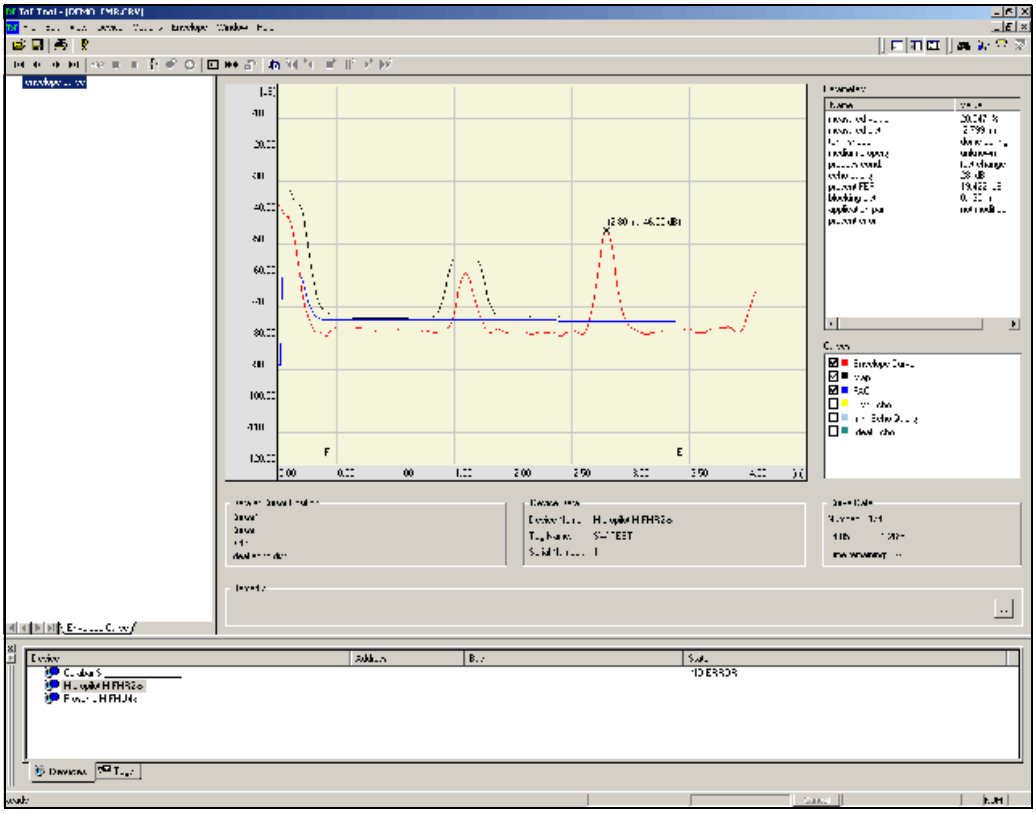
Micropilot M FMR250

Date	Software version	Changes to software	Documentation
09.2004	01.01.00	Original software. Operated via: – ToF Tool from version 2.0 – HART communicator DXR375 with Rev. 1, DD 1.	BA291F/00/en/08.04
11.2005	01.04.00	■ Function: detection window ■ Communication: PROFIBUS PA Operated via: – ToF Tool from version 4.2 – FieldCare from version 2.02.00 – HART communicator DXR375 with Rev. 1, DD 1.	BA291F/00/en/01.06
10.2006	01.05.00	Support of additional HF modules integrated. ■ Communication: FOUNDATION Fieldbus	BA221F/00/en/12.05 71030727

13 Envelope curve

13.0.1 Envelope curve with the ToF Tool

Signal analysis via envelope curve



See page 57 ff. for the envelope curve in the local display.

13.0.2 Tank mapping

Generation of an envelope curve
Depending on the distance, the electromagnetic wave with a frequency of approx. 6 GHz requires a time-of-flight between 1 ns and 270 ns. The reflected signal is expanded by means of a sampling process to approximately 0.3 ms to 20 ms.
The sampling factor for 6 GHz is 81920; it is 163 840 for 26 GHz. The resulting carrier frequency is approx. 70 kHz, and 140 kHz at 26 GHz, respectively.
The envelope curve generated such is then demodulated, processed to a logarithmic scale, amplified and finally digitalized and evaluated by a microprocessor.
In chronological order, an envelope curve consistes of the sending pulse, the electrical reverberation and one or more echoes.
The maximum measuring time depends on the maximum measuring distance. Afterwards, the next cycle starts with the sending pulse.
The envelope curve can be viewed on the local display. In order to do that, the function 09C must be selected in the operation menu. The display can be configured in function 09A and 09B. In addition, a laptop computer or PC in combination
with the E+H software “ToF Tool” and an interface adapter can be used for display and evaluation of an evelope curve. (see BA 224F – Operating Instructions for ToF Tool).

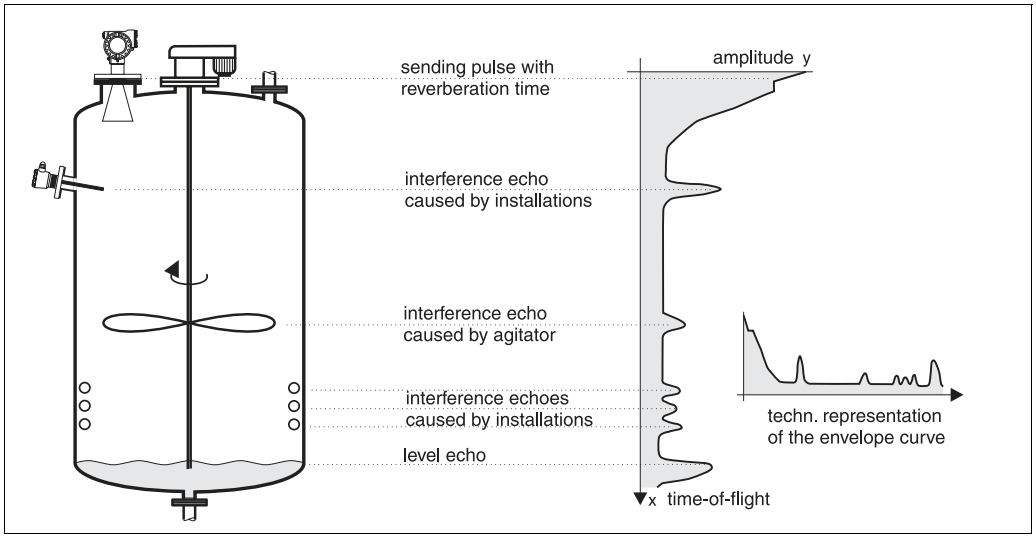


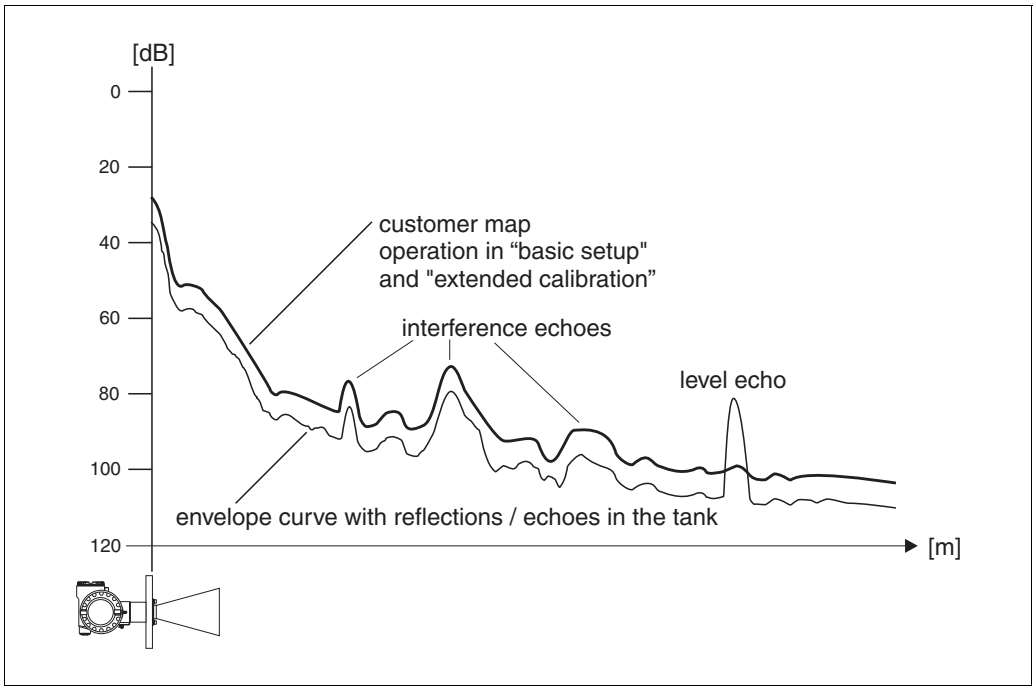
Fig. 4: Example of a tank with a schematic envelope curve

Tank mapping

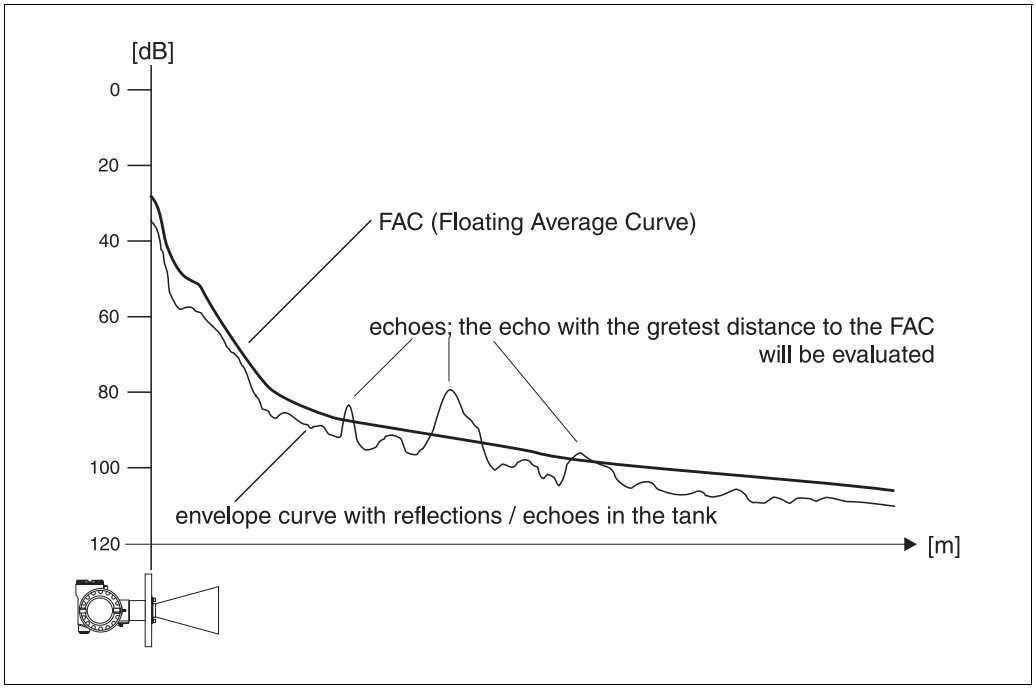
It may be required to map interference reflections inside the tank.This map is preferrably done with an empty tank. This way, all eventual interference reflections caused by installations in the tank are detected and stored in memory.

Only significant echoes will then exceed the tank map and be evaluated.

The mapping can also be performed up to the level or a defined distance, even if the tank is not empty. However, if the level drops below the mapping distance, additional reflections can interfere with the measurement.



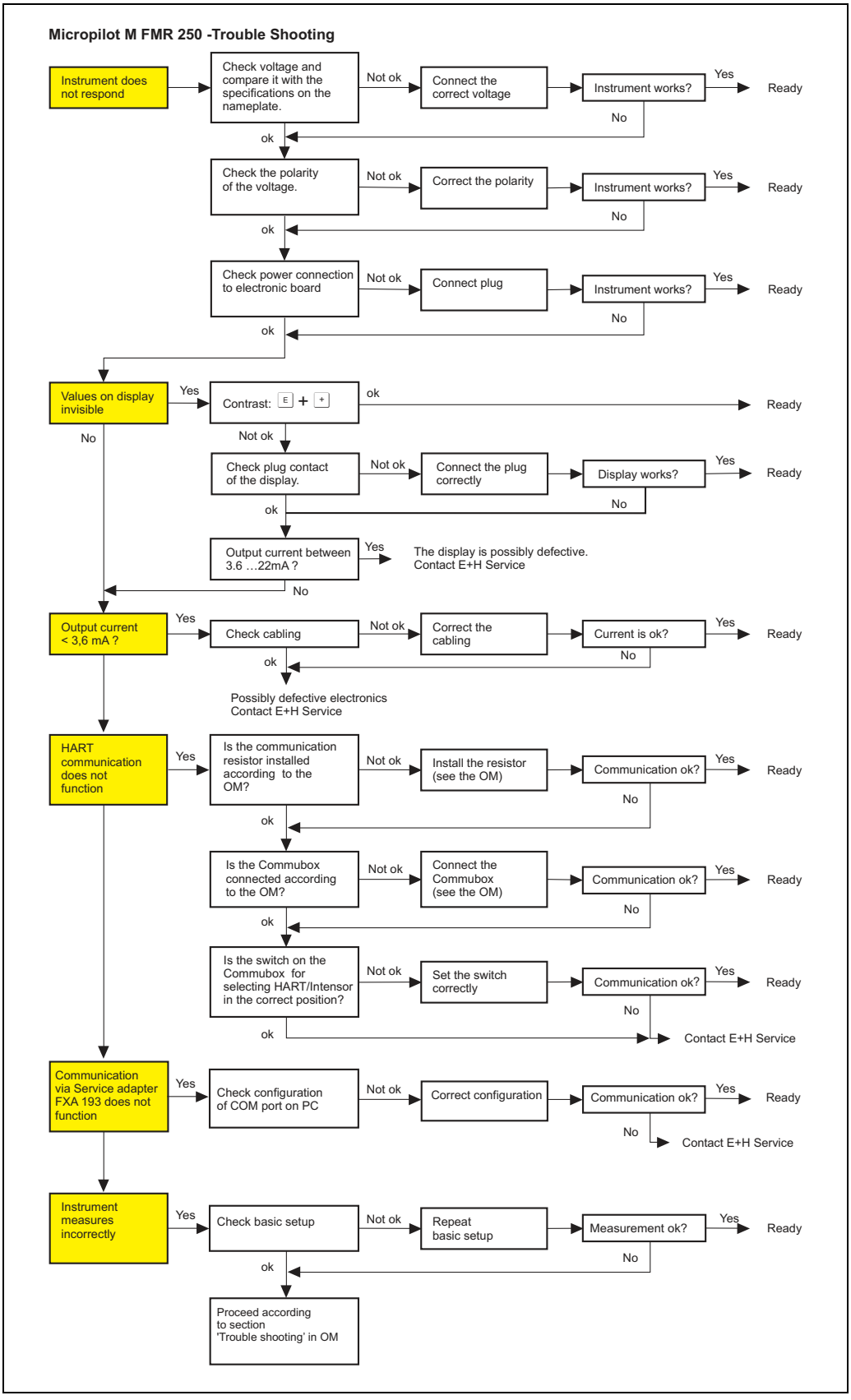
The FAC (Floating Average Curve)
The FAC is similar to the tank map, but automatically adapts itself to changing interference echoes in the tank, i.e. caused by buildup and turbulences. The FAC only covers small interference reflections, all signals below this curve are ignored.
The echo signal with the greatest distance to the FAC will be evaluated.
The FAC is not only recorded once, but newly calculated with every envelope curve. Thus, it continuously adapts itself to the conditions in the tank.



14 Trouble-shooting

If you have followed the instructions in this operating manual, the Micropilot should work correctly. If this is not the case, Micropilot has facilities for analysing and correcting errors.
You can find a structured approach for locating errors on page 79 ff. or in the appropriate instrument operating manual.

14.1 Trouble-shooting instructions

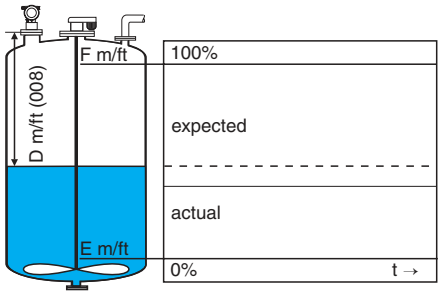
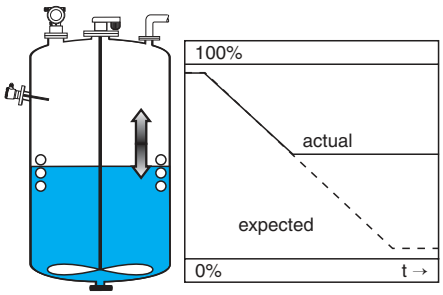


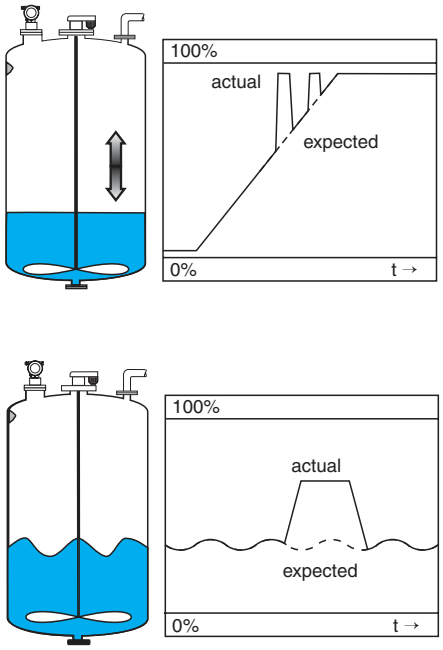
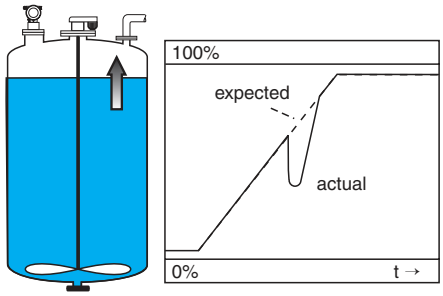
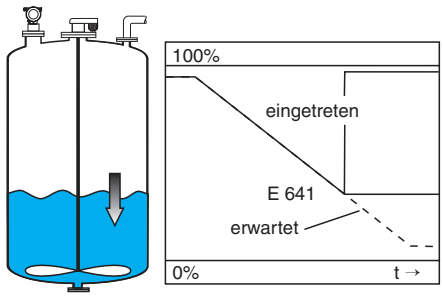
14.2 System error messages

Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E²PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising - please wait	E²PROM storage not yet finished	wait some seconds; if warning prevails, exchange electronics
A106	downloading please wait	processing data download	wait until warning disappears
A110	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E²PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A111	electronics defect	RAM defective	reset; if alarm prevails after reset, exchange electronics
A113	electronics defect	ROM defective	reset; if alarm prevails after reset, exchange electronics
A114	electronics defect	E2PROM defective	reset; if alarm prevails after reset, exchange electronics
A115	electronics defect	general hardware problem	reset; if alarm prevails after reset, exchange electronics
A116	download error repeat download	checksum of stored data not correct	restart download of data
A121	electronics defect	no factory calibration existant; E²PROM defective	contact service
W153	initialising - please wait	initialisation of electronics	wait some seconds; if warning prevails, power off device and power on again
A155	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A160	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E²PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A164	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A171	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A231	sensor 1 defect check connection	HF module or electronics defective	exchange HF module or electronics
W511	no factory calibration ch1	factory calibration has been deleted	record new factory calibration
A512	recording of mapping please wait	mapping active	wait some seconds until alarm disappears
W601	linearisation ch1 curve not monotone	linearization not monotonously increasing	correct linearisation table
W611	less than 2 linearisation points for channel 1	number of entered linearization points < 2	correct linearisation table
W621	simulation ch. 1 on	simulation mode is active	switch off simulation mode

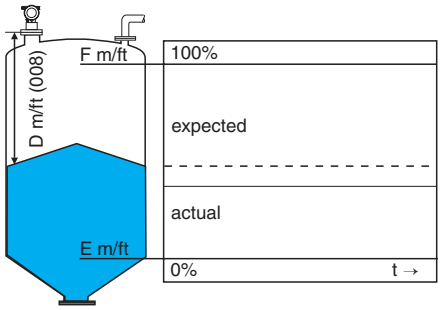
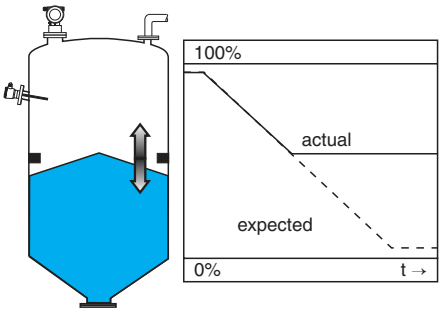
Code	Description	Possible cause	Remedy
E641	no usable echo channel 1 check calibr.	echo lost due to application conditions of built up on antenna	check installation; optimize orientation of antenna; clean antenna (cf. Operating Instructions)
E651	level in safety distance – risk of overspill	level in safety distance	alarm will disappear as soon as level leaves safety distance;
A671	linearisation ch1 not complete, not usable	linearisation table is in edit mode	activate linearisation table
W681	current ch1 out of range	current out of range (3,8 mA ... 21,5 mA)	check calibration and linearisation

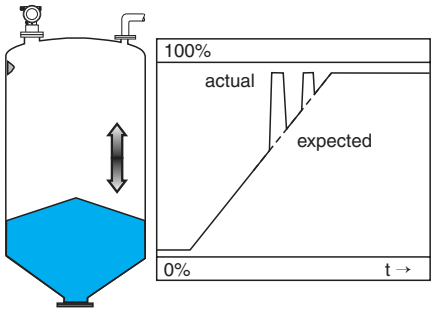
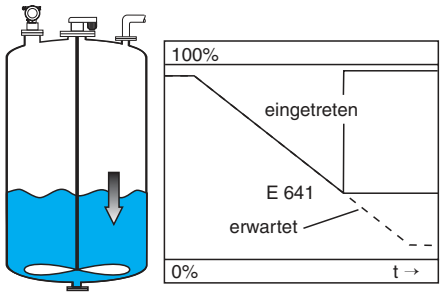
14.3 Application errors in liquids

Error	Output	Possible cause		Remedy
A warning or alarm has occurred.	Depending on the configuration	See table of error messages (see page 80)		1. See table of error messages (see page 80)
Measured value (00) is incorrect		Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: → level/ullage (040) → max. scale (046) → diameter vessel (047) → Check table
		no ↓		
		Measurement in bypass or stilling well?	yes →	1. Is bypass or stilling well selected in tank shape (002)? 2. Is the pipe diameter (007) correct?
		no ↓		
		An interference echo may have been evaluated.	yes →	1. Carry out tank mapping → basic setup
No change off measured value on filling/emptying		Interference echo from installations, nozzle or extension on the antenna		1. Carry out tank mapping → basic setup 2. If necessary, clean antenna 3. If necessary, select better mounting position 4. If necessary due to wide interference echos set function detection window (0A7) to "off"

Error	Output	Possible cause		Remedy
If the surface is not calm (e.g. filling, emptying, agitator running), the measured value jumps sporadically to a higher level		Signal is weakened by the rough surface — the interference echoes are sometimes stronger		1. Carry out tank mapping → basic setup 2. Set the process cond. (004) to "turb. surface" or "agitator" 3. Increase the output damping (058) 4. Optimise the orientation (see page 86) 5. If necessary, select a better mounting position and/or larger antenna
During filling/emptying the measured value jumps downwards		Multiple echoes	yes →	1. Check the tank shape (002), e.g. "dome ceiling" or "horizontal cyl" 2. In the range of the blocking dist. (059) there is no echo evaluation → Adapt the value 3. If possible, do not select central installation position 4. Perhaps use a stilling well
E 641 (loss of echo)		Level echo is too weak. Possible causes: ■ Rough surface due to filling/ emptying ■ Agitator running ■ Foam	yes →	1. Check application parameters (002), (003) and (004) 2. Optimise alignment (see page 86) 3. If necessary, select a better installation position and/or larger antenna

14.4 Application errors in solids

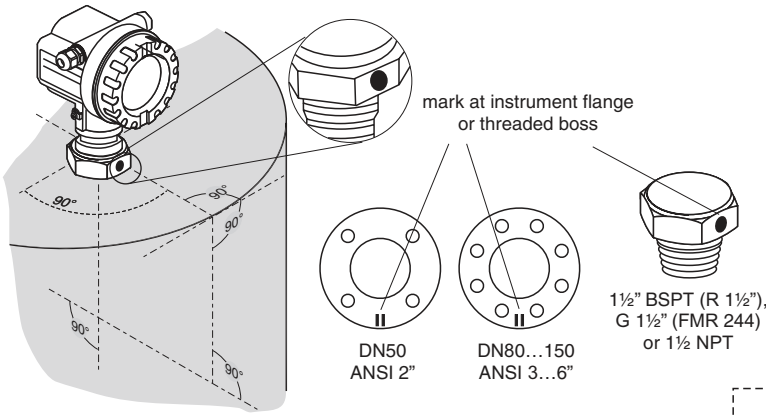
Error	Output	Possible cause		Remedy
A warning or alarm has occurred.	Depending on the configuration	See table of error messages (see page 80)		1. See table of error messages (see page 80)
Measured value (000) is incorrect		Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: → level/ullage (040) → max. scale (046) → Check table
		no ↓		
		An interference echo may have been evaluated.	yes →	1. Carry out tank mapping → basic setup
No change off measured value on filling/emptying		Interference echo from installations, nozzle or bulid up on the antenna		1. Carry out tank mapping → basic setup 2. If necessary, use top target positioner to aim antenna better to product surface (avoidance of interference echo) (see page 87) 3. If necessary, clean antenna (air purge) 4. If necessary, select better mounting position 5. If necessary due to wide interference echos set function detection window (0A7) to "off"

Error	Output	Possible cause		Remedy
During filling or emptying the measured value jumps sporadically to a higher level		Signal is weakened (e.g. by fluidisation of the surface, extreme dust formation) — the interference echoes are sometimes stronger		1. Carry out tank mapping → basic setup 2. Increase the output damping (058) 3. Optimise the orientation (see page 86) 4. If necessary, select a better mounting position and/or larger antenna
E 641 (loss of echo)		Level echo is too weak. Possible causes: ■ fluidisation of the surface ■ extreme dust formation ■ angle of repose	yes →	1. Check application parameters (00A), (00B) and (00C) 2. Optimise alignment (see page 86) 3. If necessary, select a better installation position and/or larger antenna

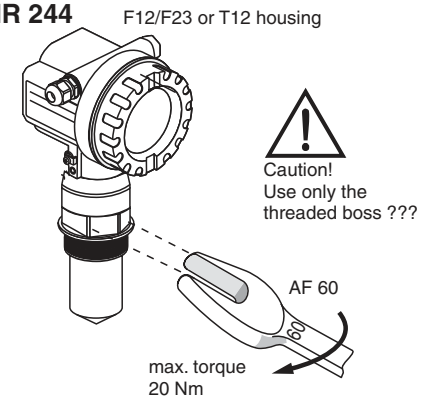
14.5 Orientation of the Micropilot

At mounting adjust the marking at the instrument flange!

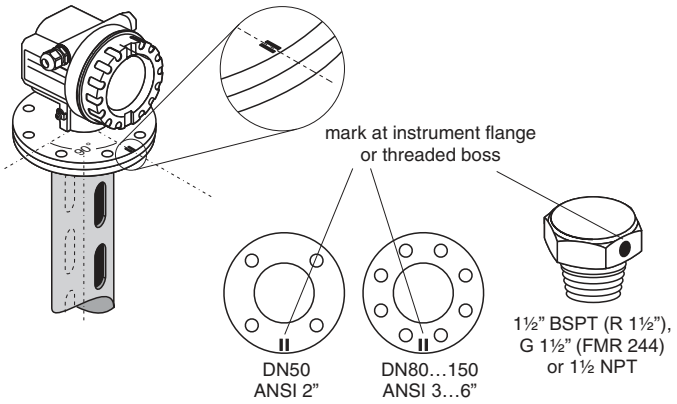
Installation in tank (free space):
Mark on process connector facing the nearest tank wall!



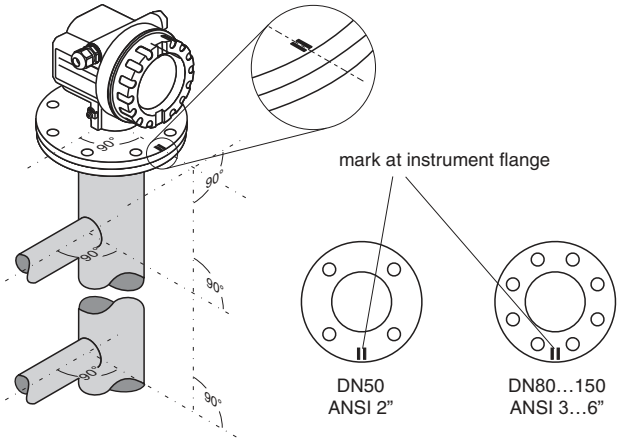
FMR 244 F12/F23 or T12 housing



Installation in stilling well:
Mark on process connector pointed towards the slots or vent holes!



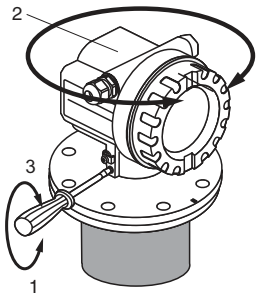
Installation in bypass:
Mark on process connector 90° offset from the tank connections!



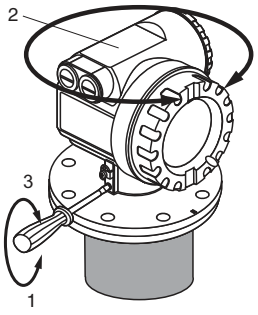
Turn housing

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

F12/F23 housing

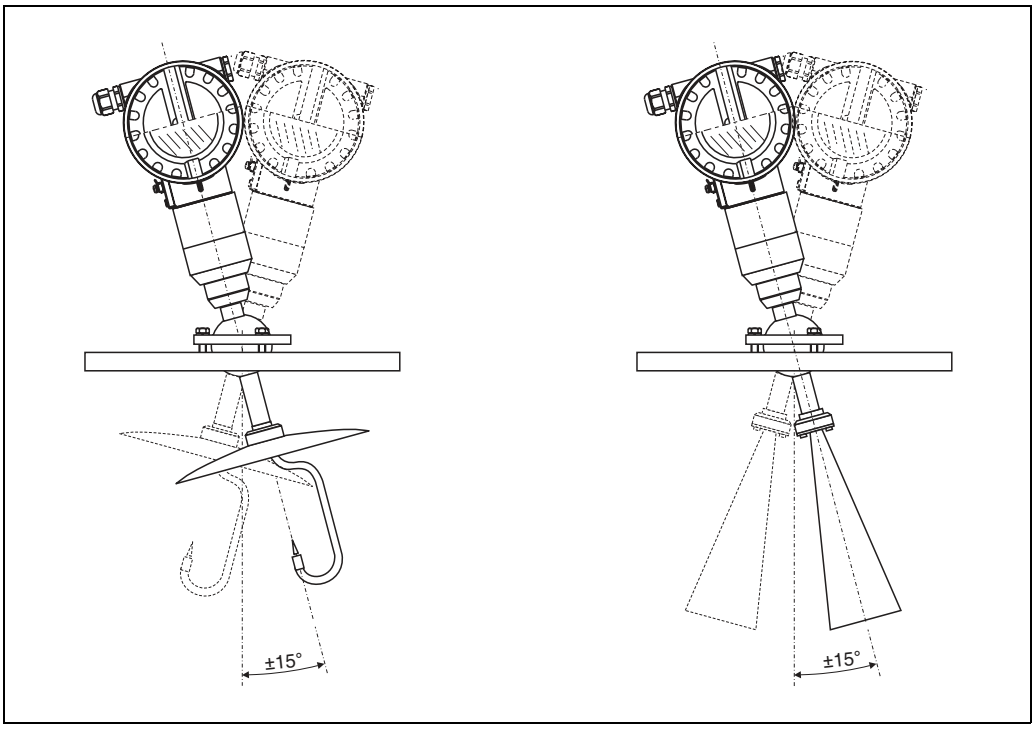


T12 housing



Allen key 4 mm / 0.1"
FMR 244: max. torque 0.5 Nm

Top target positioner – optional
Using top target positioner it is possible to tilt the antenna axis by up to 15° in all directions. The top target positioner is used for the optimum alignment of the radar beam with the bulk solids surface.



For orientation a marker is found on the flange or threaded boss of the Micropilot. During installation this must be oriented as follows (see page 86):
- In vessel: to the vessel wall
- In stilling wells: to the slots
- In bypass pipes: vertical to the vessel connectors

After commissioning the Micropilot, the echo quality indicates whether a sufficiently large measuring signal is obtained. If necessary, the quality can be optimised later. Vice versa, the presence of an interference echo can be used to minimise this by optimum orientation. The advantage of this is that the subsequent tank mapping uses a somewhat lower level that causes an increase in the strength of the measuring signal.

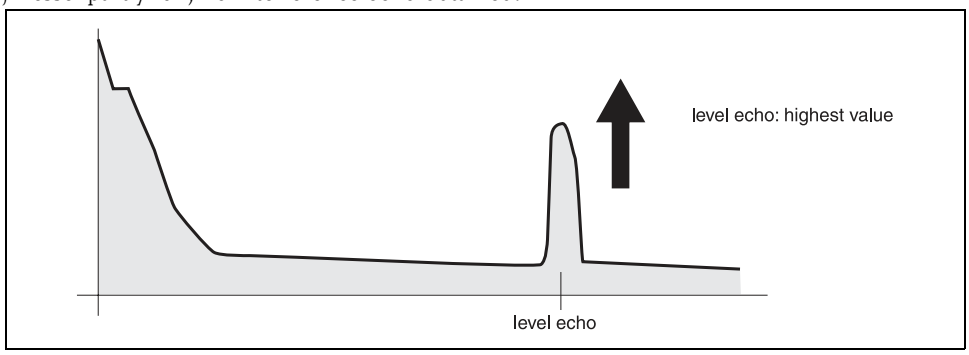
Proceed as follows:



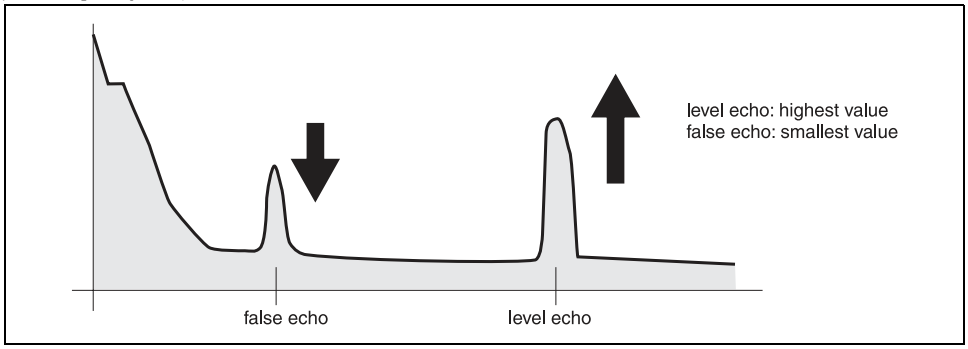
Warning!
Subsequent alignment can lead to personal injury. Before you unscrew or loosen the process connection, make sure that the vessel is not under pressure and does not contain any injurious substances.

1. It is best to empty the container so that the bottom is just covered. However, alignment can be carried out even if the vessel is empty.
2. Optimisation is best carried out with the aid of the envelope graph in the display or the ToF Tool.
3. Unscrew the flange or loosen the threaded boss by a half a turn.
4. Turn the flange by one hole or screw the threaded boss by one eighth of a turn. Note the echo quality.
5. Continue to turn until 360° is reached.

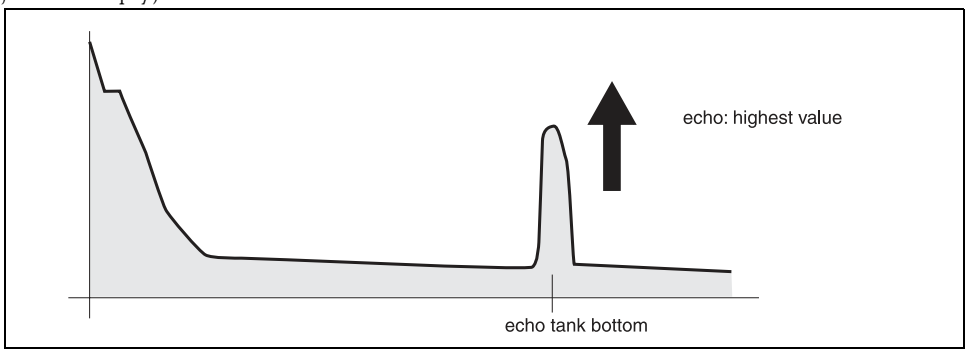
6. Optimum alignment:
   a) Vessel partly full, no interference echo obtained:



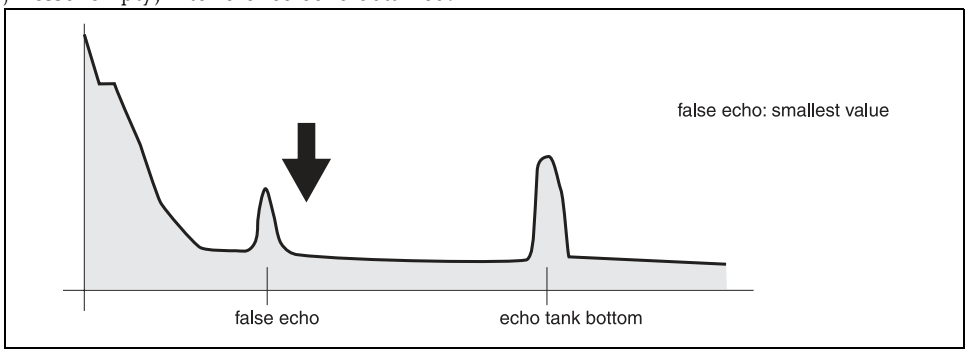
   b)Vessel partly full, interference echo obtained:



   c) Vessel empty, no interference echo:



   d) Vessel empty, interference echo obtained:



7. Fix the flange or threaded boss in this position.
   If necessary, replace the seal.
8. Carry out tank mapping, see page 22 ff.

Index function menu

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