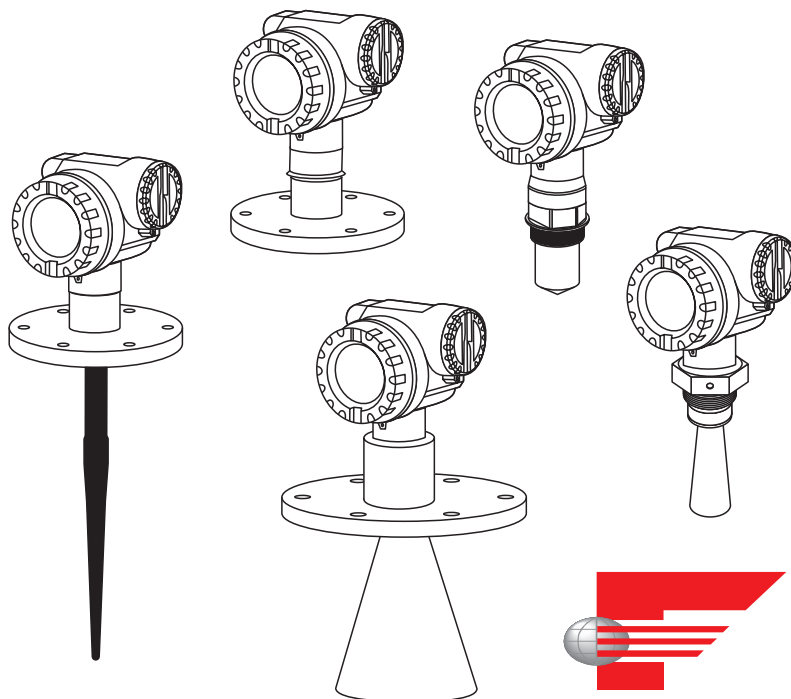
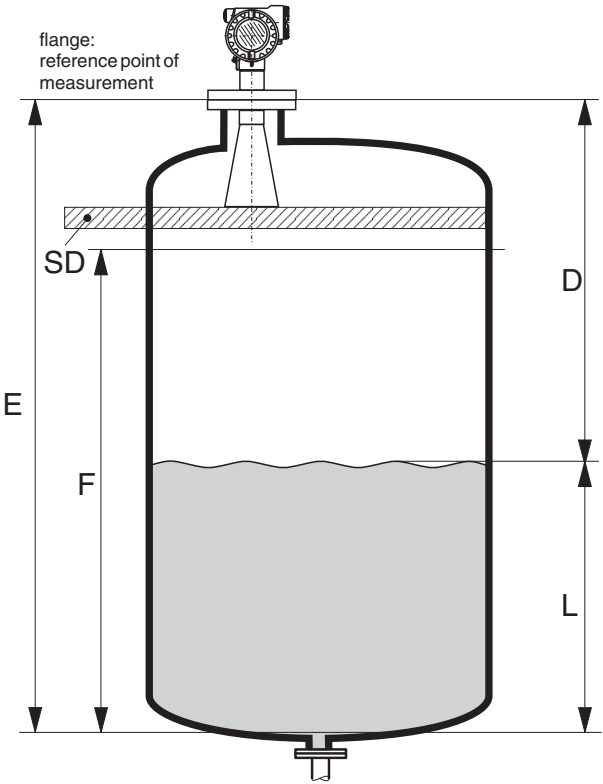
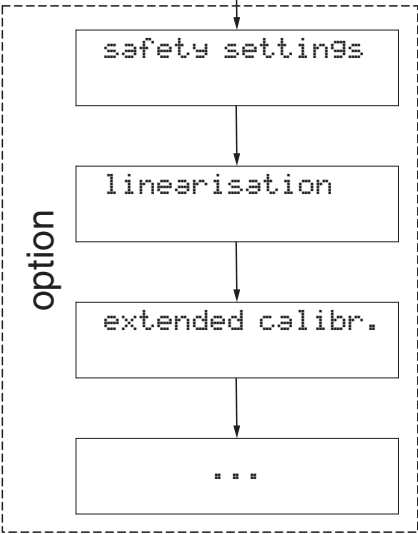
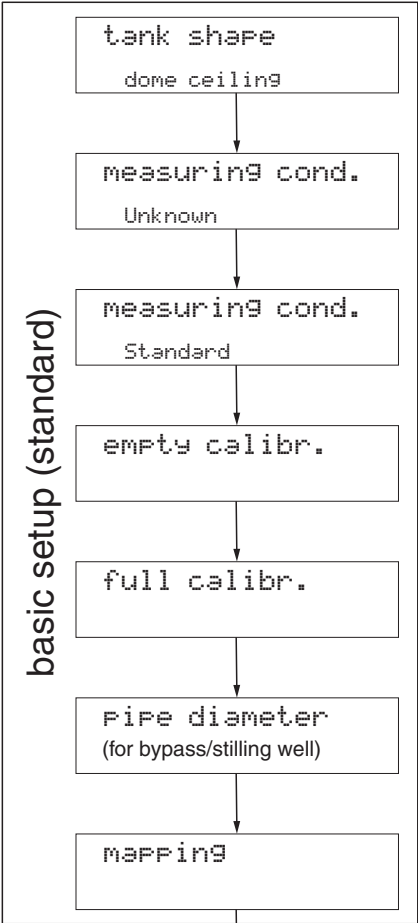


micropilot M **FMR 230/231/240/244/245** **with HART, PROFIBUS PA** **and Foundation Fieldbus** **Level-Radar**

Description of Instrument Functions



Basic Setup



- 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

Table of contents

1	Notes on use	5	6	Function group	
1.1	Using the table of contents to locate a function description	5		"extended calibr." (05)	38
1.2	Using the graphic of the function menu to locate a function description	5	6.1	Function "selection" (050)	38
1.3	Using the index of the function menu to locate a function description	5	6.2	Function "check distance" (051)	38
1.4	General structure of the operating menu	6	6.3	Function "range of mapping" (052)	39
1.5	Display and operating elements	7	6.4	Function "start mapping" (053)	39
1.6	Commissioning	10	6.5	Function "pres. map dist." (054)	40
2	Function menu Micropilot M	11	6.6	Function "cust. tank map" (055)	40
3	Function group		6.7	Function "echo quality" (056)	41
	"basic setup" (00)	13	6.8	Function "offset" (057)	42
3.1	Function "measured value" (000)	13	6.9	Function "antenna extens." (0C9)	42
3.2	Function "tank shape" (002)	13	6.10	Function "output damping" (058)	43
3.3	Function "medium property" (003)	14	6.11	Function "blocking dist." (059)	43
3.4	Function "process cond." (004)	14	7	Function group "output" (06),	
3.5	Function "empty calibr." (005)	16		- "profibus param." (06),	
3.6	Function "full calibr." (006)	17		PROFIBUS PA only	44
3.7	Function "pipe diameter" (007)	18	7.1	Function "commun. address" (060),	
3.8	Display (008)	19		HART only	44
3.9	Function "check distance" (051)	20	7.2	Function "instrument addr." (060),	
3.10	Function "range of mapping" (052)	21		PROFIBUS PA only	44
3.11	Function "start mapping" (053)	21	7.3	Function "no. of preambels" (061),	
3.12	Display (008)	22		HART only	45
4	Function group		7.4	Function "ident number" (061),	
	"safety settings" (01)	23		PROFIBUS PA only	45
4.1	Function "output on alarm" (010)	23	7.5	Function "low output limit" (062),	
4.2	Function "output on alarm" (011),			HART only	46
	HART only	25	7.6	Function "set unit to bus" (062),	
4.3	Function "outp. echo loss" (012)	25		PROFIBUS PA only	46
4.4	Function "ramp %span/min" (013)	26	7.7	Funktion "curr.output mode" (063),	
4.5	Function "delay time" (014)	27		HART only	47
4.6	Function "safety distance" (015)	27	7.8	Function "out value" (063),	
4.7	Function "in safety dist." (016)	27		PROFIBUS PA only	47
4.8	Function "ackn. alarm" (017)	29	7.9	Function "fixed cur. value" (064),	
4.9	Function "overspill prot." (018)	29		HART only	48
5	Function group		7.10	Function "out status" (064),	
	"linearisation" (04)	30		PROFIBUS PA only	48
5.1	Function "level/ullage" (040)	30	7.11	Function "simulation" (065)	49
5.2	Function "linearisation" (041)	31	7.12	Function "simulation value" (066)	50
5.3	Function "customer unit" (042)	35	7.13	Function "output current" (067),	
5.4	Function "table no." (043)	36		HART only	51
5.5	Function "input level" (044)	36	7.14	Function "2nd cyclic value" (067),	
5.6	Function "input volume" (045)	37		PROFIBUS PA only	51
5.7	Function "max. scale" (046)	37	7.15	Function "4mA value" (068),	
5.8	Function "diameter vessel" (047)	37		HART only	52
			7.16	Function "select v0h0" (068),	
				PROFIBUS PA only	52
			7.17	Function "20mA value" (069),	
				HART only	53
			7.18	Function "display value" (069),	
				PROFIBUS PA only	53

8	Function group		12	Function group	
	"envelope curve" (0E)	54		"service" (0D)	69
8.1	Function "plot settings" (0E1)	54	12.1	Software history	69
8.2	Function "recording curve" (0E2)	54			
8.3	Function "envelope curve display" (0E3)	55	13	Envelope curve	70
9	Function group		14	Trouble-shooting	74
	"display" (09)	57	14.1	Trouble-shooting instructions	75
9.1	Function "language" (092)	57	14.2	System error messages	76
9.2	Function "back to home" (093)	57	14.3	Application errors	78
9.3	Function "format display" (094)	58	14.4	Orientation of the Micropilot	80
9.4	Function "no.of decimals" (095)	58			
9.5	Function "sep. character" (096)	58	Index function menu	83	
9.6	Function "display test" (097)	59			
10	Function group				
	"diagnostics" (0A)	60			
10.1	Function "present error" (0A0)	61			
10.2	Function "previous error" (0A1)	61			
10.3	Function "clear last error" (0A2)	61			
10.4	Function "reset" (0A3)	62			
10.5	Function "unlock parameter" (0A4)	63			
10.6	Function "measured dist." (0A5)	64			
10.7	Function "measured level" (0A6)	65			
10.8	Function "application par." (0A8)	65			
11	Function group				
	"system parameters" (0C)	66			
11.1	Function "tag no." (0C0)	66			
11.2	Function "device tag" (0C0), Foundation Fieldbus only	66			
11.3	Function "Profile Version" (0C1), PROFIBUS PA only	66			
11.4	Function "protocol+sw-no." (0C2)	66			
11.5	Function "serial no." (0C4)	67			
11.6	Function "device id" (0C4), Foundation Fieldbus only	67			
11.7	Function "distance unit" (0C5)	67			
11.8	Function "download mode" (0C8)	68			
11.9	Function "antenna extens." (0C9)	68			

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 simplify 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 83) which lists all the function names alphabetically and numerically.



Note!

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

1.5 Display and operating elements

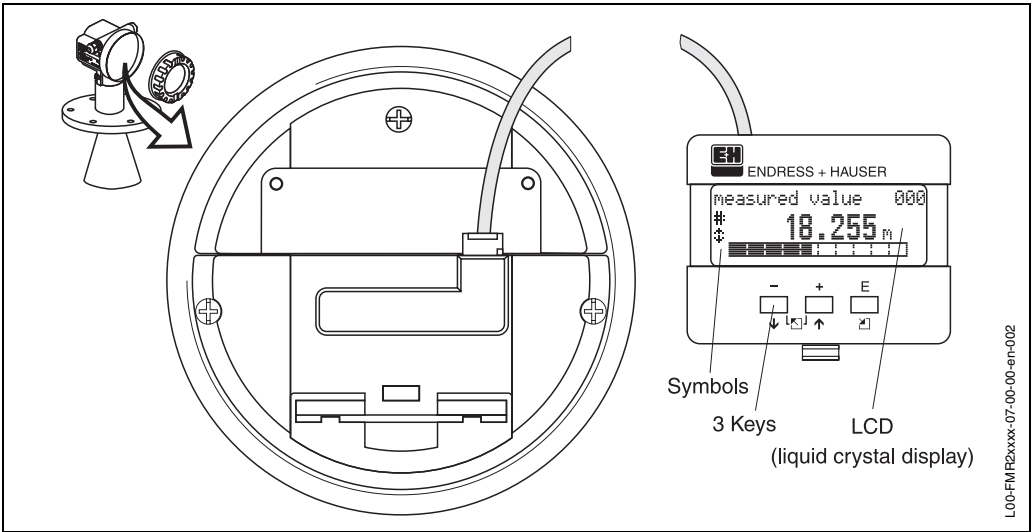


Abb. 3 Layout of the display and operating elements

1.5.1 Display

Liquid crystal display (LCD):

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

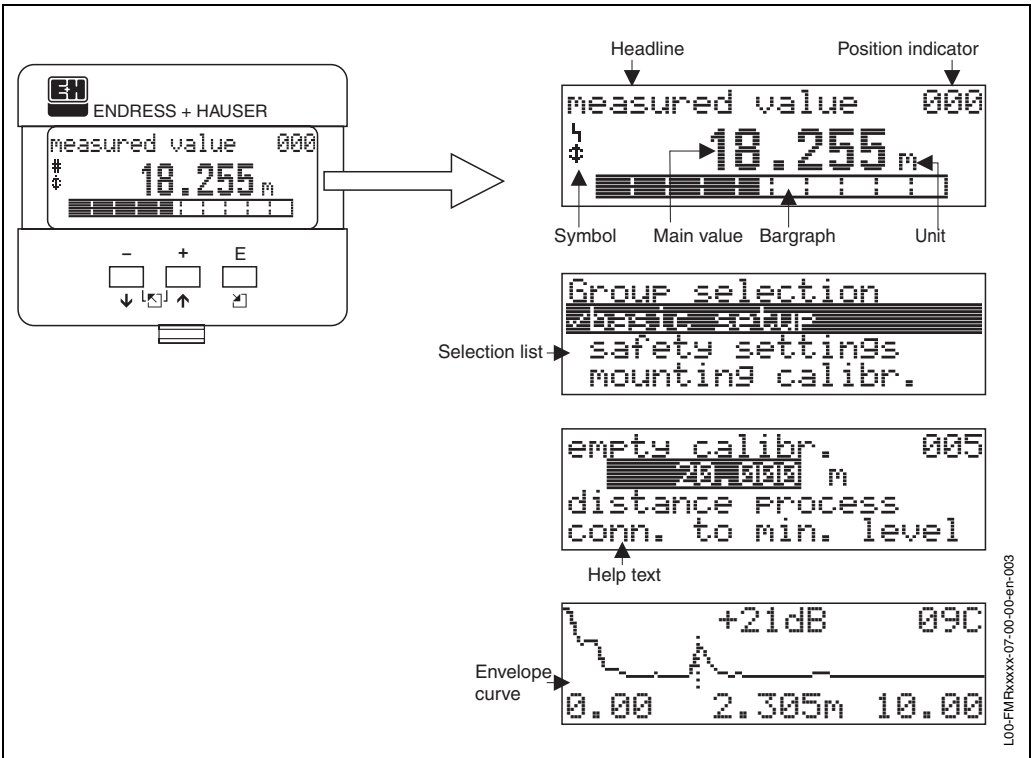


Abb. 4 Display

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 Meaning 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
 or 	Navigate to the left within a function group
 or 	Navigate to the right within a function group, confirmation.
 and  or  and 	Contrast settings of the LCD
 and  and 	Hardware lock / unlock After a hardware lock, an operation of the 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. 2 Function of the keys

1.5.4 Operation with the VU 331

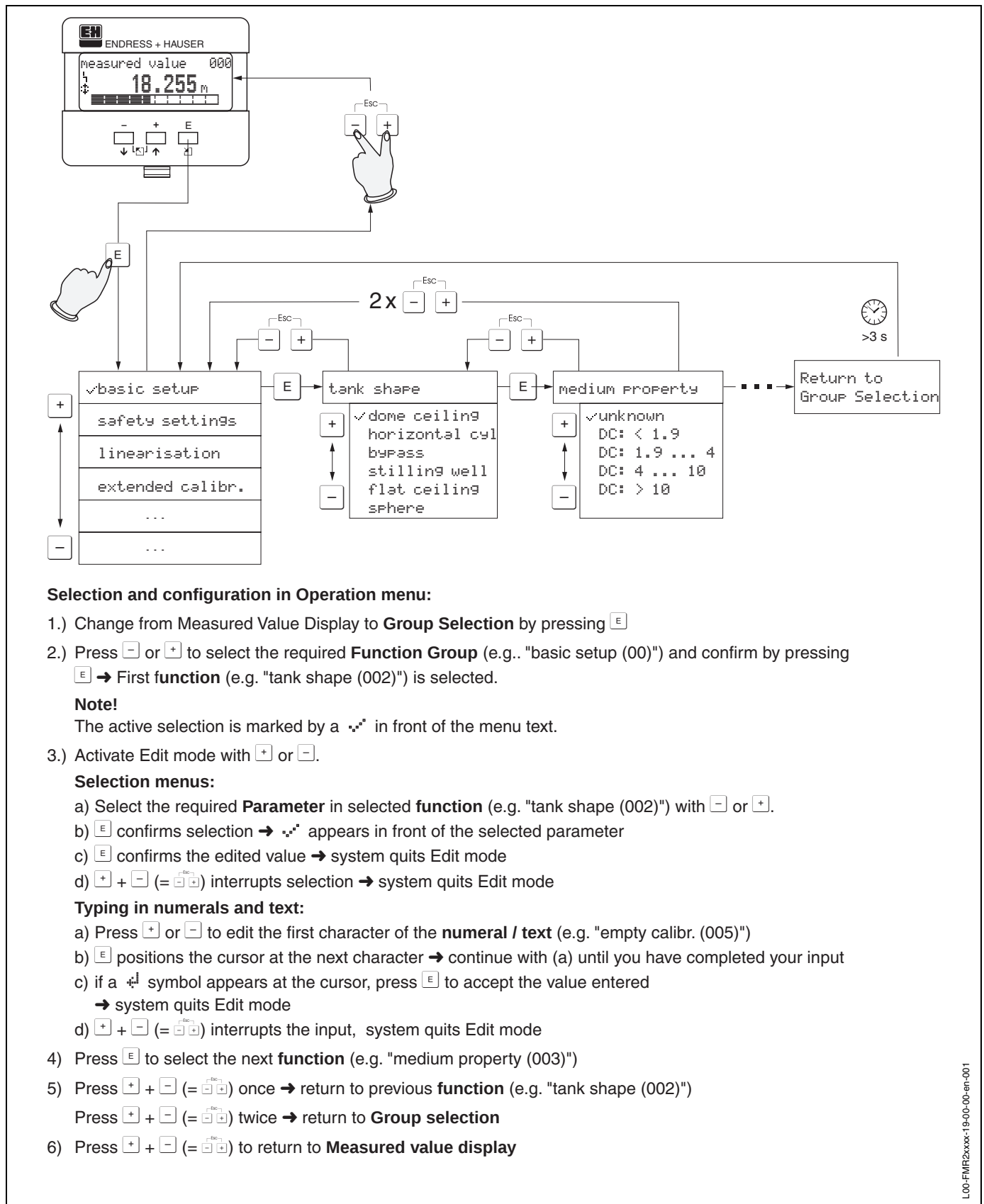
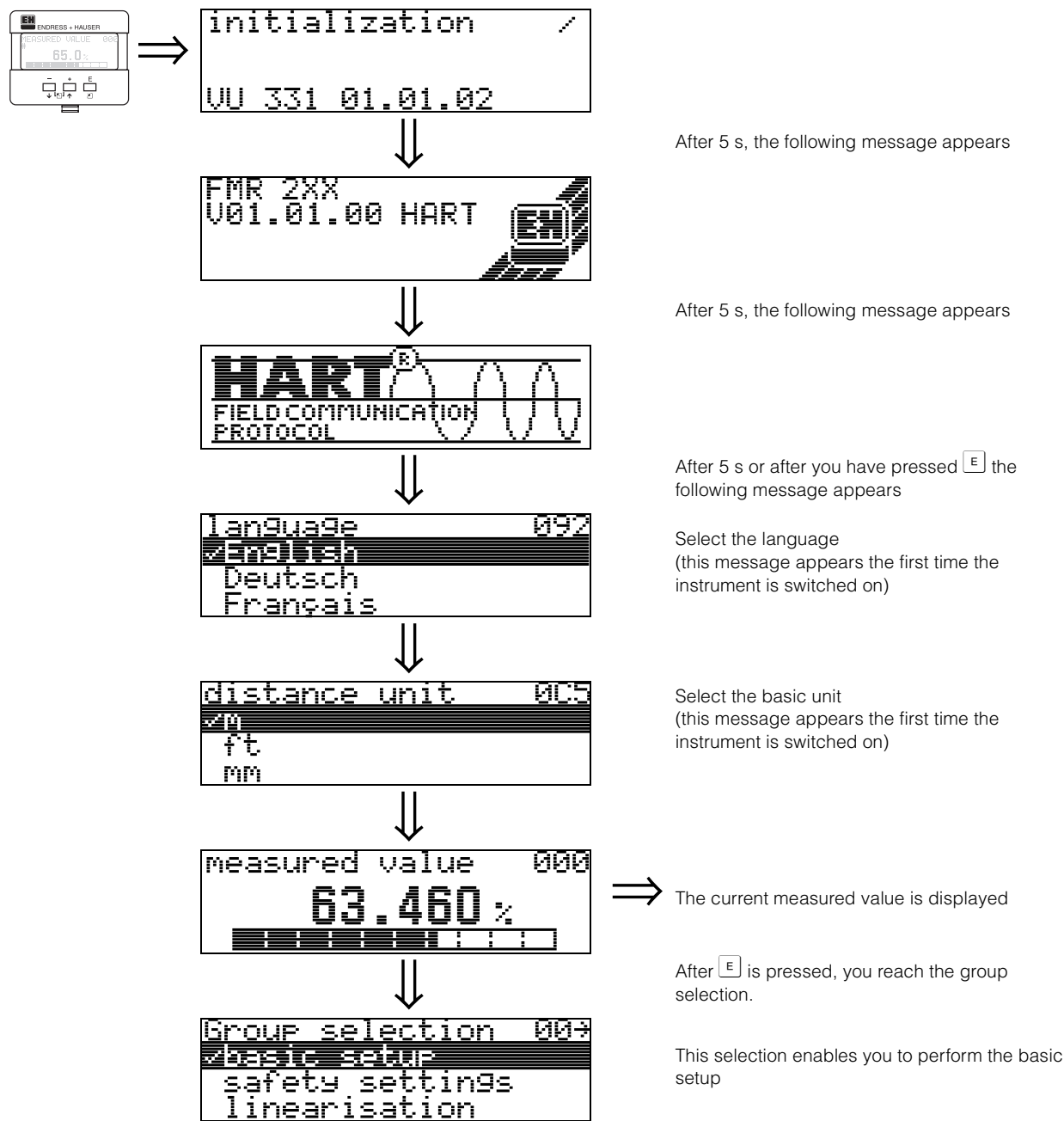


Abb. 5 Selection and configuration in operation menu

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:



2 Function menu Micropilot M

Function group		Function		Description
basic setup 00 (see Page 13) ↓	⇒	measured value 000	→	Page 13
		tank shape 002	→	Page 13
		medium property 003	→	Page 14
		process cond. 004	→	Page 14
		empty calibr. 005	→	Page 16
		full calibr. 006	→	Page 17
		pipe diameter 007	→	Page 18
		check distance 051	→	Page 20
		range of mapping 052	→	Page 21
		start mapping 053	→	Page 21
safety settings 01 (see Page 23) ↓	⇒	output on alarm 010	→	Page 23
		output on alarm (HART only) 011	→	Page 25
		outp. echo loss 012	→	Page 25
		ramp %span/min 013	→	Page 26
		delay time 014	→	Page 27
		safety distance 015	→	Page 27
		in safety dist. 016	→	Page 27
		ackn. alarm 017	→	Page 29
		overspill prot. 018	→	Page 29
linearisation 04 (see Page 30) ↓	⇒	level/ullage 040	→	Page 30
		linearisation 041	→	Page 31
		customer unit 042	→	Page 35
		table no. 043	→	Page 36
		input level 044	→	Page 36
		input volume 045	→	Page 37
		max. scale 046	→	Page 37
		diameter vessel 047	→	Page 37
extended calibr. 05 (see Page 38) ↓	⇒	selection 050	→	Page 38
		check distance 051	→	Page 38
		range of mapping 052	→	Page 39
		start mapping 053	→	Page 39
		pres. map dist. 054	→	Page 40
		cust. tank map 055	→	Page 40
		echo quality 056	→	Page 41
		offset 057	→	Page 42
		antenna extens. 0C9	→	Page 42
		output damping 058	→	Page 43
		blocking dist. 059	→	Page 43

Function group	Function	Description
output 06 profibus param. 06 PROFIBUS PA only (see Page 44) ↓	⇒ commun. address (HART only) 060 →	Seite 44
	instrument addr. (PROFIBUS PA only) 060 →	Page 44
	no. of preambels (HART only) 061 →	Page 45
	ident number (PROFIBUS PA only) 061 →	Page 45
	low output limit (HART only) 062 →	Page 46
	set unit to bus (PROFIBUS PA only) 062 →	Page 46
	curr.output mode (HART only) 063 →	Page 47
	out value (PROFIBUS PA only) 063 →	Page 47
	fixed cur. value (HART only) 064 →	Page 48
	out status (PROFIBUS PA only) 064 →	Page 48
	simulation 065 →	Page 49
	simulation value 066 →	Page 49
	output current (HART only) 067 →	Page 49
	2nd cyclic value (PROFIBUS PA only) 067 →	Page 51
	4mA value 068 →	Page 52
	select v0h0 (PROFIBUS PA only) 068 →	Page 53
	20mA value 069 →	Page 53
	display value (PROFIBUS PA only) 069 →	Page 53
envelope curve 0E (see Page 54) ↓	⇒ plot settings 0E1 →	Page 54
	recording curve 0E2 →	Page 54
	envelope curve display 0E3 →	Page 55
display 09 (see Page 57) ↓	⇒ language 092 →	Page 57
	back to home 093 →	Page 57
	format display 094 →	Page 58
	no.of decimals 095 →	Page 58
	sep. character 096 →	Page 58
	display test 097 →	Page 59
diagnostics 0A (see Page 60) ↓	⇒ present error 0A0 →	Page 61
	previous error 0A1 →	Page 61
	clear last error 0A2 →	Page 61
	reset 0A3 →	Page 62
	unlock parameter 0A4 →	Page 63
	measured dist. 0A5 →	Page 64
	measured level 0A6 →	Page 65
	application par. 0A8 →	Page 65
system parameters 0C (see Page 66) ↓	⇒ tag no. 0C0 →	Page 66
	device tag (Foundation Fieldbus only) 0C0 →	Page 66
	Profile Version (PROFIBUS PA only) 0C1 →	Page 66
	protocol+sw-no. 0C2 →	Page 66
	serial no. 0C4 →	Page 67
	device id (Foundation Fieldbus only) 0C4 →	Page 67
	distance unit 0C5 →	Page 67
	download mode 0C8 →	Page 68
	antenna extens. 0C9 →	Page 68
service D00	⇒ service level D00	Page 69

3 Function group "basic setup" (00)



3.1 Function "measured value" (000)



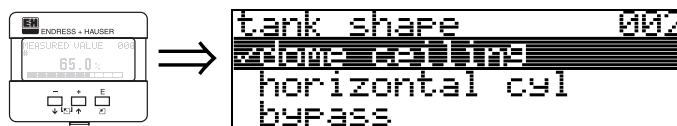
This function displays the current measured value in the selected unit (see "**customer unit**" (042) function). The number of digits after decimal point can be selected in the "**no.of decimals**" (095) function.



Caution!

When using an FAR 10 antenna extension, carry out an correction before the basic setup. The length of the FAR 10 is to be entered in the function "**antenna extens**" (0C9) (see Page 42 or Page 68).

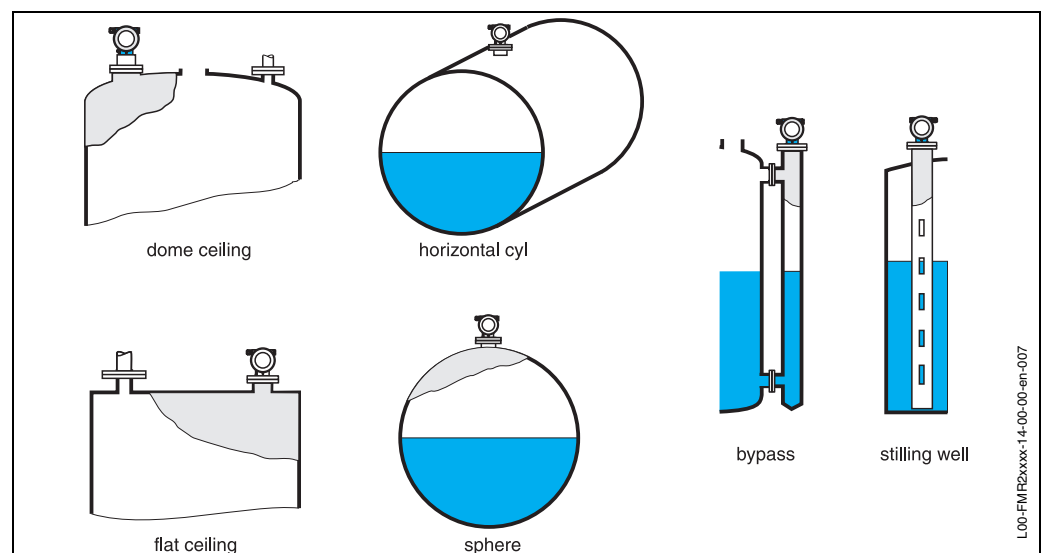
3.2 Function "tank shape" (002)



This function is used to select the tank shape.

Selection:

- dome ceiling
- horizontal cyl
- bypass
- stilling well
- flat ceiling
- sphere



3.3 Function "medium property" (003)



This function is used to select the dielectric constant.

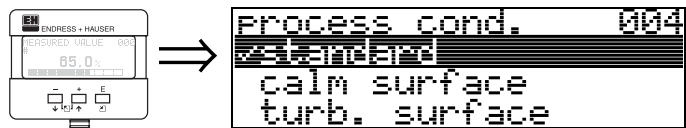
Selection:

- unknown
- < 1.9
- 1.9 ... 4
- 4 ... 10
- > 10

Product class	DK (ϵ_r)	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 FMR 230 in a stilling well.

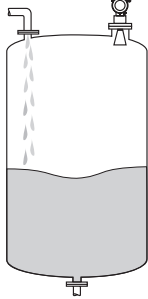
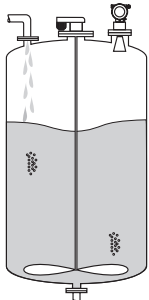
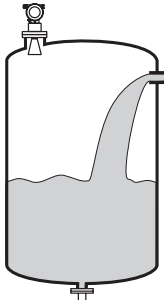
3.4 Function "process cond." (004)



This function is used to select the process conditions.

Selection:

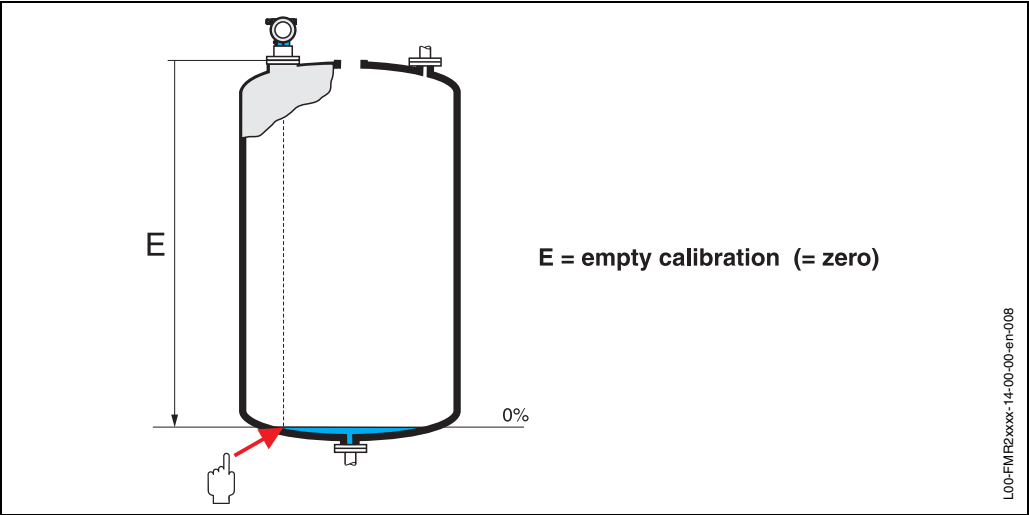
- standard
- calm surface
- turb. surface
- add. agitator
- fast change
- test:no filter

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.

3.5 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).

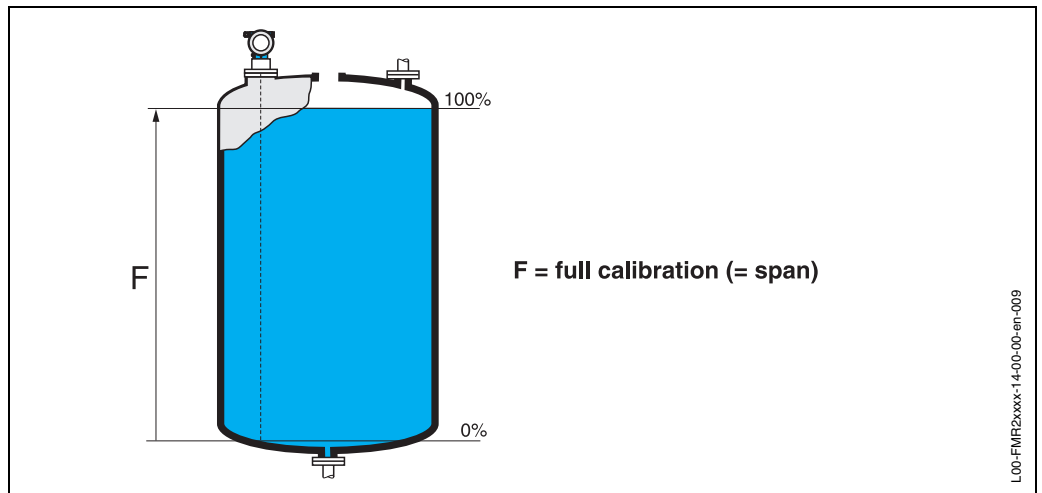


Caution!
For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the tank.

3.6 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 (FMR 244: 150 mm / 6", FMR 245: 200 mm / 8").



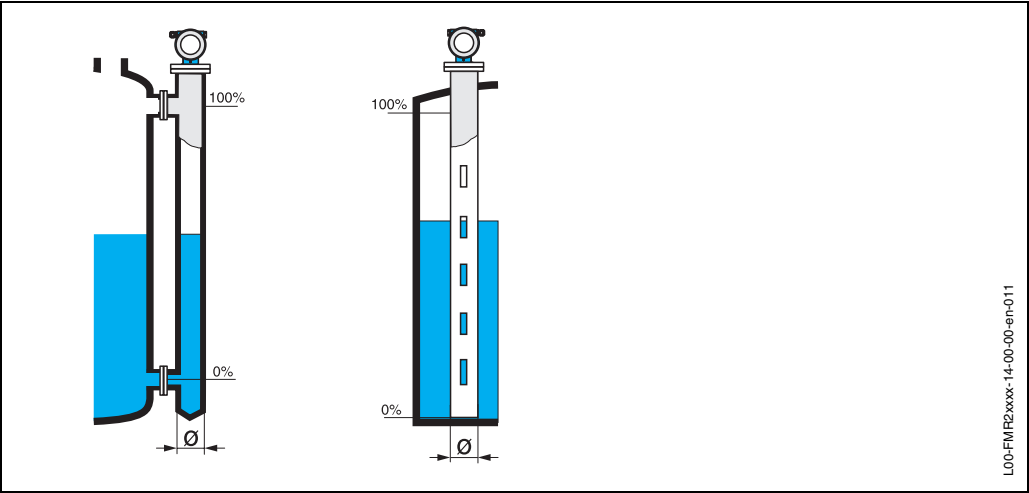
Note!

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

3.7 Function "pipe diameter" (007)

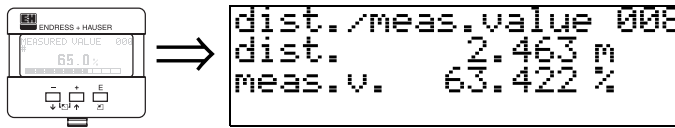


This function is used to enter the pipe diameter of the stilling well or bypass pipe.



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.

3.8 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)**

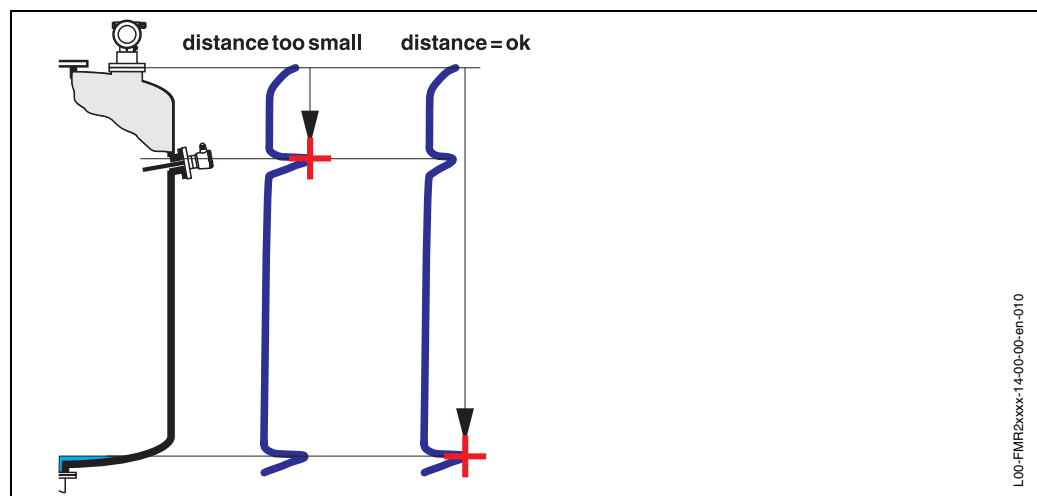
3.9 Function "check distance" (051)



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 echo.
- 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

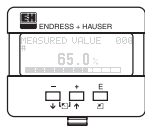
A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "**range of mapping (052)**" function.

**Caution!**

The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty tank, do not enter E, but $E - 0.5 \text{ m (20")}$.

If a mapping already exists, it is overwritten up to the distance specified in **"range of mapping" (052)**. Beyond this value the existing mapping remains unchanged.

3.10 Function "range of mapping" (052)

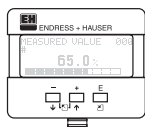


```
range of mapping 052
0.000 m
input of
mapping range
```

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.

3.11 Function "start mapping" (053)



```
start mapping 053
off
on
```

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

Selection:

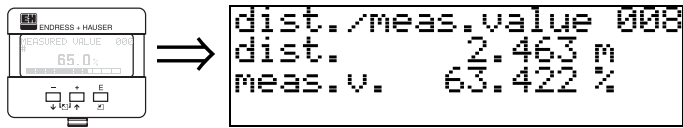
- **off:** no mapping is carried out
- **on:** mapping is started

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

**Caution!**

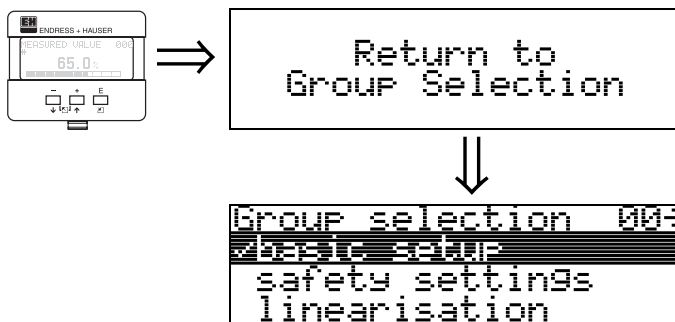
A mapping will be recorded only, if the device is not in error state.

3.12 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)



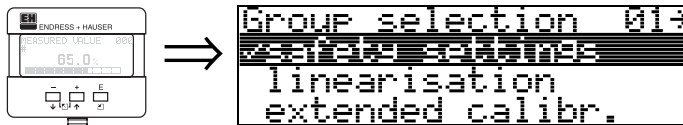
After 3 s, the following message appears



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)

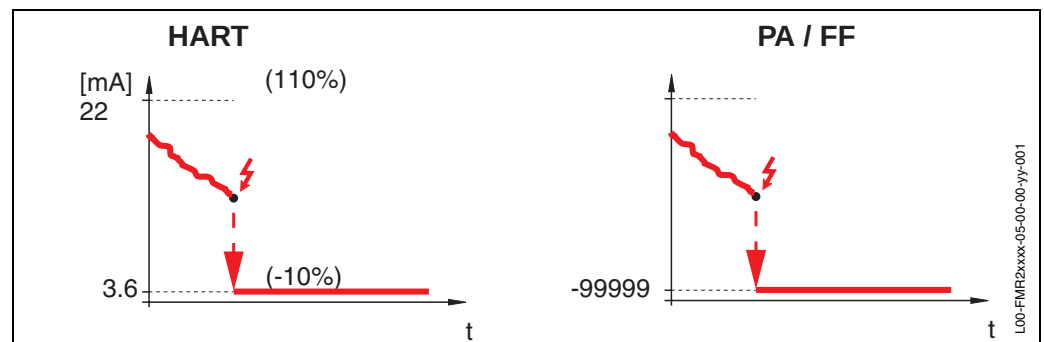


This function is used to select the reaction of the output on an alarm.

Selection:

- MIN ($\leq 3.6\text{mA}$)
- **MAX (22mA)**
- hold
- user specific

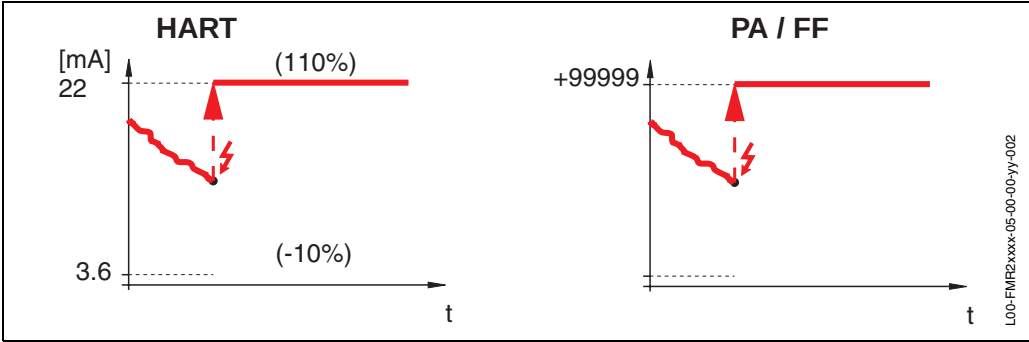
MIN ($\leq 3.6\text{mA}$)



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

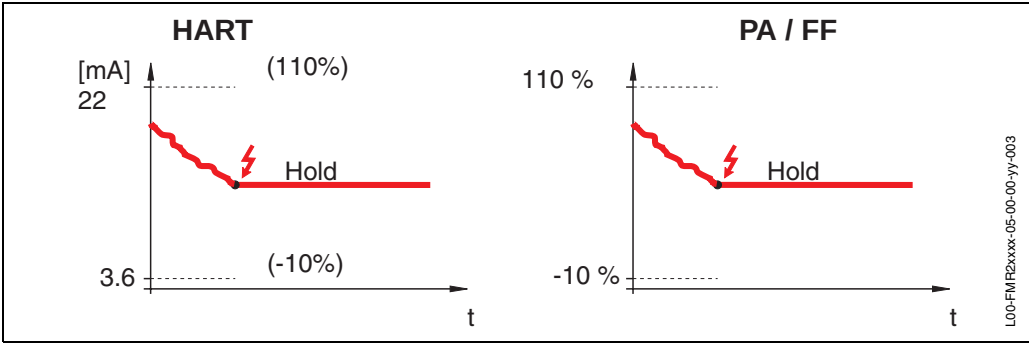
MAX (22mA)



If the instrument is in alarm state, the output changes as follows:

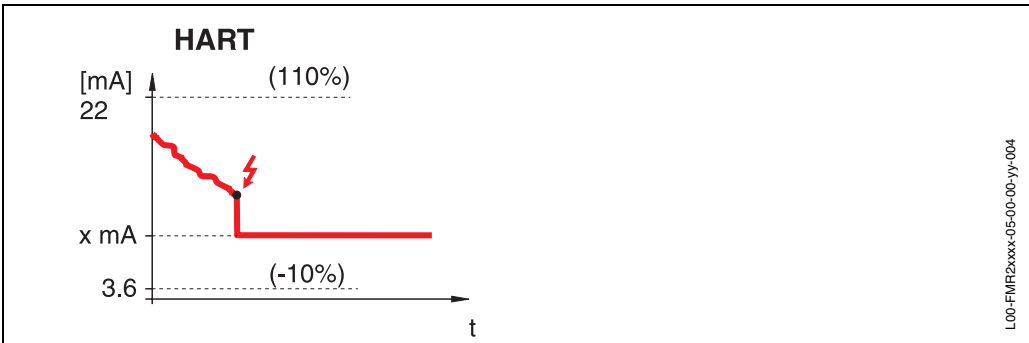
- HART: MAX-Alarm 22 mA
- PROFIBUS PA: MAX-Alarm +99999
- Foundation Fieldbus: MAX-Alarm +99999

hold



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

user specific



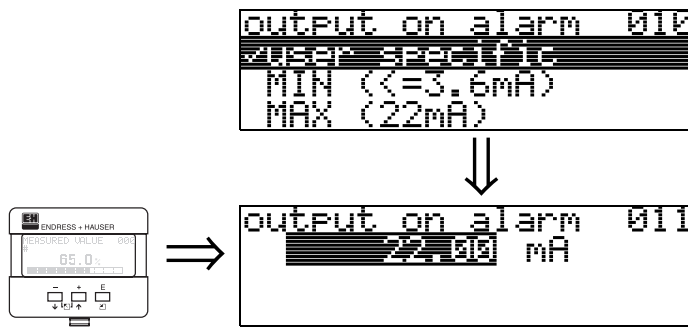
If the instrument is in alarm state, the output is set to the value configured in "output on alarm" (011) (x mA).



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)

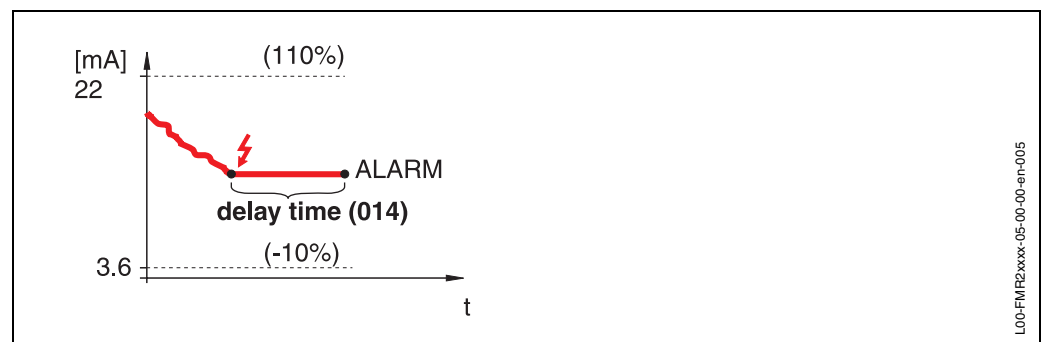


Use this function to set the output response on echo loss.

Selection:

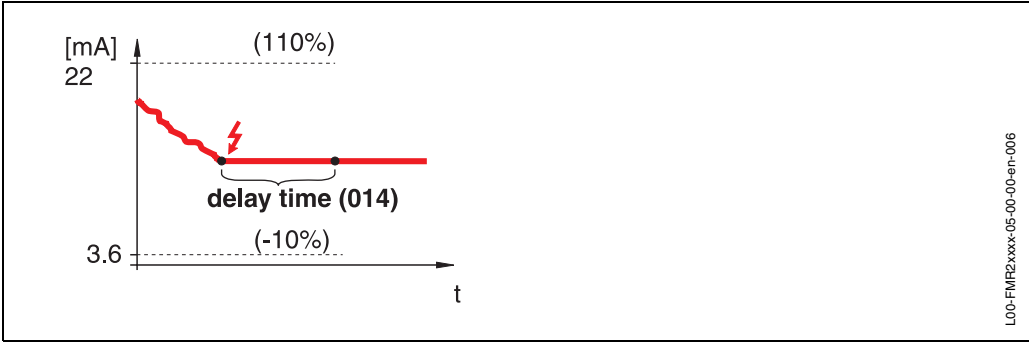
- alarm
- **hold**
- ramp %/min

alarm



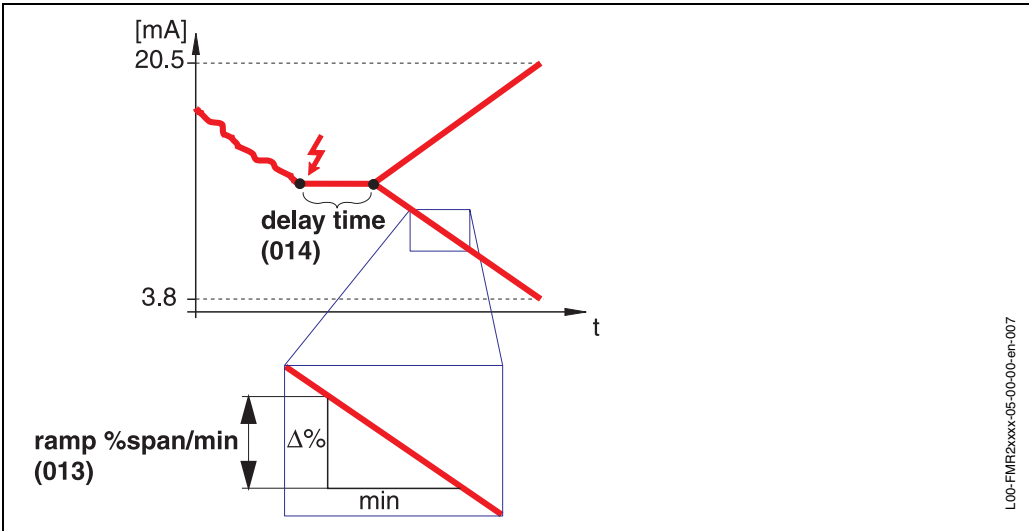
On echo loss, the instrument switches to alarm state after an adjustable **"delay time" (014)**. The output response depends on the configuration set in **"output on alarm" (010)**.

hold



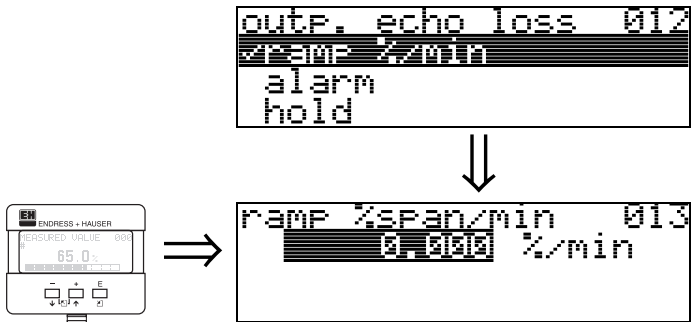
On echo loss, a warning is generated after a definable "delay time" (014). Output is held.

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.

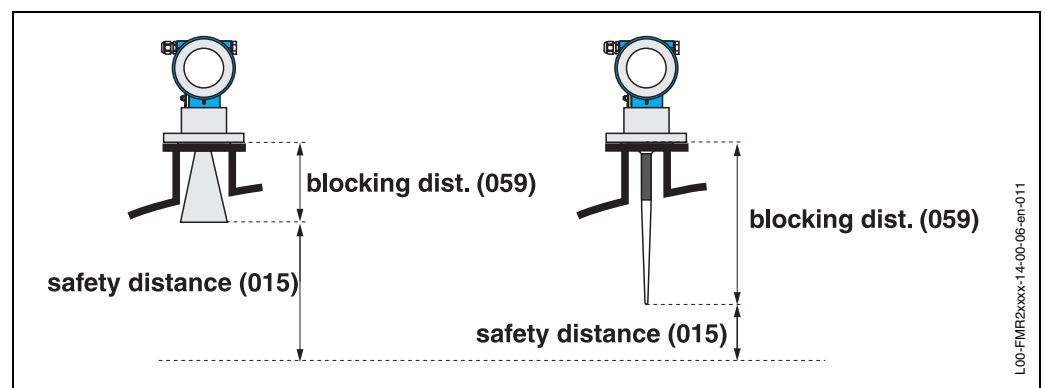
4.5 Function "delay time" (014)



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.

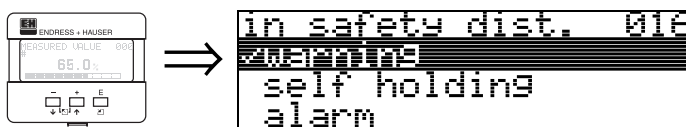
4.6 Function "safety distance" (015)

A configurable safety distance is placed before the **"blocking dist." (059)** (see page 43). 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.

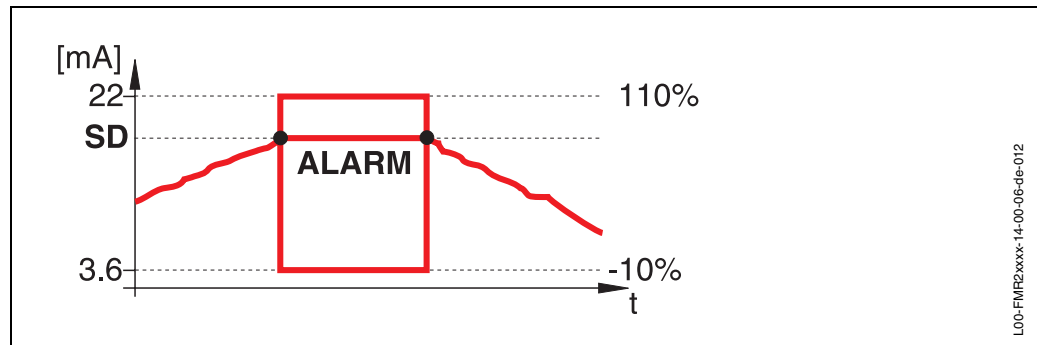
4.7 Function "in safety dist." (016)



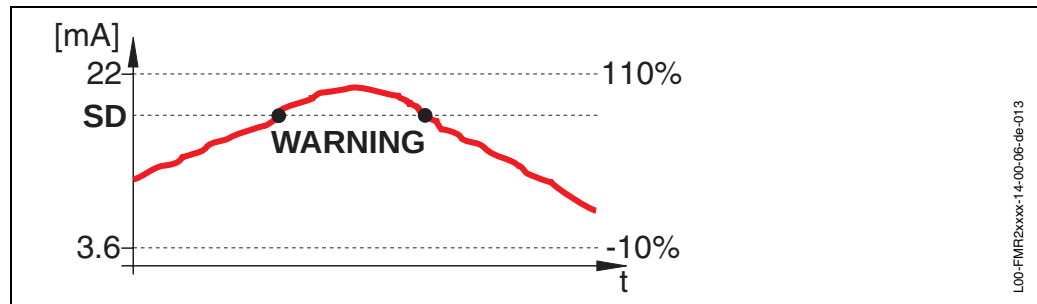
This function defines the response when the level enters the safety distance .

Selection:

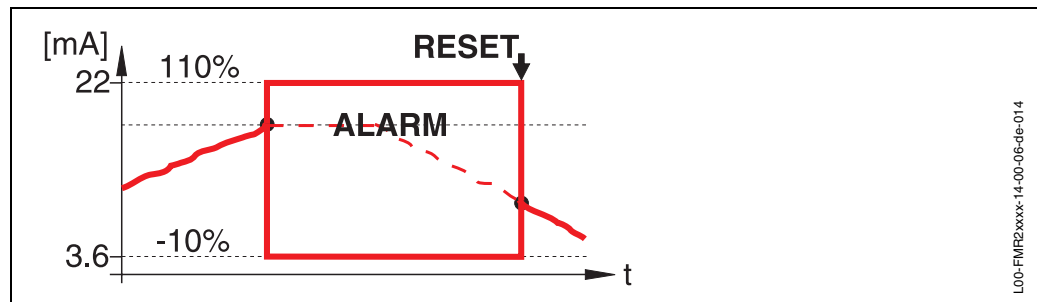
- alarm
- **warning**
- self holding

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.

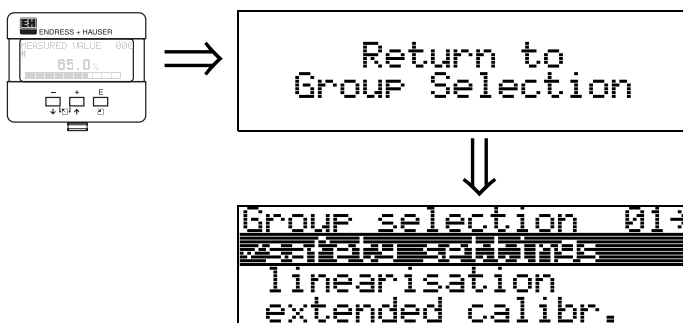
yes

Acknowledgement takes place.

4.9 Function "overspill prot." (018)

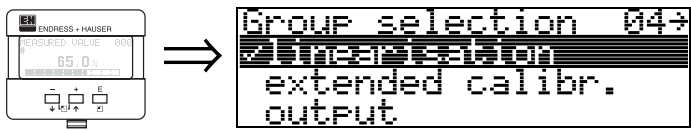


When "**german WHG**" is selected, various parameters relating to WHG overspill protection/SIL are modified and the instrument is locked against further operation. Select "**Standard**" to unlock. Thereby the WHG parameter adjustment is preserved. In order to reset the WHG-specific parameters it is recommended to carry out a reset of the instrument (see Page 62). For further information see ZE 244F/00/de (for german WHG) or SD 150F/00/en (for 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%.

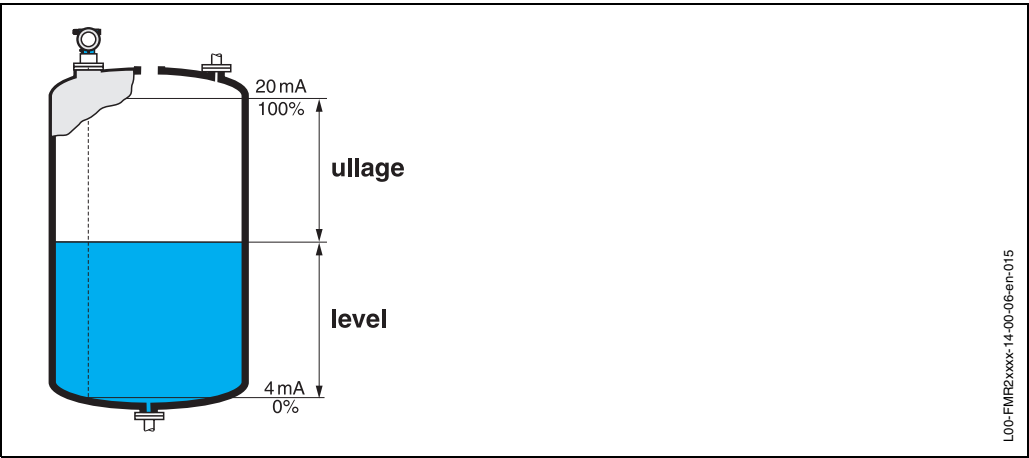
ullage DU

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



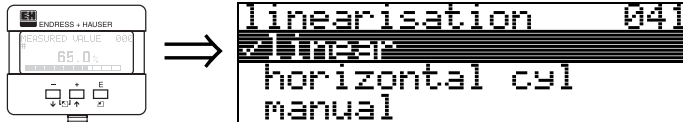
Note!

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.

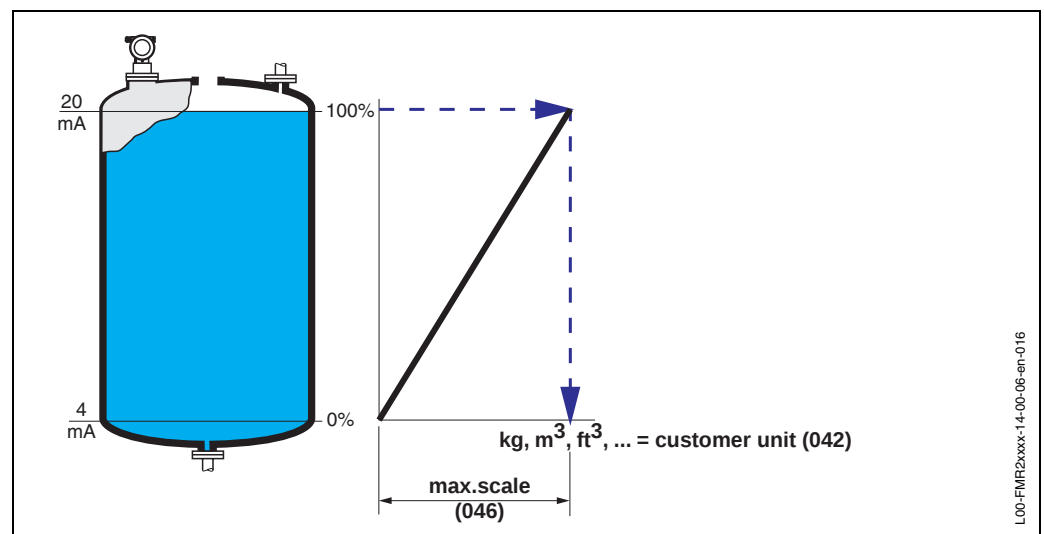
Selection:

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

linear

The tank is linear e.g. a cylindrical vertical tank. You can measure in customer units by entering a maximum volume/weight.

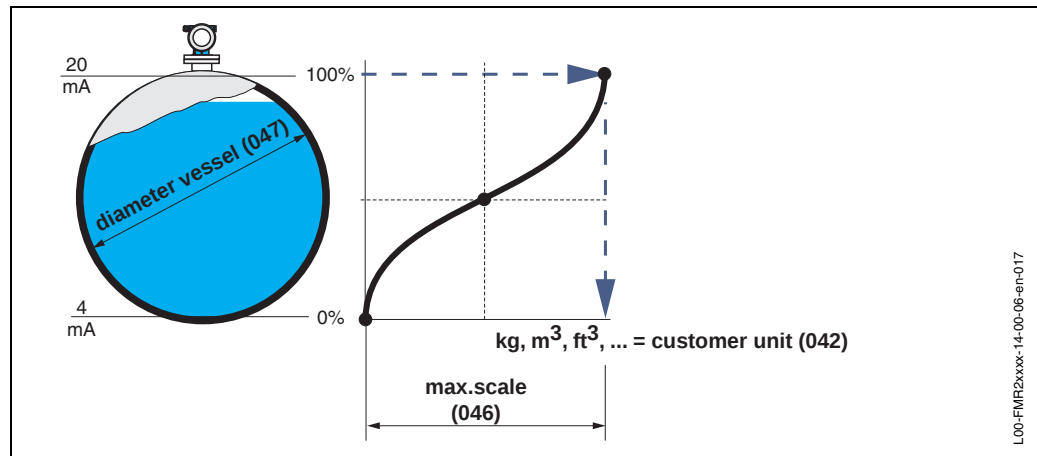
You can select the "**customer unit**" (042). Define the volume value corresponding to the calibration in "**max. scale**" (046). This value corresponds to an output of 100% (= 20 mA for HART).



L00-FMP2xxx-14-00-06-en-016

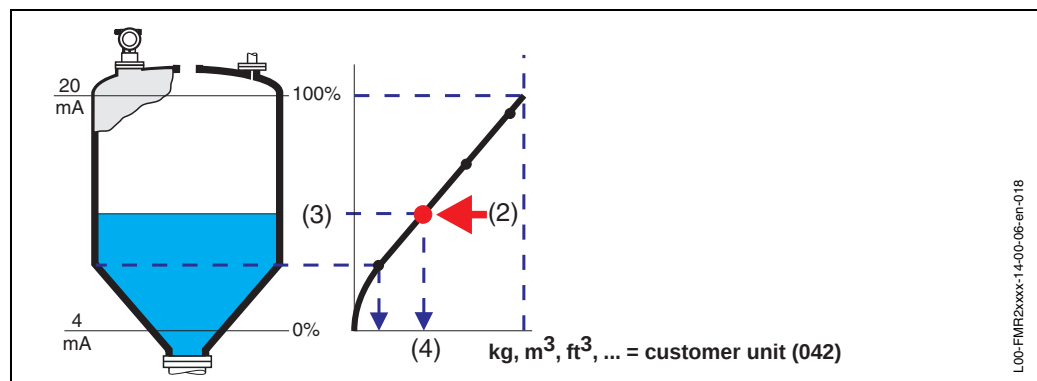
horizontal cyl

The volume, mass etc. are calculated automatically in cylindrical horizontal tanks 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).

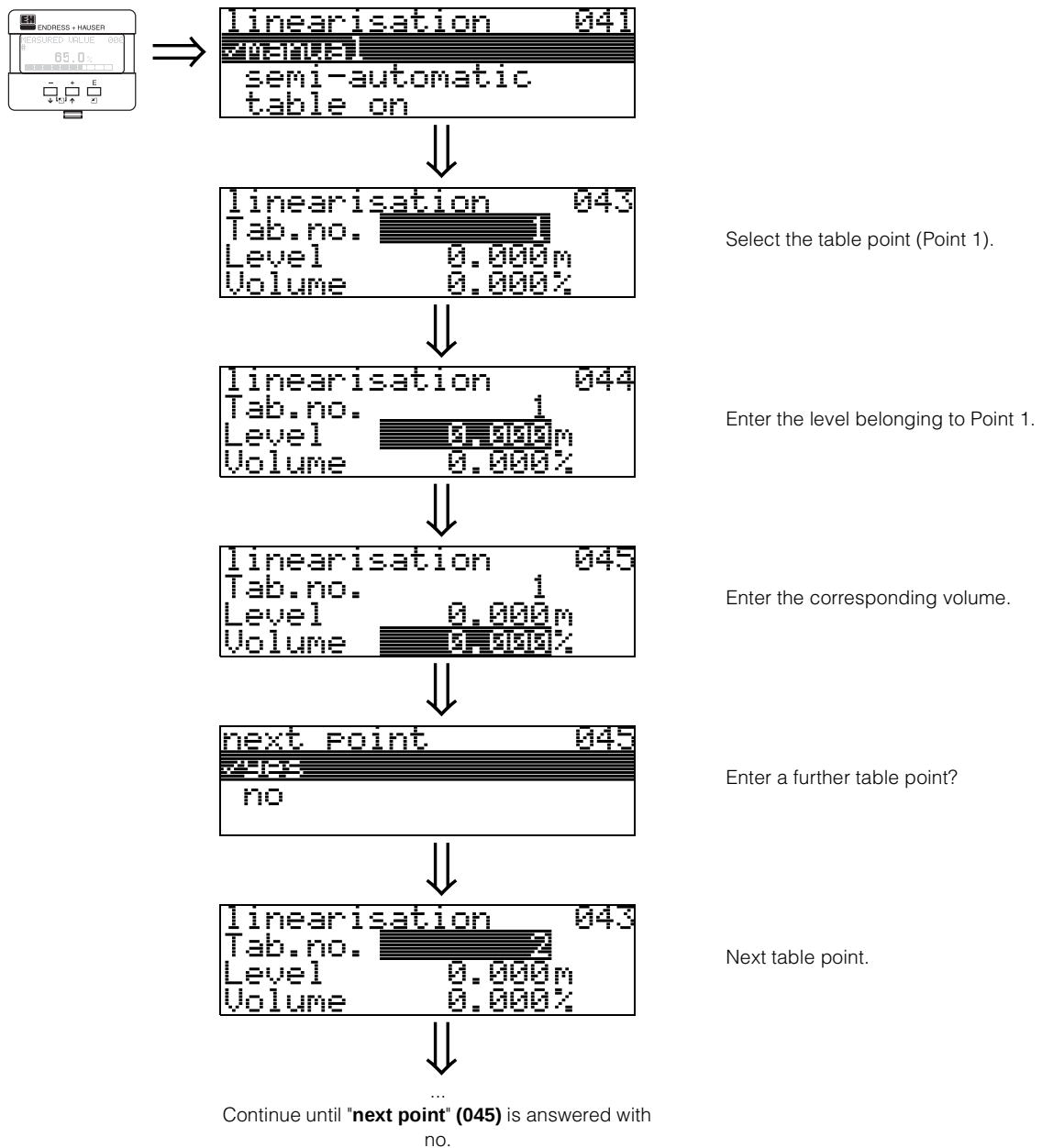
**manual**

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).

**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 tank forms can be calculated additionally.

semi-automatic

The tank 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 tank 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.

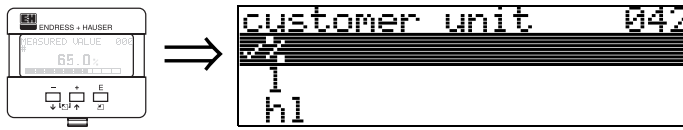
clear table

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:

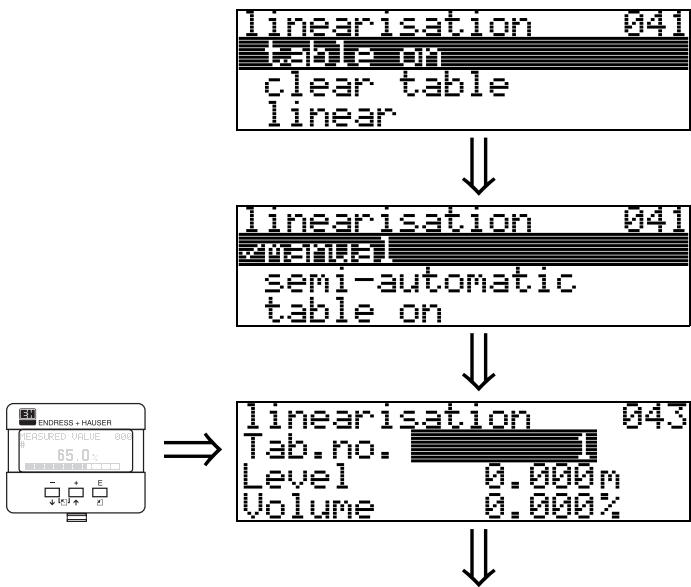
- %
- l
- hl
- m3
- dm3
- cm3
- ft3
- usgal
- i gal
- kg
- t
- lb
- ton
- m
- ft
- mm
- inch

Dependence

The units of the following parameters are changed:

- measured value (000)
- input volume (045)
- max. scale (046)
- simulation value (066)

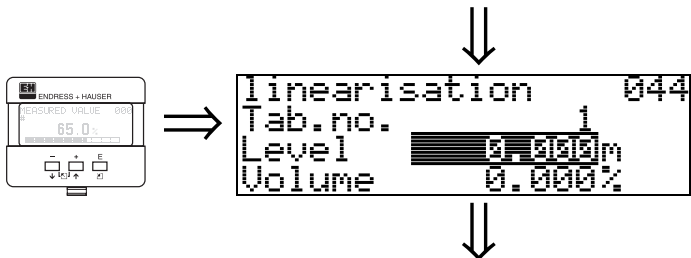
5.4 Function "table no." (043)



Position of the value pair in the linearisation table.

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

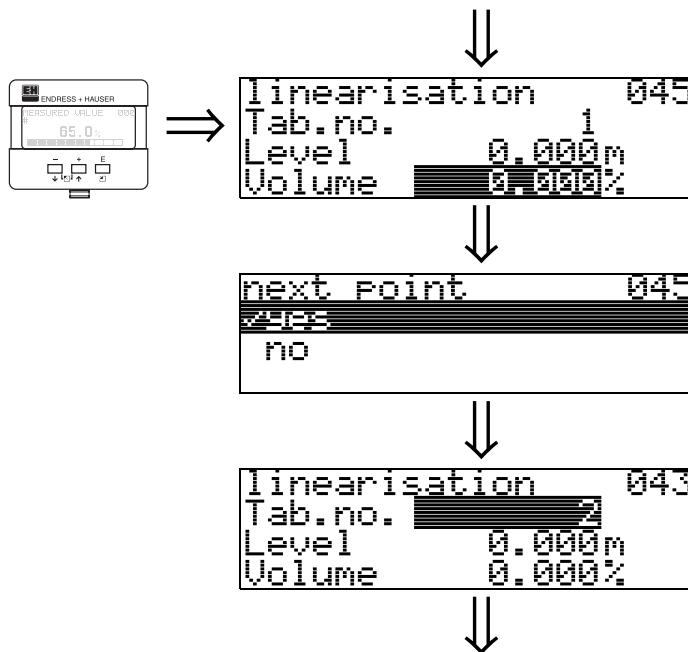
5.5 Function "input level" (044)



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:

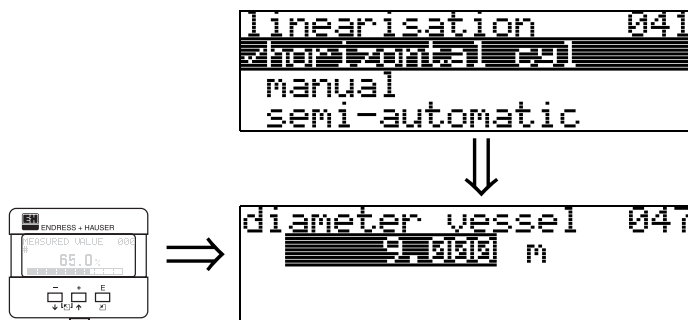
Volume in "customer unit" (042).

5.7 Function "max. scale" (046)



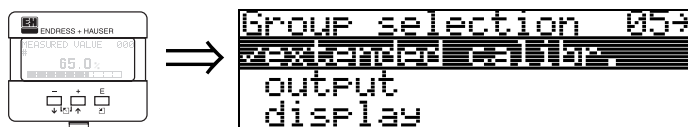
You can enter the end value of the measuring range with this function. This input is necessary if you selected "linear" or "horizontal cyl" in the "linearisation" (041) function.

5.8 Function "diameter vessel" (047)



Enter the tank 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.

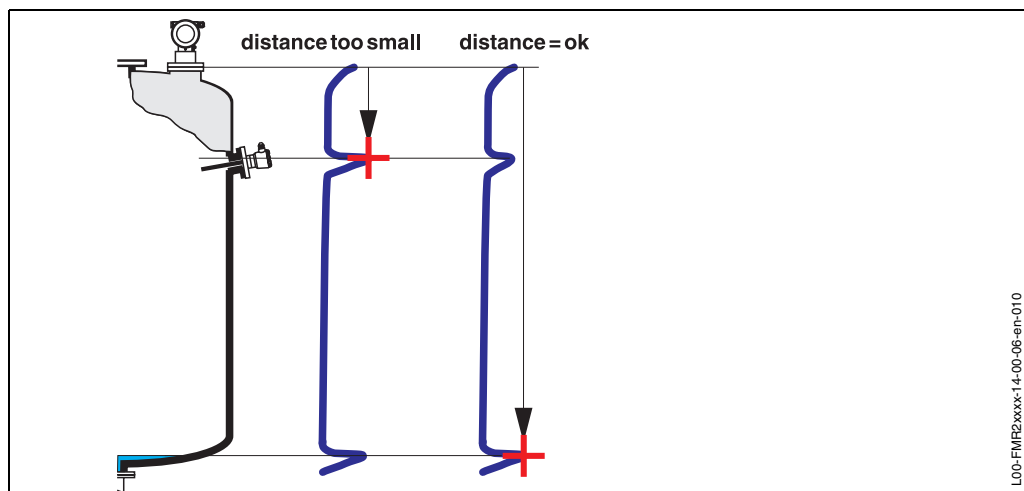
6.2 Function "check distance" (051)



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



L00-FMRxxxx-14-00-06-en-010

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

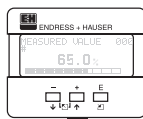
A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "**range of mapping (052)**" function.

**Caution!**

The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty tank, do not enter E, but E – 0.5 m (20").

If a mapping already exists, it is overwritten 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)

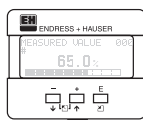


```
range of mapping 052
0.000 m
input of
mapping range
```

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)



```
start mapping 053
off
on
```

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

Selection:

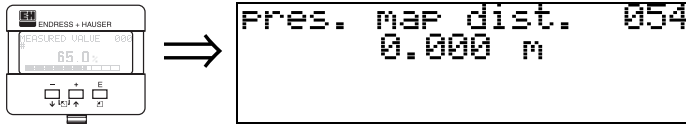
- **off:** no mapping is carried out
- **on:** mapping is started

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

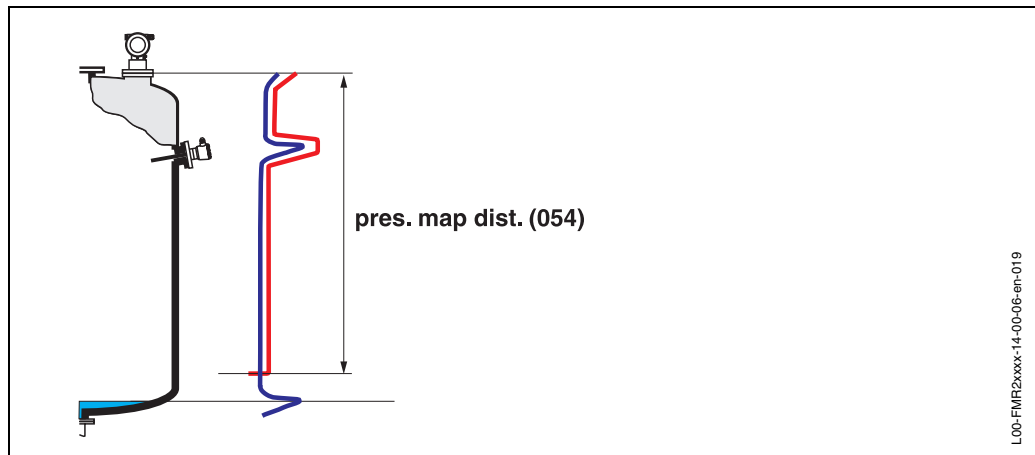
**Caution!**

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

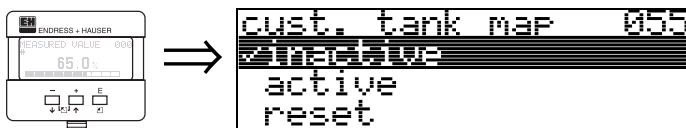
6.5 Function "pres. map dist." (054)



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 73).

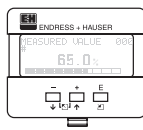
active

Evaluation is using the customer tank map (see page 72).

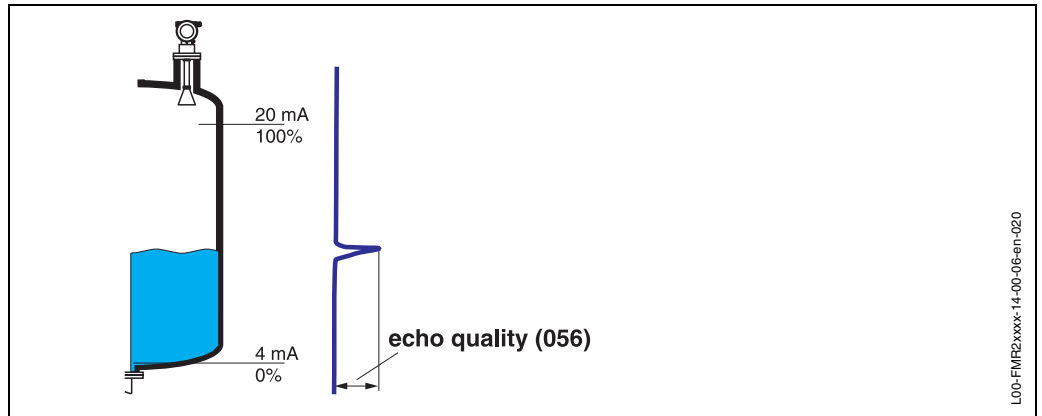
reset

Deletes the complete tank map.

6.7 Function "echo quality" (056)



```
echo quality 056
19 dB
```



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 80).

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 extends." (0C9)



With this function, the length of the antenna extension FAR 10 can be entered (FMR 230 only).

The influence of slower speed of propagation of the microwaves within the FAR 10 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

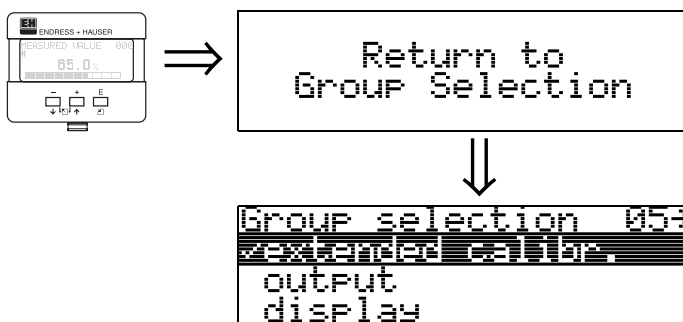
The default value depends on the selected application parameters **"tank shape" (002)**, **"medium property" (003)** and **"process cond." (004)**.

6.11 Function "blocking dist." (059)



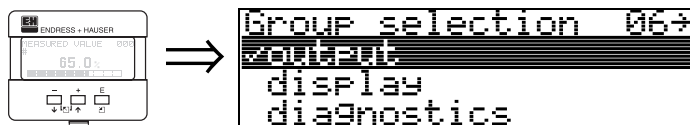
A window below the antenna tip can be suppressed when there are strong reflections of structures, welding joints or struts near the antenna.

- 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 27).
- For FMR 244 and FMR 245, 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 27).
- The customer can set the Micropilot to respond to circumstances when the product is within this zone (safety distance) (see page 27).

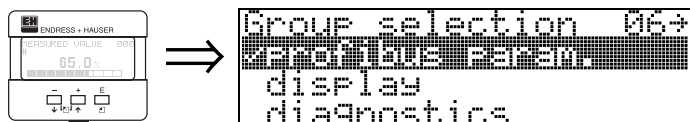


After 3 s, the following message appears

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

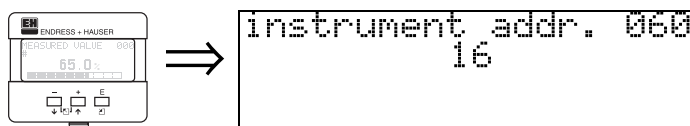
In multidrop mode the default value of the output current is 4 mA. It can be modified in the function "**fixed cur. value**" (064).



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



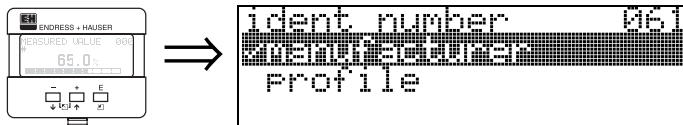
Enter the number of preambels for the HART protocol with this function.
An increase in the value is advisable for "bad" lines with communications problems.



Caution!

This user input is available for HART devices only!

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



- manufacturer
- profile

manufacturer

Set to 1522 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!

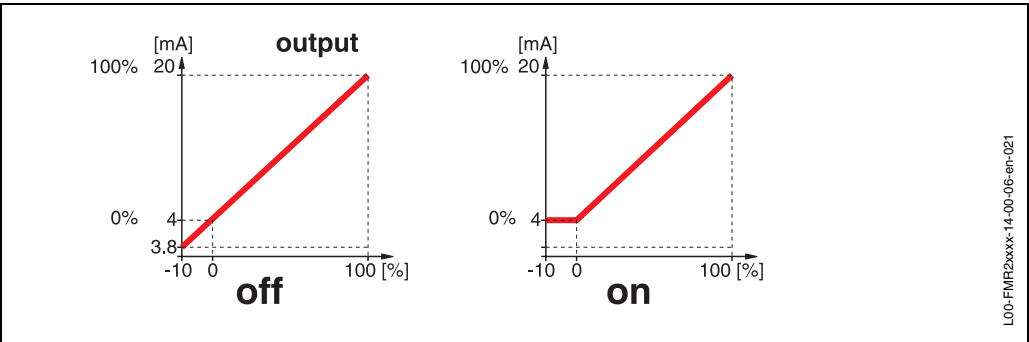
7.5 Function "low output limit" (062), HART only



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

Selection:

- off minimum output -10% (3.8 mA for HART)
- on minimum 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).

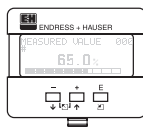
This function must always be executed after changing the unit.



Caution!

This function is available for PROFIBUS PA devices only!

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



```
curr.output mode 063
standard
curr.turn down
fixed current
```

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 interval (4 ... 20 mA).

curr.turn down

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

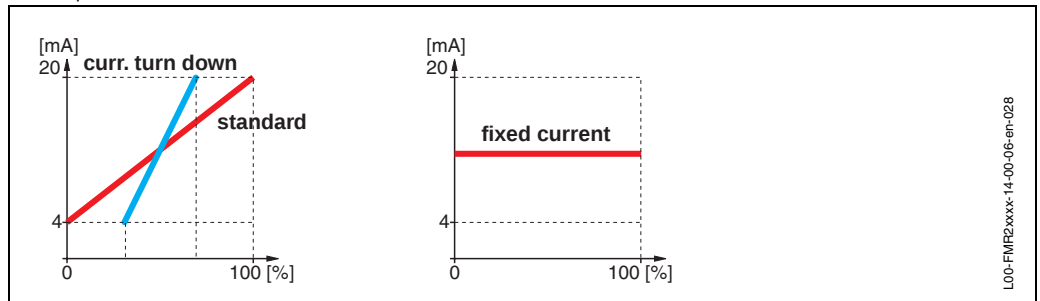
fixed current

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.

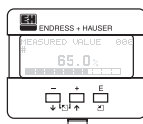
Caution!

This function is available for HART devices only!

Example:



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



```
out value 063
0.000
```

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



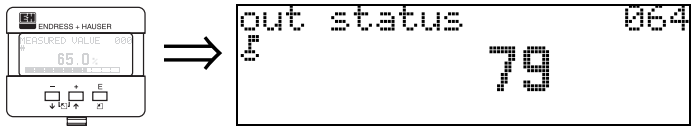
Set the fixed current value with this function. This entry is necessary when you have switched on the "fixed current" (063) function.

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!

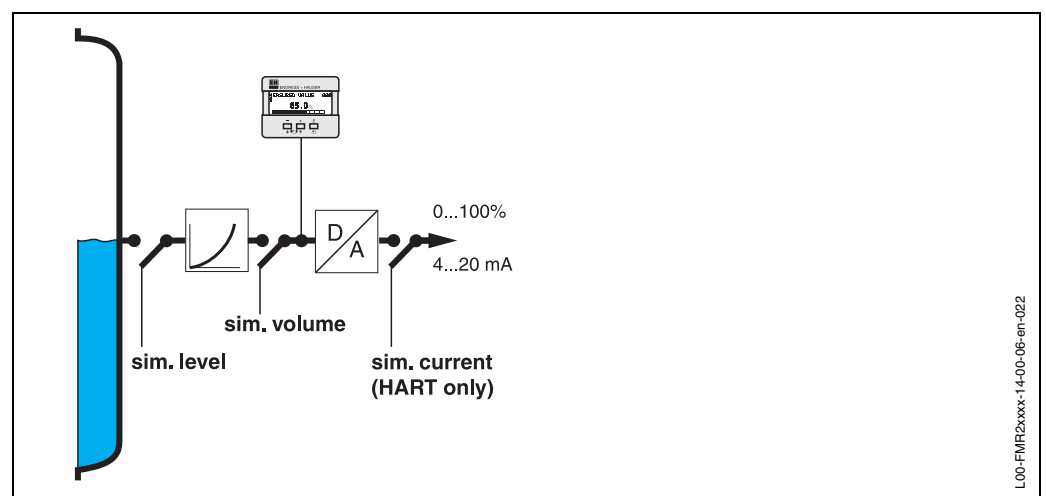
7.11 Function "simulation" (065)



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 (HART only)



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) - only with HART instruments!
- follow the entered values.

sim. volume

Enter the volume value in "**simulation value**" (066).

The functions

- measured value (000)
 - output current" (067) - only with HART instruments!
- follow the entered values.

sim. current (HART only)

Enter the current value in "**simulation value**" (066).

The function

- output current" (067) - only with HART instruments!
- 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.

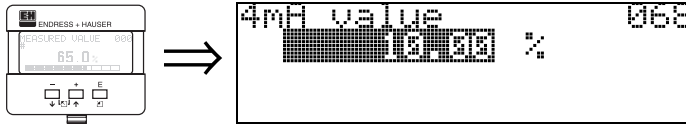
Micropilot always transmits the distance as the second cyclical value.



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

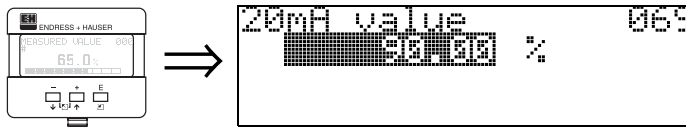
The value in **"display value" (069)** is displayed in the **"measured value" (000)** function.



Caution!

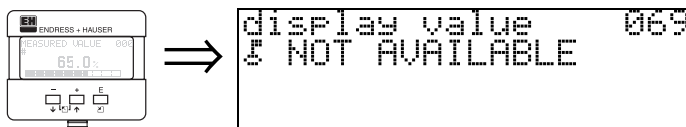
This function is available for PROFIBUS PA devices only!

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



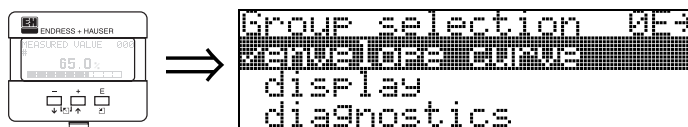
This field can be set externally, e.g. from a PLC. The value is then displayed as the main measured variable in the display by selecting the **"select v0h0" (068) = "display value"** function.



Caution!

This function is available for PROFIBUS PA devices only!

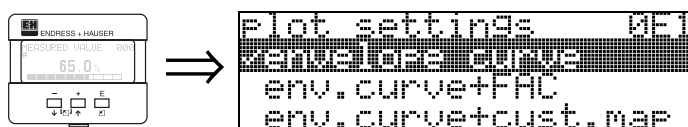
8 Function group "envelope curve" (0E)



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 73)
- 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.

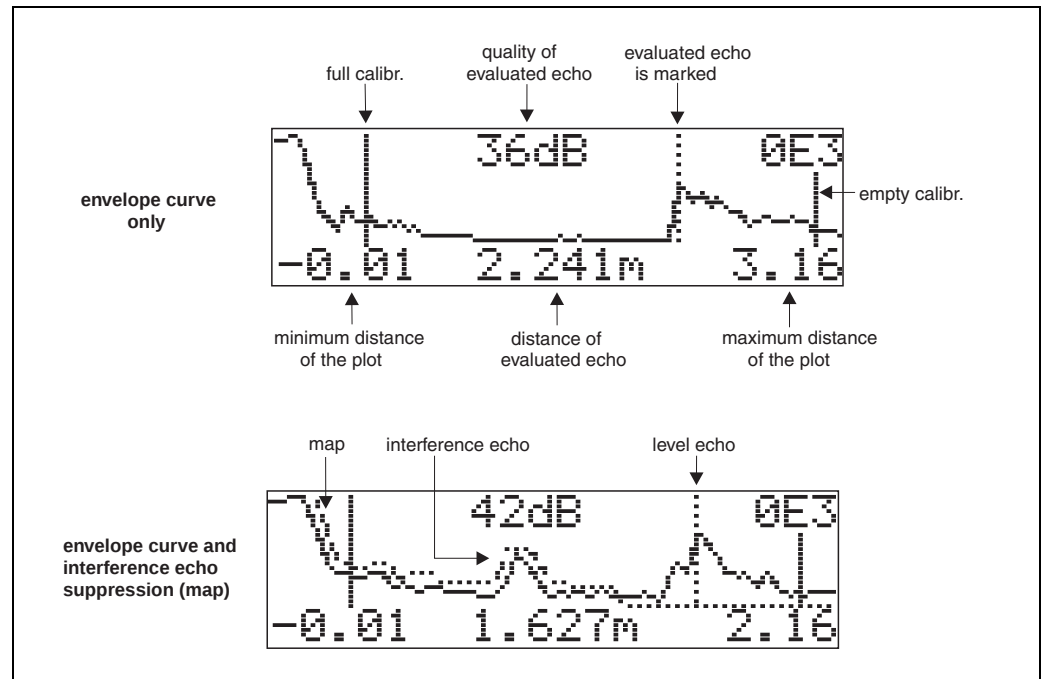


Note!

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 80).

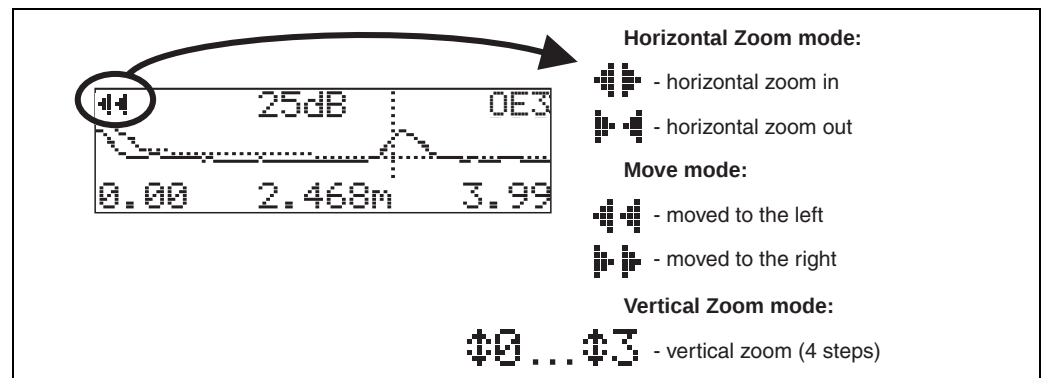
8.3 Function "envelope curve display" (0E3)

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



Navigating in the envelope curve display

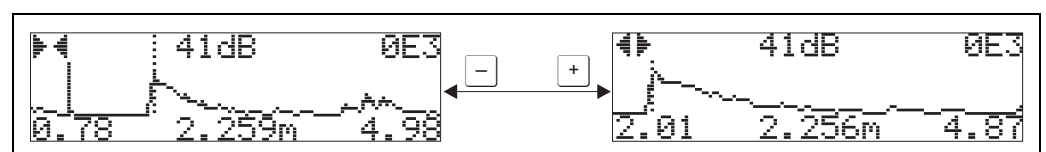
Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.



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:

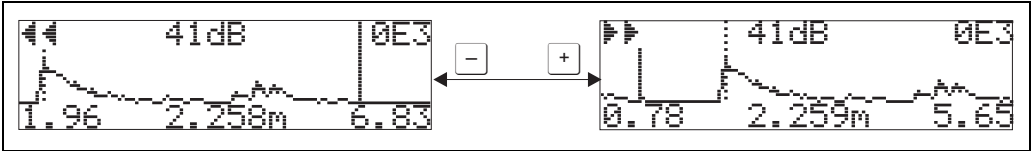
- increases the horizontal scale.
- reduces the horizontal scale.



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.

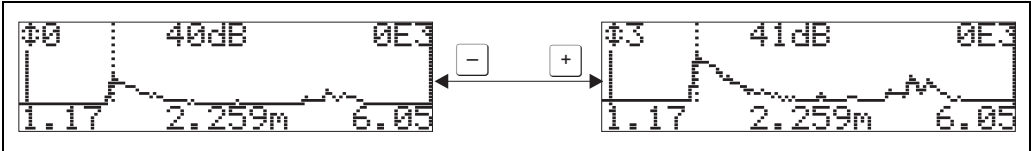


Vertical Zoom mode

Press **E** once more to switch to Vertical Zoom mode. **⌕1** is displayed.
You now have the following options:

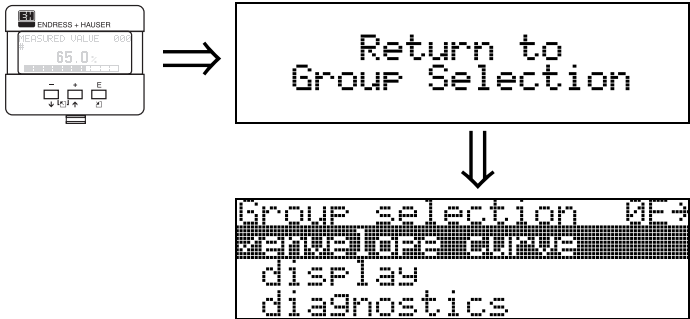
- **+** increases the vertical scale.
- **-** reduces the vertical scale.

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



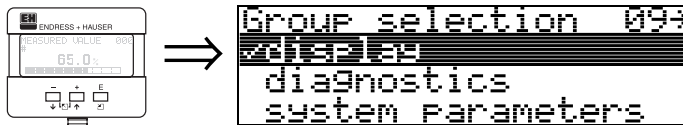
Exiting the navigation

- 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
- 二六三 (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 III!

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 III!

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 III!

9.4 Function "no.of decimals" (095)



Selection:

- x
- x.x
- x.xxx
- 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.

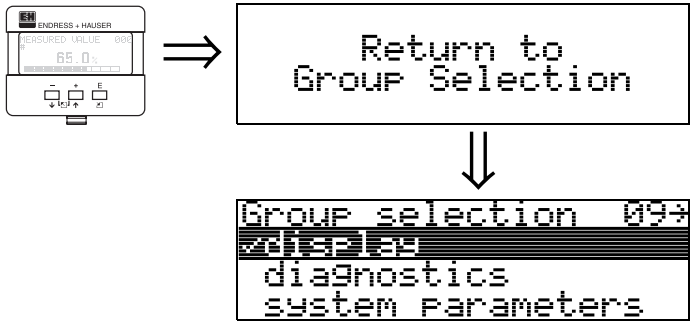
9.6 Function "display test" (097)



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

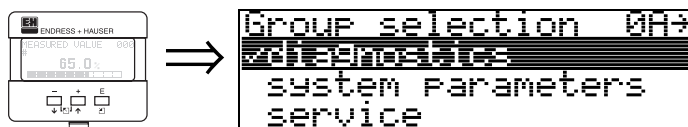


Caution!
This function can be performed on the display only!



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  symbol.
(For a description of the codes, see Table 14.2 on Page 76)
- **W (Warning):**
Instrument continue measuring, error message is displayed.
Indicated by a flashing  symbol.
(For a description of the codes, see Table 14.2 on Page 76)
- **E (Alarm / Warning):**
Configurable (e.g. loss of echo, level within the safety distance)
Indicated by a constant/flashing  symbol.
(For a description of the codes, see Table 14.2 on Page 76)

Error messages

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

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

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:

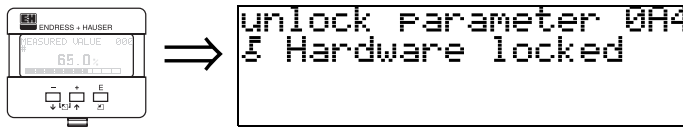
- | | |
|-------------------------|--------------------------|
| • tank shape (002) | • diameter vessel (047) |
| • empty calibr. (005) | • range of mapping (052) |
| • full calibr. (006) | • pres. Map dist (054) |
| • pipe diameter (007) | • offset (057) |
| • output on alarm (010) | • low output limit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

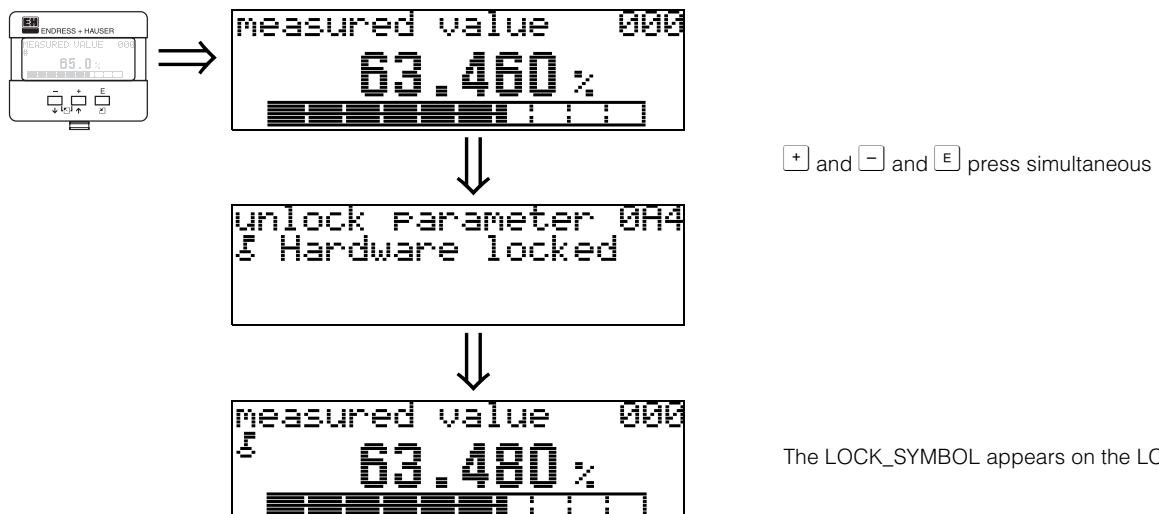
"unlock parameter" (0A4):

A value $\neq 100$ for HART (e.g. 99) or $\neq 2457$ 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 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 be 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)

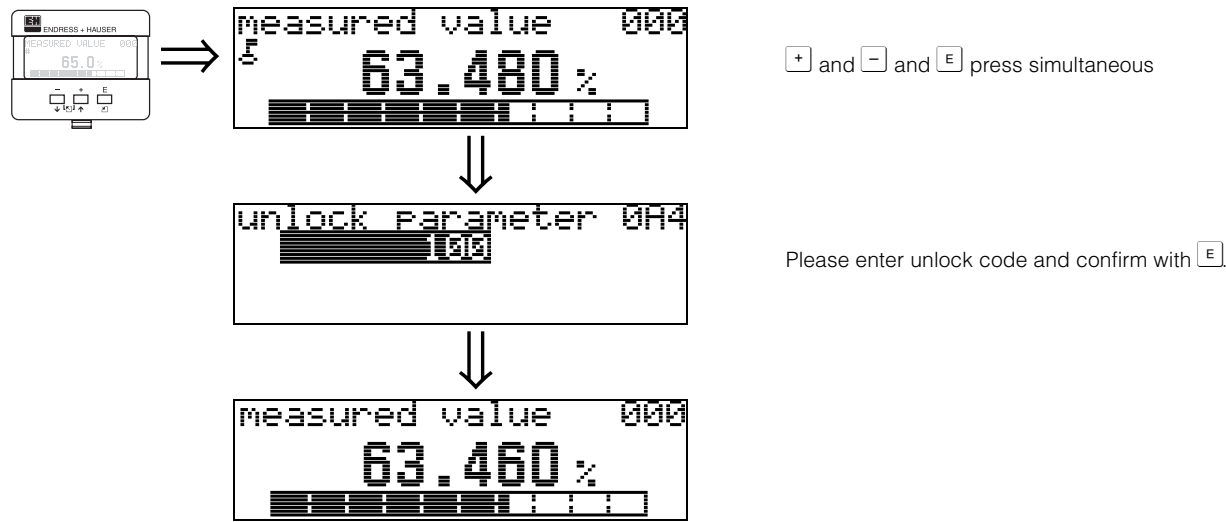
- 100 = for HART devices
- 2457 = for PROFIBUS PA and Foundation Fieldbus devices

the Micropilot is released for operation.

Hardware-Verriegelung:

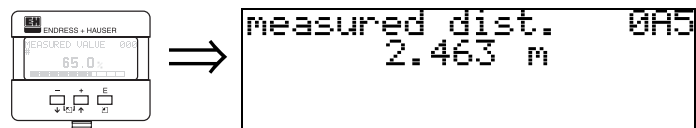
After pressing the  and  and  keys at the same time, the user is asked to enter the unlock parameter

- 100 = for HART devices
- 2457 = for PROFIBUS PA and Foundation Fieldbus devices.



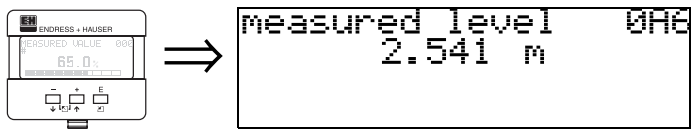
Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special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

10.6 Function "measured dist." (0A5)

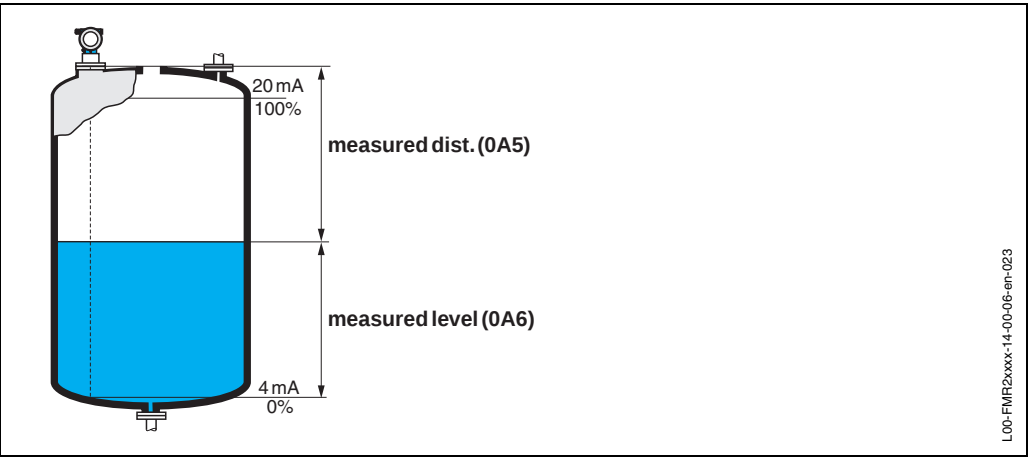


Display of measured distance in the selected "distance unit" (0C5).

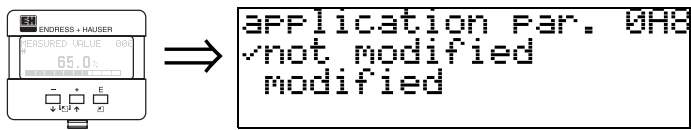
10.7 Function "measured level" (0A6)



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

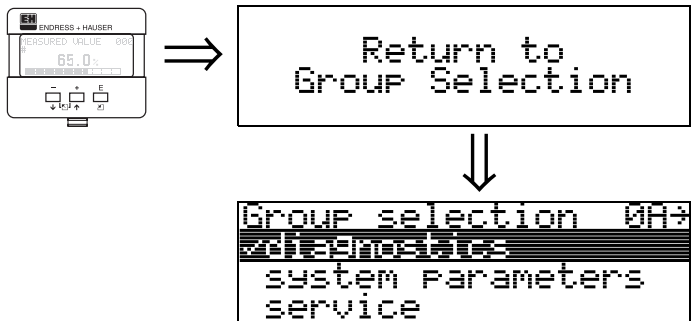


10.8 Function "application par." (0A8)



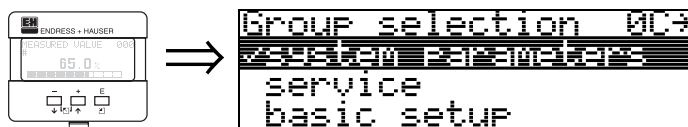
Displays whether or not one of the settings dependent on the "tank shape" (002), "medium property" (003) and "process cond." (004) application parameters has been changed.
If, for example, the "output damping" (058) is changed, the "application par." shows "modified".

- 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.

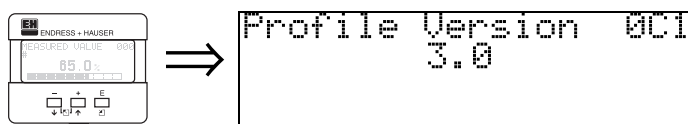
User input:

- 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



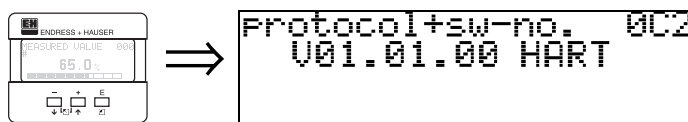
The PA Profile version is shown using this function (Profile 3.0).



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: protocol 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)
- 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)
- antenna extens. (0C9)

11.8 Function "download mode" (0C8)



This parameter defines which values are written to the instrument during a ToF Tool or Commuwin 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 extends." (0C9)

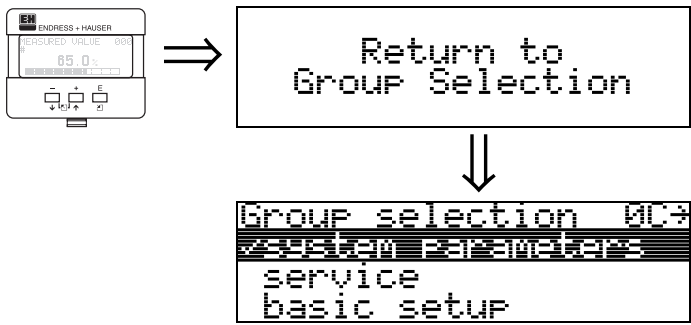


With this function, the length of the antenna extension FAR 10 can be entered (FMR 230 only). The influence of slower speed of propagation of the microwaves within the FAR 10 is corrected automatically.



Note!

This function can only be edited in the "extended calibr." (05) function group (see Chap. 6.9 on Page 42).



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.

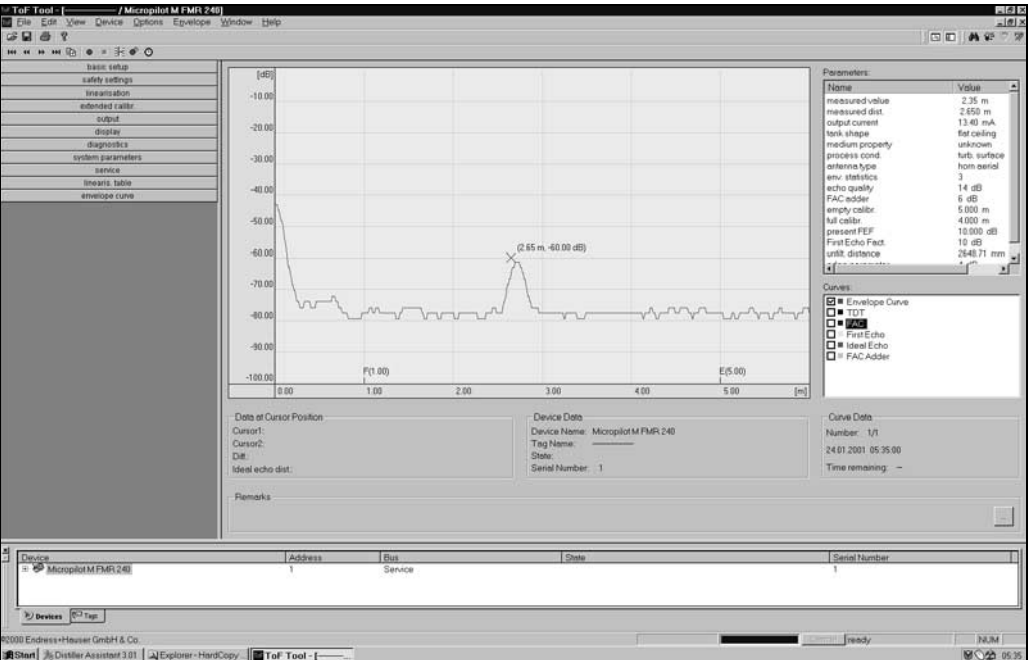
12.1 Software history

Software version / Date	Software changes	Documentation changes
V 01.01.00 / 12.2000	Original software. Operated via: – ToF Tool from version 1.5 – Commuwin II (from version 2.07-3) – HART communicator DXR 275 (from OS 4.6) with Rev. 1, DD 1.	
V 01.02.00 / 05.2002 V 01.02.02 / 03.2003	• Function group: envelope curve display • Katakana (japanese) • current turn down • the customer tank map can be edited • length of antenna extension FAR 10 can be entered directly Operated via: – ToF Tool from version 3.1 – Commuwin II (from version 2.07-4) – HART communicator DXR 275 (from OS 4.6) with Rev. 2, DD 1.	Description of new functions.

13 Envelope curve

13.0.1 Envelope curve with the ToF Tool

Signal analysis via envelope curve



See page 54 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 consists 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 envelope curve. (see BA 224F - Operating Instructions for ToF Tool).

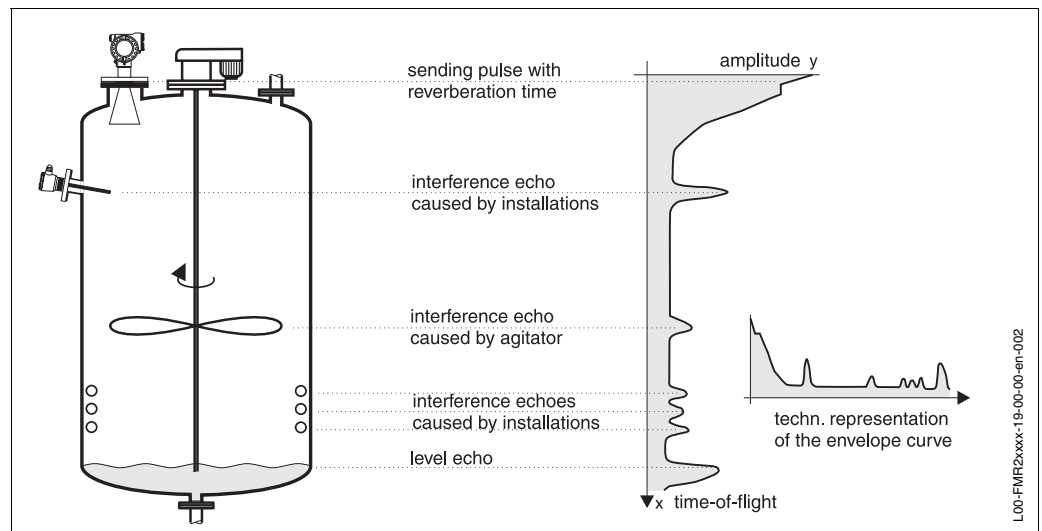


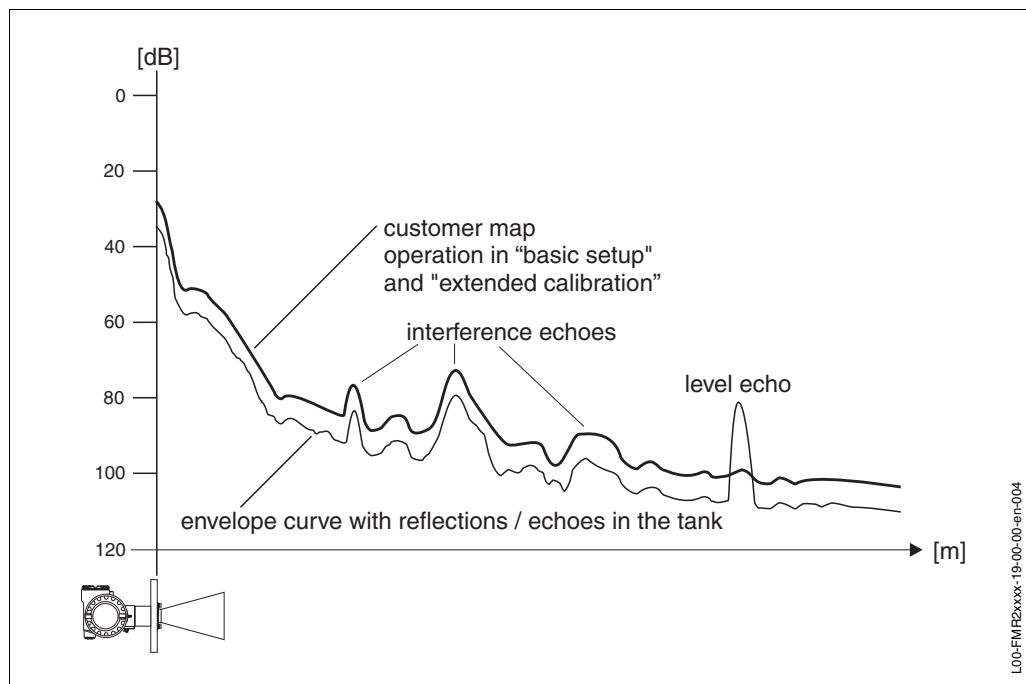
Abb. 6 Example of a tank with a schematic envelope curve

Tank mapping

It may be required to map interference reflections inside the tank. This map is preferably 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.



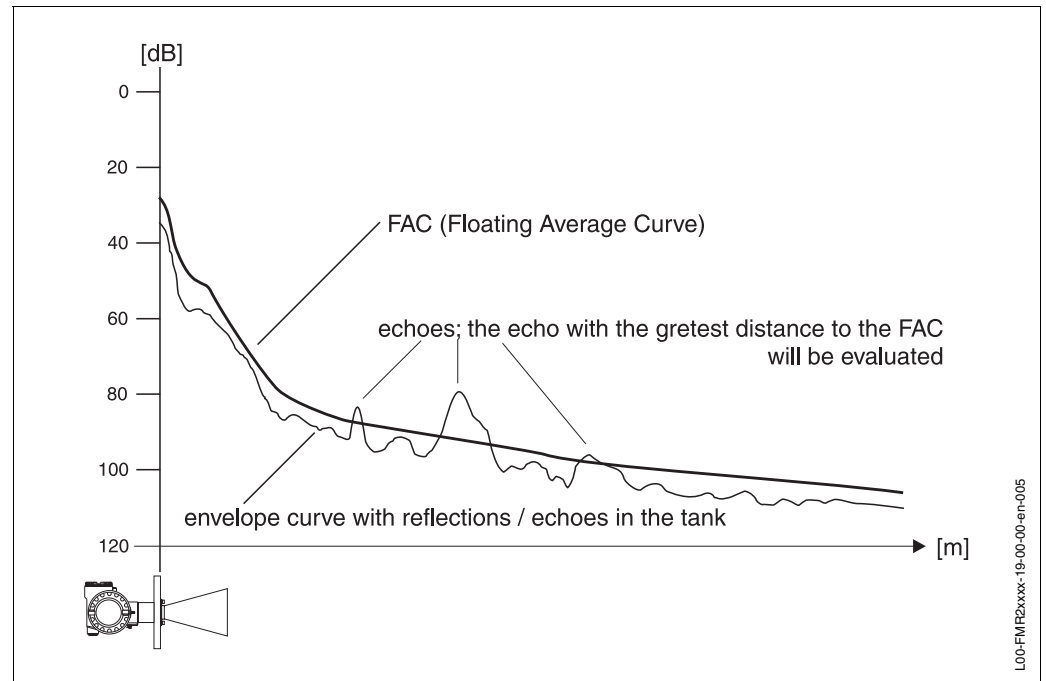
The FAC (Floating Average Curve)

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.

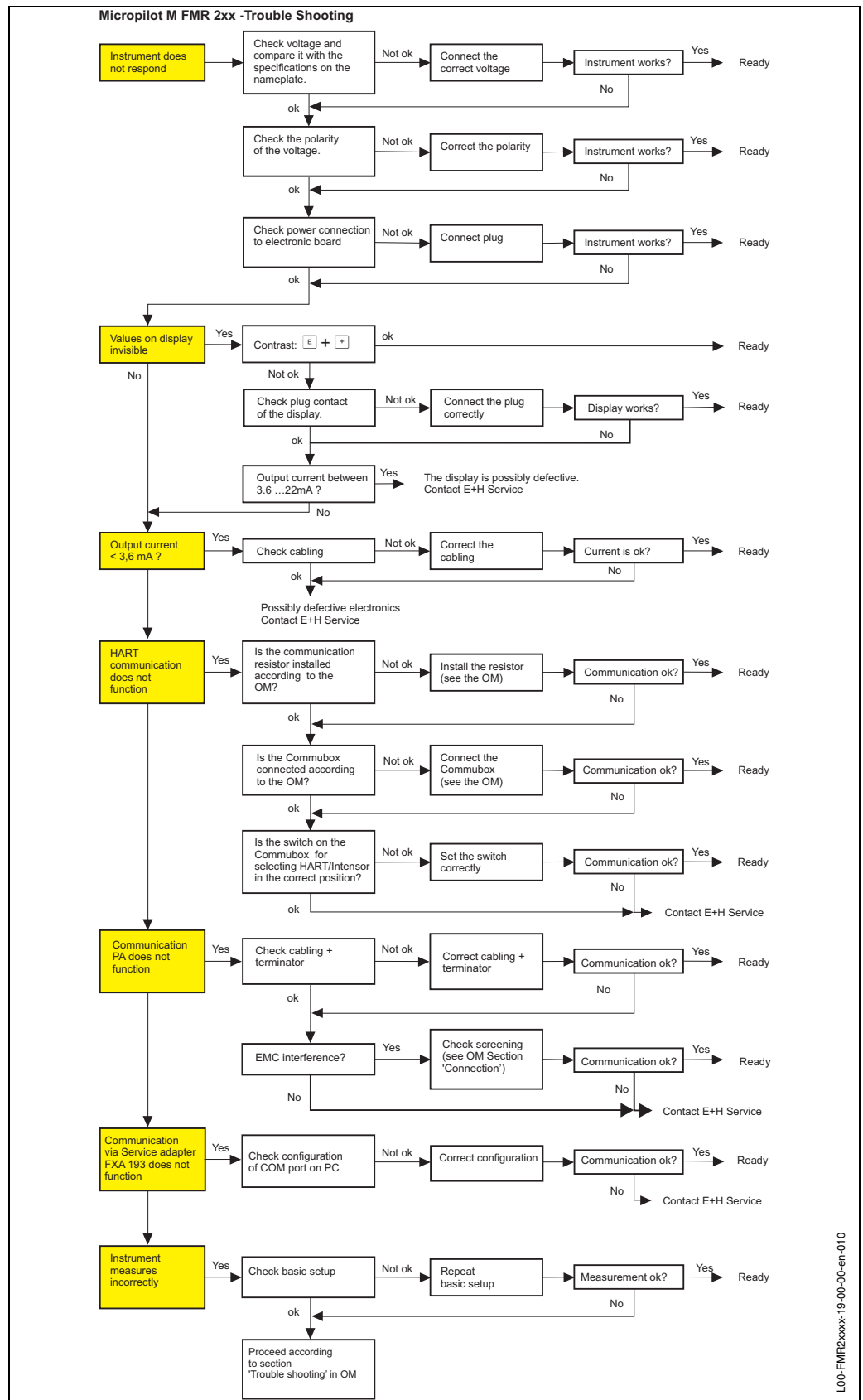


14 Trouble-shooting

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 75 ff. or in the appropriate instrument operating manual.

14.1 Trouble-shooting instructions



14.2 System error messages

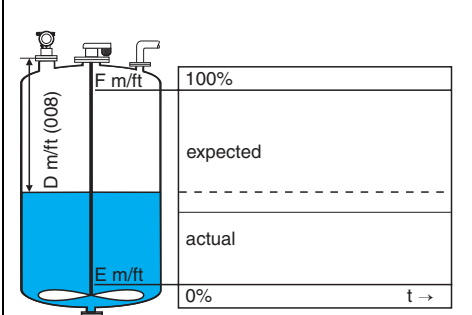
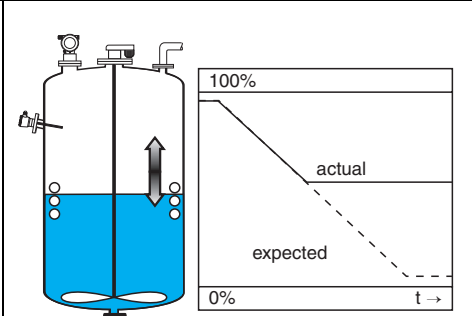
Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E ² PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising - please wait	E ² PROM storage 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; E ² PROM 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; E ² PROM 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; E ² PROM 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

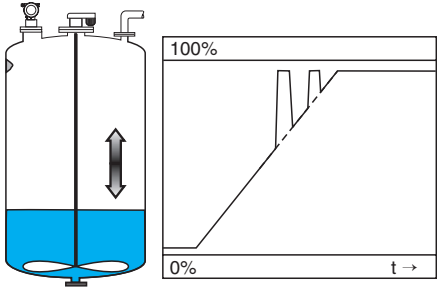
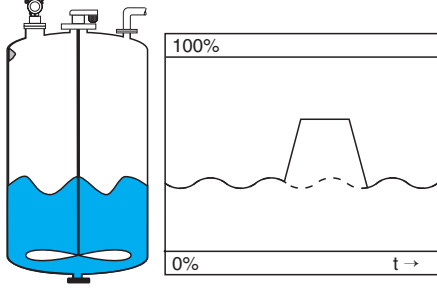
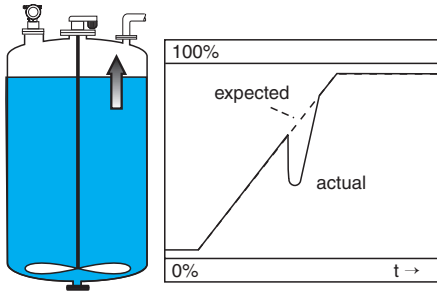
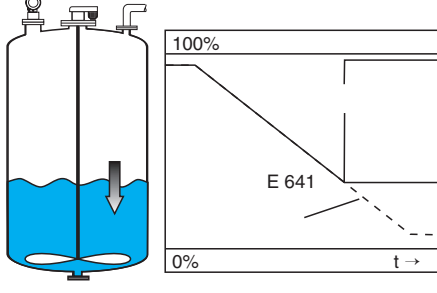
Tab. 3 System error messages

Code	Description	Possible cause	Remedy
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
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

Tab. 3 System error messages

14.3 Application errors

Error	Output	Possible cause	Remedy
A warning or alarm has occurred.	Depending on the configuration	See table of error messages (see page 76)	1. See table of error messages (see page 76)
Measured value (00) is incorrect		Measured distance (008) OK? yes → no ↓ Measurement in bypass or stilling well? yes → no ↓ Is an FAR 10 antenna extension being used? yes → no ↓ An interference echo may have been evaluated.	yes → 1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: →level/ullage (040) →max. scale (046) →diameter vessel (047) →Check table yes → 1. Is bypass or stilling well selected in tank shape (002)? 2. Is the pipe diameter (007) correct? yes → 1. offset (057) correctly set? (see page 42) 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

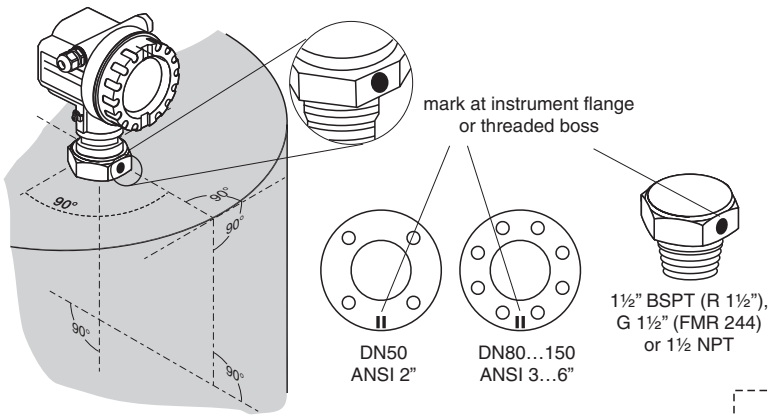
Error	Output	Possible cause	Remedy
If the surface is not calm (e.g. filling, emptying, agitator running), the measured value jumps sporadically to a higher level	 	Signal is weakened by the rough surface — the interference echoes are sometimes stronger	1. Carry out tank mapping → basic setup 2. Set the process cond. (004) to "turb. surface" or "agitator" 3. Increase the output damping (058) 4. Optimise the orientation (see page 80) 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 80) 3. If necessary, select a better installation position and/or larger antenna
E 641 (loss of echo) after turn on the power supply	If the instrument is configured to Hold by loss of echo the output is set to any value/current.	noise level during the initialisation phase to high.	Repeat once more empty calibr. (005). Caution! Before conformation change with  or  to the edit mode.

14.4 Orientation of the Micropilot

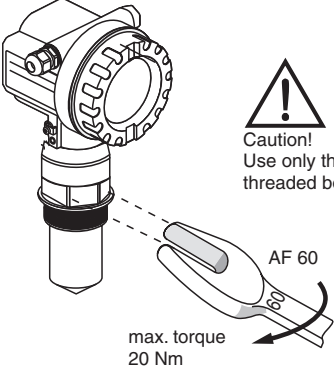


At mounting adjust the marking at the instrument flange!

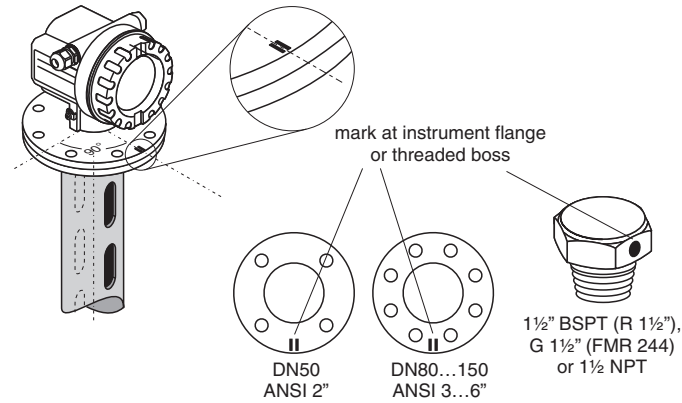
Installation in tank (free space):
Mark on process connector facing the nearest tank wall!



FMR 244 F12/F23 or T12 housing



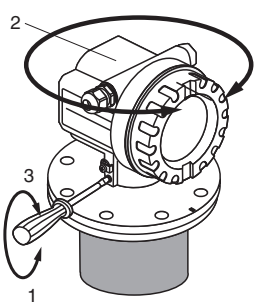
Installation in stilling well:
Mark on process connector pointed towards the slots or vent holes!



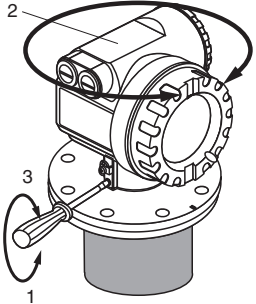
Turn housing

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

F12/F23 housing

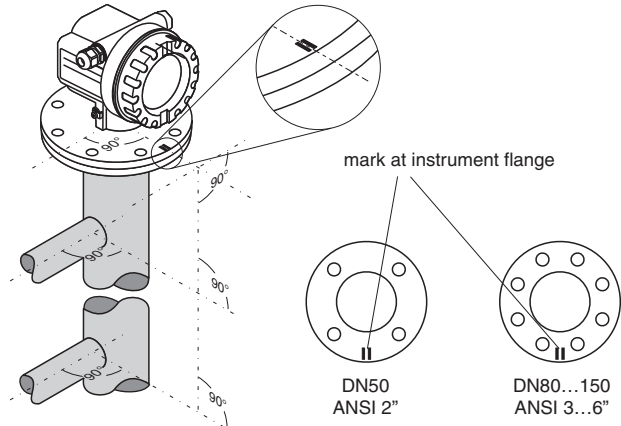


T12 housing



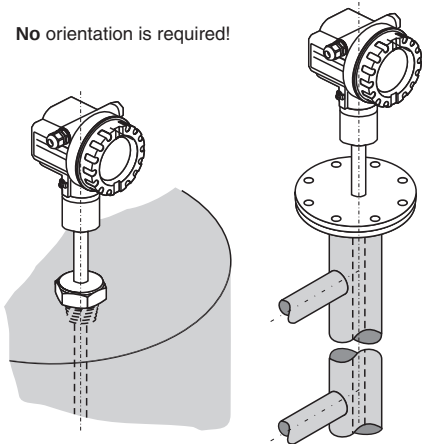
Allen key 4 mm / 0.1"
FMR 244: max. torque 0.5 Nm

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



Installation with Wave Guide antenna:

No orientation is required!



L00-FMR2xxx-17-00-00-en-012

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 80):

- In tanks: to the vessel wall
- In stilling wells: to the slots
- In bypass pipes: vertical to the tank 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.

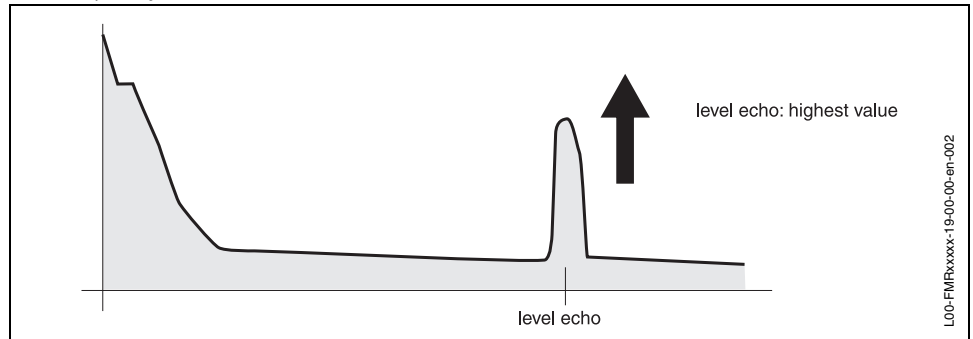
Proceed as follows:



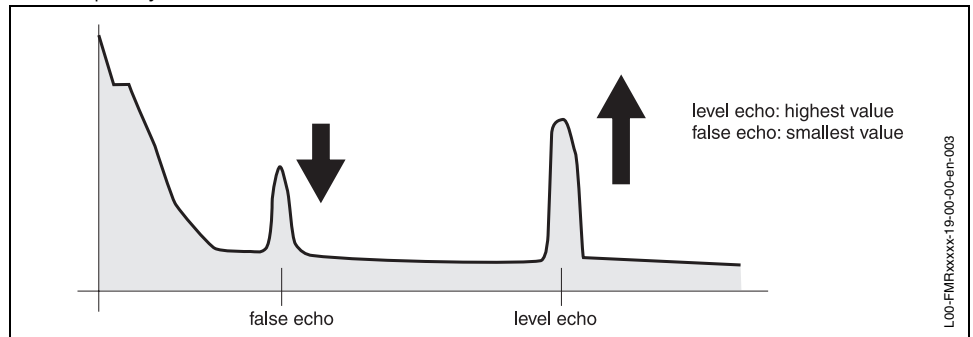
Warning!

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.

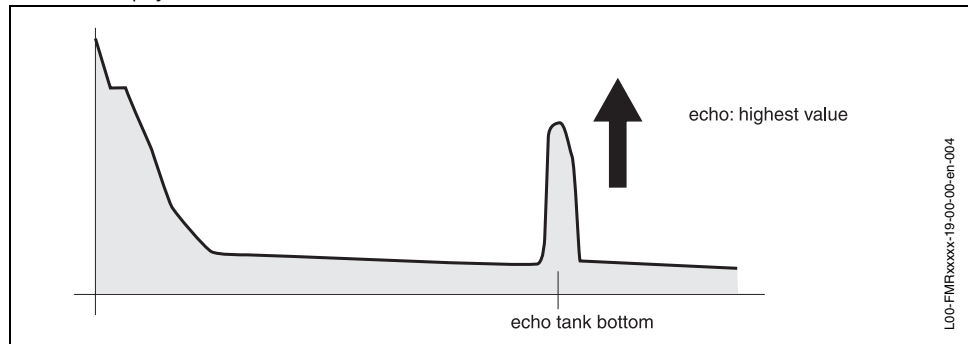
1. It is best to empty the container so that the bottom is just covered. However, alignment can be carried out even if the vessel is empty.
2. Optimisation is best carried out with the aid of the envelope graph in the display or the ToF Tool.
3. Unscrew the flange or loosen the threaded boss by a half 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:



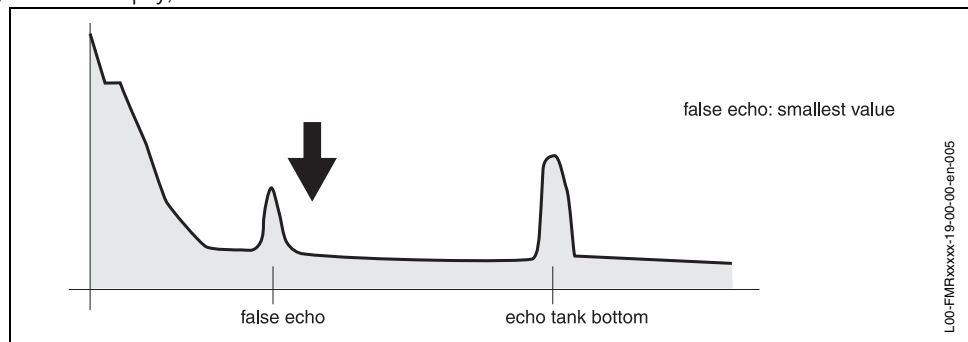
- b) Vessel partly full, interference echo obtained:



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 19 ff.

Index function menu

Function group

00 = basic setup	13
01 = safety settings	23
04 = linearisation	30
05 = extended calibr.	38
06 = output	44
06 = profibus param. (PROFIBUS PA only)	44
09 = display	57
0A = diagnostics	60
0C = system parameters	66
0E = envelope curve	54

Function

000 = measured value	13
002 = tank shape	13
003 = medium property	14
004 = process cond.	14
005 = empty calibr.	16
006 = full calibr.	17
007 = pipe diameter	18
010 = output on alarm	23
011 = output on alarm (HART only)	25
012 = outp. echo loss	25
013 = ramp %span/min	26
014 = delay time	27
015 = safety distance	27
016 = in safety dist.	27
017 = ackn. alarm	29
018 = overspill prot.	29
040 = level/ullage	30
041 = linearisation	31
042 = customer unit	35
043 = table no.	36
044 = input level	36
045 = input volume	37
046 = max. scale	37
047 = diameter vessel	37
050 = selection	38
051 = check distance	38
052 = range of mapping	39
053 = start mapping	39
054 = pres. map dist.	40
055 = cust. tank map	40
056 = echo quality	41
057 = offset	42
058 = output damping	43
059 = blocking dist.	43

060 = commun. address (HART only)	44
060 = instrument addr. (PROFIBUS PA only)	44
061 = no. of preambels (HART only)	45
061 = ident number (PROFIBUS PA only)	45
062 = low output limit (HART only)	46
062 = set unit to bus (PROFIBUS PA only)	46
063 = curr.output mode (HART only)	47
063 = out value (PROFIBUS PA only)	47
064 = fixed cur. value (HART only)	48
064 = out status (PROFIBUS PA only)	48
065 = simulation	49
066 = simulation value	49
067 = output current (HART only)	49
067 = 2nd cyclic value (PROFIBUS PA only)	51
068 = 4mA value" (HART only)	52
068 = select v0h0 (PROFIBUS PA only)	53
069 = 20mA value" (HART only)	53
069 = display value (PROFIBUS PA only)	53
092 = language	57
093 = back to home	57
094 = format display	58
095 = no.of decimals	58
096 = sep. character	58
097 = display test	59
0A0 = present error	61
0A1 = previous error	61
0A2 = clear last error	61
0A3 = reset	62
0A4 = unlock parameter	63
0A5 = measured dist.	64
0A6 = measured level	65
0A8 = application par.	65
0C0 = tag no.	66
0C0 = device tag (Foundation Fieldbus only)	66
0C1 = Profile Version (PROFIBUS PA only)	66
0C2 = protocol+sw-no.	66
0C4 = serial no.	67
0C4 = device id (Foundation Fieldbus only)	67
0C5 = distance unit	67
0C8 = download mode	68
0C9 = antenna extens.	68
0E1 = plot settings	54
0E2 = recording curve	54
0E3 = envelope curve display	55
D00 = service level	69

Europe	
Austria ☐ Endress+Hauser Ges.m.b.H. Wien Tel. (01) 88056-0, Fax (01) 88056-35	Netherlands ☐ Endress+Hauser B.V. Naarden Tel. (035) 6958611, Fax (035) 6958825
Belarus ☐ Belorgsintez Minsk Tel. (0172) 508473, Fax (0172) 508583	Norway ☐ Endress+Hauser A/S Tranby Tel. (032) 859850, Fax (032) 859851
Belgium / Luxembourg ☐ Endress+Hauser N.V. Brussels Tel. (02) 2480600, Fax (02) 2480553	Poland ☐ Endress+Hauser Polska Sp. z o.o. Wroclaw Tel. (022) 7803723, Fax (022) 7803760
Bulgaria INTERTECH-AUTOMATION Sofia Tel. (02) 664869, Fax (02) 9631389	Portugal Tecnisis - Tecnica de Sistemas Industriais Linda-a-Velha Tel. (21) 4267290, Fax (21) 4267299
Croatia ☐ Endress+Hauser GmbH+Co. Zagreb Tel. (01) 6637785, Fax (01) 6637823	Romania Romconseng S.R.L. Bucharest Tel. (01) 4101634, Fax (01) 4112501
Cyprus I+G Electrical Services Co. Ltd. Nicosia Tel. (02) 484788, Fax (02) 484690	Russia ☐ Endress+Hauser Moscow Office Moscow Tel. (095) 1587564, Fax (095) 1589871
Czech Republic ☐ Endress+Hauser GmbH+Co. Praha Tel. (026) 6784200, Fax (026) 6784179	Slovakia Transcom Technik s.r.o. Bratislava Tel. (7) 44888684, Fax (7) 44887112
Denmark ☐ Endress+Hauser A/S Søborg Tel. (70) 131132, Fax (70) 132133	Slovenia ☐ Endress+Hauser D.O.O. Ljubljana Tel. (01) 5192217, Fax (01) 5192298
Estonia ELVI-Aqua Tartu Tel. (7) 441638, Fax (7) 441582	Spain ☐ Endress+Hauser S.A. Sant Just Desvern Tel. (93) 4803366, Fax (93) 4733839
Finland ☐ Endress+Hauser Oy Helsinki Tel. (0204) 83160, Fax (0204) 83161	Sweden ☐ Endress+Hauser AB Sollentuna Tel. (08) 55511600, Fax (08) 55511655
France ☐ Endress+Hauser S.A. Huningue Tel. (389) 696768, Fax (389) 694802	Switzerland ☐ Endress+Hauser Metso AG Reinach/BL 1 Tel. (061) 7157575, Fax (061) 7111650
Germany ☐ Endress+Hauser Messtechnik GmbH+Co. Weil am Rhein Tel. (07621) 975-01, Fax (07621) 975-555	Turkey Intek Endüstriyel Ölçü ve Kontrol Sistemleri İstanbul Tel. (0212) 2751355, Fax (0212) 2662775
Great Britain ☐ Endress+Hauser Ltd. Manchester Tel. (0161) 2865000, Fax (0161) 9981841	Ukraine Photonika GmbH Kiev Tel. (44) 26881, Fax (44) 26908
Greece I & G Building Services Automation S.A. Athens Tel. (01) 9241500, Fax (01) 9221714	Yugoslavia Rep. Meris d.o.o. Beograd Tel. (11) 4441966, Fax (11) 4441966
Hungary Mile Ipari-Elektro Budapest Tel. (01) 4319800, Fax (01) 4319817	
Iceland BIL ehf Reykjavik Tel. (05) 619616, Fax (05) 619617	
Ireland Flomeaco Company Ltd. Kildare Tel. (045) 868615, Fax (045) 868182	
Italy ☐ Endress+Hauser S.p.A. Cernusco s/N Milano Tel. (02) 92192-1, Fax (02) 92192-362	
Latvia Rino TK Riga Tel. (07) 315087, Fax (07) 315084	
Lithuania UAB "Agava" Kaunas Tel. (07) 202410, Fax (07) 207414	

Bolivia Tritec S.R.L. Cochabamba Tel. (042) 56993, Fax (042) 50981	Brazil ☐ Samson Endress+Hauser Ltda. Sao Paulo Tel. (011) 50313455, Fax (011) 50313067
Canada ☐ Endress+Hauser Ltd. Burlington, Ontario Tel. (905) 6819292, Fax (905) 6819444	Chile ☐ Endress+Hauser Chile Ltd. Santiago Tel. (02) 321-3009, Fax (02) 321-3025
Colombia Colsein Ltda. Bogota D.C. Tel. (01) 2367659, Fax (01) 6104186	Costa Rica EURO-TEC S.A. San Jose Tel. (02) 961542, Fax (02) 961542
Ecuador Insetec Cia. Ltda. Quito Tel. (02) 269148, Fax (02) 461833	Guatemala ACISAAutomatizacionYControlIndustrial S.A. Ciudad de Guatemala, C.A. Tel. (03) 345985, Fax (03) 327431
Mexico ☐ Endress+Hauser S.A. de C.V. Mexico City Tel. (5) 5682405, Fax (5) 5687459	Paraguay Incoel S.R.L. Asuncion Tel. (021) 213989, Fax (021) 226583
Uruguay Circular S.A. Montevideo Tel. (02) 925785, Fax (02) 929151	USA ☐ Endress+Hauser Inc. Greenwood, Indiana Tel. (317) 535-7138, Fax (317) 535-8498
Venezuela Controlval C.A. Caracas Tel. (02) 9440966, Fax (02) 9444554	
Asia	
China ☐ Endress+Hauser Shanghai Instrumentation Co. Ltd. Shanghai Tel. (021) 54902300, Fax (021) 54902303	☐ Endress+Hauser Beijing Office Beijing Tel. (010) 68344058, Fax: (010) 68344068
Hong Kong ☐ Endress+Hauser HK Ltd. Hong Kong Tel. 25283120, Fax 28654171	
India ☐ Endress+Hauser (India) Pvt. Ltd. Mumbai Tel. (022) 8521458, Fax (022) 8521927	
Indonesia PT Grama Bazita Jakarta Tel. (21) 7975083, Fax (21) 7975089	
Japan ☐ Sakura Endress Co. Ltd. Tokyo Tel. (0422) 540613, Fax (0422) 550275	
Malaysia ☐ Endress+Hauser (M) Sdn. Bhd. Petaling Jaya, Selangor Darul Ehsan Tel. (03) 7334848, Fax (03) 7338800	

Pakistan Speedy Automation Karachi Tel. (021) 7722953, Fax (021) 7736884	Philippines ☐ Endress+Hauser Philippines Inc. Metro Manila Tel. (2) 3723601-05, Fax (2) 4121944
Singapore ☐ Endress+Hauser (S.E.A.) Pte., Ltd. Singapore Tel. 5668222, Fax 5666848	South Korea ☐ Endress+Hauser (Korea) Co., Ltd. Seoul Tel. (02) 6587200, Fax (02) 6592838
Taiwan Kingjari Corporation Taipei R.O.C. Tel. (02) 27183938, Fax (02) 27134190	Thailand ☐ Endress+Hauser Ltd. Bangkok Tel. (2) 9967811-20, Fax (2) 9967810
Vietnam Tan Viet Bao Co. Ltd. Ho Chi Minh City Tel. (08) 8335225, Fax (08) 8335227	Iran PATSA Co. Tehran Tel. (021) 8754748, Fax (021) 8747761
Israel Instrumetrics Industrial Control Ltd. Tel-Aviv Tel. (09) 8357090, Fax (09) 8350619	Jordan A.P. Parpas Engineering S.A. Amman Tel. (06) 4643246, Fax (06) 4645707
Kingdom of Saudi Arabia Anasia Ind. Agencies Jeddah Tel. (02) 6710014, Fax (02) 6725929	Lebanon Network Engineering Jbeil Tel. (3) 944080, Fax (9) 548038
Sultanate of Oman Mustafa & Sultan Science & Industry Co. L.L.C. Ruwi Tel. 602009, Fax 607066	United Arab Emirates Descon Trading EST. Dubai Tel. (04) 2653651, Fax (04) 2653264
Yemen YemenCompany for Ghee and Soap Industry Taiz Tel. (04) 230664, Fax (04) 212338	

Australia + New Zealand

Australia ALSTOM Australia Limited Milperra Tel. (02) 97747444, Fax (02) 97744667	New Zealand EMC Industrial Group Limited Auckland Tel. (09) 4155110, Fax (09) 4155115
---	---

All other countries

☐ Endress+Hauser GmbH+Co. KG Instruments International Weil am Rhein Germany Tel. (07621) 975-02, Fax (07621) 975-345
--

For more Endress+Hauser product please visit: www.ainstru.com

Mail: Sales@ainstru.com

