

Description of Device Parameters

Micropilot FMR50, FMR51, FMR52, FMR53, FMR54, FMR56, FMR57

PROFIBUS PA

Free space radar

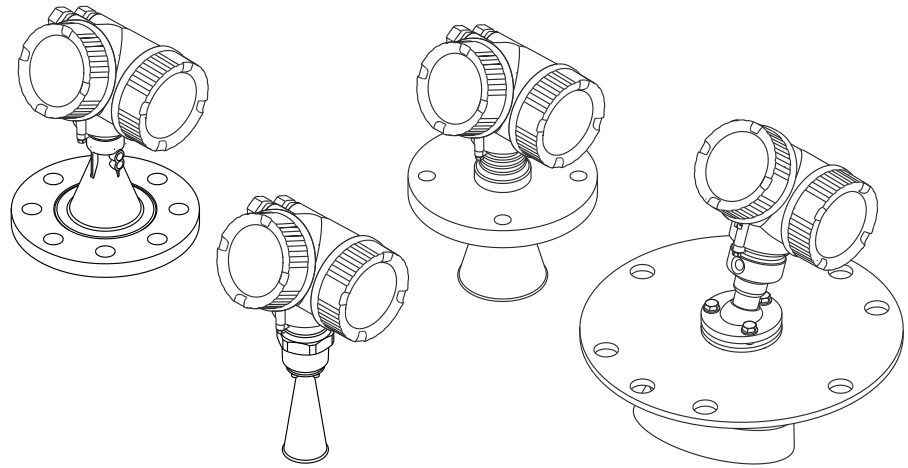


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1 Important document information

1.1 Document function

The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu.

1.2 Symbols

1.2.1 Symbols for certain types of information

Symbol	Meaning
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Operation via local display
	Operation via operating tool
	Write-protected parameter

1.2.2 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3 ...	Item numbers	A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections		

2 Overview of the operating menu

- i
 - The following table lists all parameters the "Expert" menu may contain. The page number refers to where a description of the parameter can be found.
 - Depending on the device version and parametrization some parameters will not be available in a given situation. For details on the conditions refer to the "Prerequisite" category in the description of the respective parameter.
 - The representation essentially corresponds to the menu seen when using an operating tool (e.g. FieldCare). On the local display there may be minor differences in the menu structure. Details are mentioned in the description of the respective submenu.

Navigation  Expert


























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























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























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














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3 "Expert" menu

The **Expert** menu contains all parameters of the device. It is structured according to the function blocks of the device.


3.1 Structure of the menu



Navigation  Expert

 Expert		
Direct access (0106)		→  23
Locking status (0004)		→  23
Access status display (0091)		→  24
Access status tooling (0005)		→  24
Enter access code (0003)		→  25
▶ System		→  26
▶ Sensor		→  44
▶ Output		→  134
▶ Communication		→  142
▶ Analog input 1 to 6		→  159
▶ Discrete input 1 to 4		→  176
▶ Analog output 1 to 4		→  187
▶ Discrete output 1 to 4		→  201
▶ Diagnostics		→  213



3.2 Description of parameters



Navigation   Expert

Direct access	
----------------------	-------------------------------------------------------------------------------------








Navigation	 Expert → Direct access (0106)
Description	Enter the access code of a parameter in order to access this parameter directly (i.e. without navigation).
User entry	0 to 65 535
Factory setting	0
Additional information	<p>The direct access code consists of a five digit number and an optional channel code, which specifies an input or output channel, e.g. 00353-2</p> <ul style="list-style-type: none"> ■ Leading zeros need not to be entered. Example: You may enter "353" instead of "00353" ■ If the channel code is not entered, channel 1 is automatically selected. Example: By entering "353" you access the following parameter: Curr.output 1 → Current span (0353-1) ■ In order to access a different channel: Enter the direct access code with the channel code. Example: By entering "353-2" you access the following parameter: Curr.output 2 → Current span (0353-2) <p> In this document, the direct access code is added in brackets after the parameter name in the <i>Navigation</i> category.</p>

Locking status


Navigation	  Expert → Locking status (0004)
Description	Indicates the write protection with the highest priority that is currently active.
User interface	<ul style="list-style-type: none"> ■ Hardware locked ■ SIL locked ■ WHG locked ■ Temporarily locked

Additional information	<p>Meaning and priorities of the types of write protection</p> <ul style="list-style-type: none"> ▪ Hardware locked (priority 1) The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters. ▪ SIL locked (priority 2) The SIL mode is activated. Writing access to the relevant parameters is denied. ▪ WHG locked (priority 3) The WHG mode is activated. Writing access to the relevant parameters is denied. ▪ Temporarily locked (priority 4) Write access to the parameters is temporarily locked on account of internal processes in progress in the device (e.g. data upload/download, reset etc.). The parameters can be modified as soon as the processes are complete. <p> On the display module, the -symbol appears in front of parameters that cannot be modified since they are write-protected.</p>
-------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Access status display

Navigation	 Expert → Access stat.disp (0091)
Prerequisite	The device has a local display.
Description	Indicates access authorization to parameters via local display.
User interface	<ul style="list-style-type: none"> ▪ Operator ▪ Maintenance ▪ Service
Additional information	<p> If a  symbol appears in front of a parameter, the parameter cannot be changed via the local display with the current access authorization.</p> <p> The access authorization can be changed via the Enter access code parameter (→  25).</p> <p> If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the Locking status parameter (→  23).</p>

Access status tooling

Navigation	 Expert → Access stat.tool (0005)
Description	Indicates access authorization to parameters via operating tool (e.g. FieldCare).
User interface	<ul style="list-style-type: none"> ▪ Operator ▪ Maintenance ▪ Service

Additional information

The access authorization can be changed via the **Enter access code** parameter (→ 25).



If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter (→ 23).

Enter access code

Navigation

Expert → Ent. access code (0003)

Description

Enter access code to disable write protection of parameters.

User entry

0 to 9999

Additional information

- For local operation, the customer-specific access code, which has been defined in the **Define access code** parameter (→ 41), has to be entered.
- If an incorrect access code is entered, the user retains his current access authorization.
- The write protection affects all parameters marked with the -symbol in this document. On the local display, the -symbol in front of a parameter indicates that the parameter is write-protected.
- If no key is pressed for 10 min, or the user switches from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after another 60 s.






Please contact your Endress+Hauser Sales Center if you lose your access code.

3.3 "System" submenu

The **System** submenu contains all general parameters which affect neither the measurement nor the measured value communication.

3.3.1 Structure of the submenu

Navigation  Expert → System


▶ System	
▶ Display	→  27
▶ Configuration backup display	→  36
▶ Administration	→  40















3.3.2 "Display" submenu

The **Display** submenu is used to configure the representation of measured values on the local display module. Up to four measured values can be allocated to the local display module. Additionally, display characteristics such as the format of numbers, the associated texts or the display contrast can be configured.


 This submenu is only visible if a display module is connected to the device.

Structure of the submenu

Navigation  Expert → System → Display

► Display	
Language	→  28
Format display	→  28
Value 1 to 4 display	→  30
Decimal places 1 to 4	→  30
Display interval	→  30
Display damping	→  31
Header	→  31
Header text	→  32
Separator	→  32
Number format	→  32
Decimal places menu	→  32
Contrast display	→  33
Backlight	→  33
Access status display	→  34

Description of parameters

Navigation  Expert → System → Display

Language

Navigation  Expert → System → Display → Language (0104)

Description Set display language.


Selection

- English
- Deutsch ¹⁾
- Français ¹⁾
- Español ¹⁾
- Italiano ¹⁾
- Nederlands ¹⁾
- Portuguesa ¹⁾
- Polski ¹⁾
- русский язык (Russian) ¹⁾
- Svenska ¹⁾
- Türkçe ¹⁾
- 中文 (Chinese) ¹⁾
- 日本語 (Japanese) ¹⁾
- 한국어 (Korean) ¹⁾
- العربية (Arabic) ¹⁾
- Bahasa Indonesia ¹⁾
- ภาษาไทย (Thai) ¹⁾
- tiếng Việt (Vietnamese) ¹⁾
- čeština (Czech) ¹⁾

Factory setting The additional language selected in feature 500 of the product structure.
If no additional language has been selected: **English**

Additional information The **English** option can be selected in every device. One additional operating language can be selected in the product structure when ordering a device (feature 500 "Additional Operation Language") and will be selectable in the **Language** parameter.

Format display

Navigation  Expert → System → Display → Format display (0098)

Description Select how measured values are shown on the display.

Selection

- 1 value, max. size
- 1 bargraph + 1 value
- 2 values
- 1 value large + 2 values
- 4 values

1) Visibility depends on order options or device settings

Factory setting

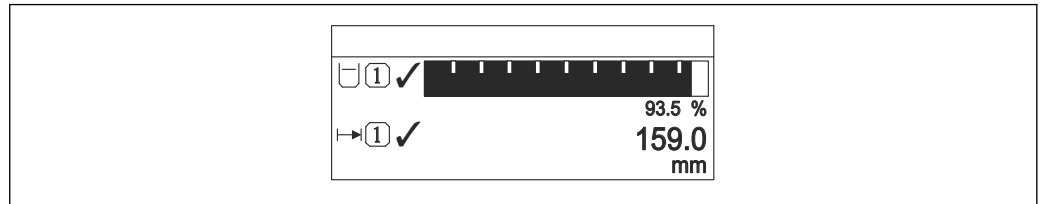
1 value, max. size

Additional information



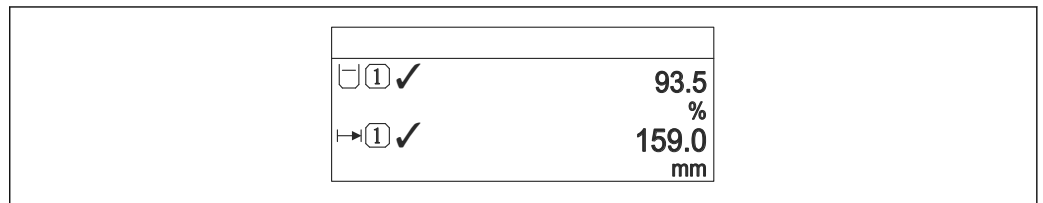
A0019963

1 "Format display" = "1 value, max. size"



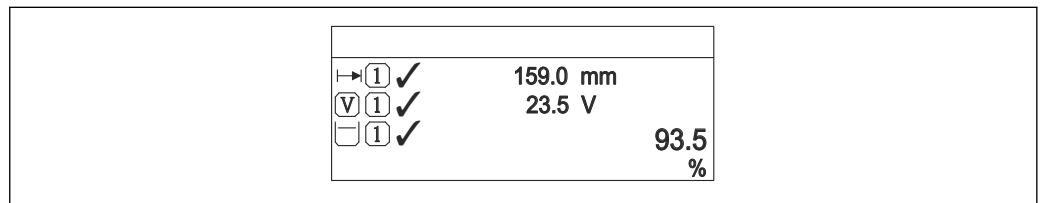
A0019964

2 "Format display" = "1 bargraph + 1 value"



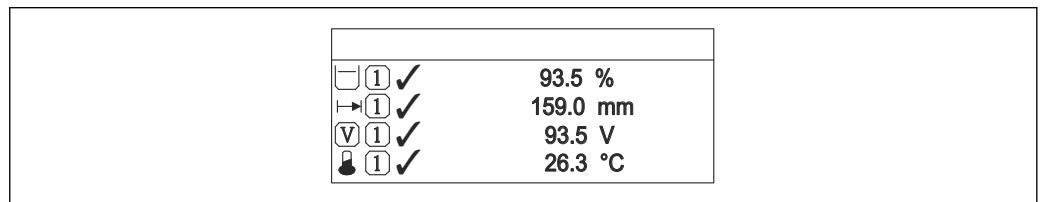
A0019965

3 "Format display" = "2 values"



A0019966

4 "Format display" = "1 value large + 2 values"



A0019968

5 "Format display" = "4 values"

- i
■
 The **Value 1 to 4 display** → 30 parameters specify which measured values are shown on the display and in which order.
- If more measured values are specified than the current display mode permits, the values alternate on the device display. The display time until the next change is configured in the **Display interval** parameter (→ 30).

Value 1 to 4 display



Navigation Expert → System → Display → Value 1 display (0107)

Description Select the measured value that is shown on the local display.

Selection

- None ²⁾
- Level linearized
- Distance
- Current output 1 ³⁾
- Measured current
- Current output 2
- Terminal voltage
- Electronic temperature
- Absolute echo amplitude
- Relative echo amplitude
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2
- Area of incoupling

Factory setting

- Value 1 display: Level linearized
- Value 2 display: None
- Value 3 display: None
- Value 4 display: None

Decimal places 1 to 4



Navigation Expert → System → Display → Decimal places 1 to 4 (0095-1 to 4)

Description Select the number of decimal places for the display value.

Selection

- x
- x.x
- x.xx
- x.xxx
- x.xxxx

Factory setting x.xx

Additional information The setting does not affect the measuring or computational accuracy of the device.

Display interval

Navigation Expert → System → Display → Display interval (0096)

Description Set time measured values are shown on display if display alternates between values.

2) can not be selected for the "Value 1 display" parameter.

3) "Visibility depends on order options or device settings"

User entry	1 to 10 s
Factory setting	5 s
Additional information	This parameter is only relevant if the number of selected measuring values exceeds the number of values the selected display format can display simultaneously.

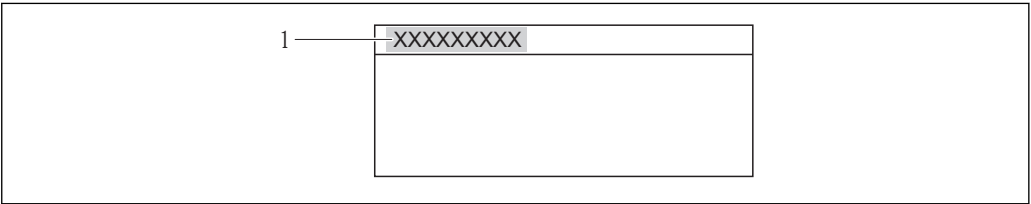
Display damping 🔒

Navigation	🔍📄 Expert → System → Display → Display damping (0094)
Description	Define display reaction time to fluctuations in the measured value.
User entry	0.0 to 999.9 s
Factory setting	0.0 s

Header 🔒

Navigation	🔍📄 Expert → System → Display → Header (0097)
Description	Select header contents on local display.
Selection	<ul style="list-style-type: none"> ▪ Device tag ▪ Free text
Factory setting	Device tag

Additional information



The diagram shows a rectangular display area. A horizontal line labeled '1' points to a small rectangular box at the top of the display area. Inside this box, the text 'XXXXXXXXXX' is displayed. Below this box is a larger, empty rectangular area representing the rest of the display.



A0013375


1 Position of the header text on the display

Meaning of the options

- **Device tag**
Is defined in the **Device tag** parameter.
- **Free text**
Is defined in the **Header text** parameter (→ 📄 32).

Header text 

Navigation   Expert → System → Display → Header text (0112)

Prerequisite Header (→  31) = Free text

Description Enter display header text.

Factory setting -----

Additional information The number of characters which can be displayed depends on the characters used.

Separator 

Navigation   Expert → System → Display → Separator (0101)



Description Select decimal separator for displaying numerical values.

Selection

- .
- ,

Factory setting .

Number format 

Navigation   Expert → System → Display → Number format (0099)

Description Choose number format for the display.



Selection

- Decimal
- ft-in-1/16"

Factory setting Decimal

Additional information The **ft-in-1/16"** option is only valid for distance units.

Decimal places menu 

Navigation   Expert → System → Display → Dec. places menu (0573)

Description Select number of decimal places for the representation of numbers within the operating menu.

Selection	<ul style="list-style-type: none"> ■ X ■ X.X ■ X.XX ■ X.XXX ■ X.XXXX
Factory setting	x.xxxx
Additional information	<ul style="list-style-type: none"> ■ Is only valid for numbers in the operating menu (e.g. Empty calibration, Full calibration), but not for the measured value display. The number of decimal places for the measured value display is defined in the Decimal places 1 to 4 → 30 parameters. ■ The setting does not affect the accuracy of the measurement or the calculations.

Contrast display

Navigation	Expert → System → Display → Contrast display (0105)
Description	Adjust local display contrast setting to ambient conditions (e.g. lighting or reading angle).
User entry	20 to 80 %
Factory setting	Dependent on the display.
Additional information	Setting the contrast via push-buttons: <ul style="list-style-type: none"> ■ Darker: press the and buttons simultaneously. ■ Brighter: press the and buttons simultaneously.

Backlight

Navigation	Expert → System → Display → Backlight (0111)
Prerequisite	The device has the SD03 local display (with optical keys).
Description	Switch the local display backlight on and off.
Selection	<ul style="list-style-type: none"> ■ Disable ■ Enable
Factory setting	Disable
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ■ Disable Switches the backlight off. ■ Enable Switches the backlight on. Regardless of the setting in this parameter the backlight may be automatically switched off by the device if the supply voltage is too low.

Access status display

Navigation Expert → System → Display → Access stat.disp (0091)**Prerequisite**

The device has a local display.







Description

Indicates access authorization to parameters via local display.

User interface


- Operator
- Maintenance
- Service

Additional information

-  If a  symbol appears in front of a parameter, the parameter cannot be changed via the local display with the current access authorization.
-  The access authorization can be changed via the **Enter access code** parameter (→  25).
-  If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter (→  23).

3.3.3 "Configuration backup display" submenu

 This submenu is only visible if a display module is connected to the device.

All software configurations are initially stored in a memory module (HistoROM) in the housing and are thus permanently connected with the device. As an additional option, the display module contains a backup memory for the device configuration. The transmission of configuration data between these two memory modules is controlled by the **Configuration management** parameter (→  37). It provides the following options:

- **Execute backup**

Saves the current device configuration in the display module.

- **Restore**


This option can be used to restore a configuration back into the device which has previously been saved in the display module.

- **Duplicate**

If the configuration has been saved into the display module, the module can be connected to a different device and the configuration can be duplicated to this device. This allows to efficiently configure a number of devices in the same way.

- **Compare**






The comparison result indicates whether the device configuration has been changed since the last backup.

 If an existing backup is restored to a different device using the **Restore** option, it may occur that some device functionalities are no longer available. Even a reset to the delivery state won't restore the original state in some cases.

In order to transfer the configuration to a different device only the **Duplicate** option should be used.

Structure of the submenu


Navigation  Expert → System → Conf.backup disp

► Configuration backup display	
Operating time	→  37
Last backup	→  37
Configuration management	→  37
Backup state	→  38
Comparison result	→  38

Description of parameters

Navigation  Expert → System → Conf.backup disp

Operating time

Navigation  Expert → System → Conf.backup disp → Operating time (0652)

Description Indicates how long the device has been in operation.

User interface Days (d), hours (h), minutes (m), seconds (s)

Additional information *Maximum time*
9 999 d (≈ 27 years)

Last backup

Navigation  Expert → System → Conf.backup disp → Last backup (0102)

Description Indicates when the last data backup was saved to the display module.

User interface Days (d), hours (h), minutes (m), seconds (s)

Configuration management

Navigation  Expert → System → Conf.backup disp → Config. managem. (0100)

Description Select action for managing the device data in the display module.

Selection

- Cancel
- Execute backup
- Restore
- Duplicate
- Compare
- Clear backup data

Factory setting Cancel

Additional information **Meaning of the options**

- **Cancel**
No action is executed and the user exits the parameter.
- **Execute backup**
A backup copy of the current device configuration in the HistoROM (built-in in the device) is saved to the display module of the device.
- **Restore**
The last backup copy of the device configuration is copied from the display module to the HistoROM of the device.


- **Duplicate**

The transmitter configuration is duplicated to another device using the transmitter display module. The following parameters, which characterize the individual measuring point are **not** included in the transmitted configuration:

Medium type

- **Compare**

The device configuration saved in the display module is compared to the current device configuration of the HistoROM. The result of this comparison is displayed in the

Comparison result parameter (→  38).

- **Clear backup data**

The backup copy of the device configuration is deleted from the display module of the device.



While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.




If an existing backup is restored to a different device using the **Restore** option, it may occur that some device functionalities are no longer available. In some cases even a device reset will not restore the original status.

In order to transmit a configuration to a different device, the **Duplicate** option should always be used.

Backup state

Navigation

 Expert → System → Conf.backup disp → Backup state (0121)

Description

Displays which backup action is currently in progress.

Comparison result

Navigation

  Expert → System → Conf.backup disp → Compar. result (0103)

Description

Displays the comparison result between the device and the display.

Additional information

Meaning of the display options

- **Settings identical**

The current device configuration of the HistoROM is identical to the backup copy in the display module.

- **Settings not identical**

The current device configuration of the HistoROM is not identical to the backup copy in the display module.

- **No backup available**

There is no backup copy of the device configuration of the HistoROM in the display module.

- **Backup settings corrupt**

The current device configuration of the HistoROM is corrupt or not compatible with the backup copy in the display module.


- **Check not done**

The device configuration of the HistoROM has not yet been compared to the backup copy in the display module.


- **Dataset incompatible**

The data sets are incompatible and can not be compared.



To start the comparison, set **Configuration management** (→  37) = **Compare**.



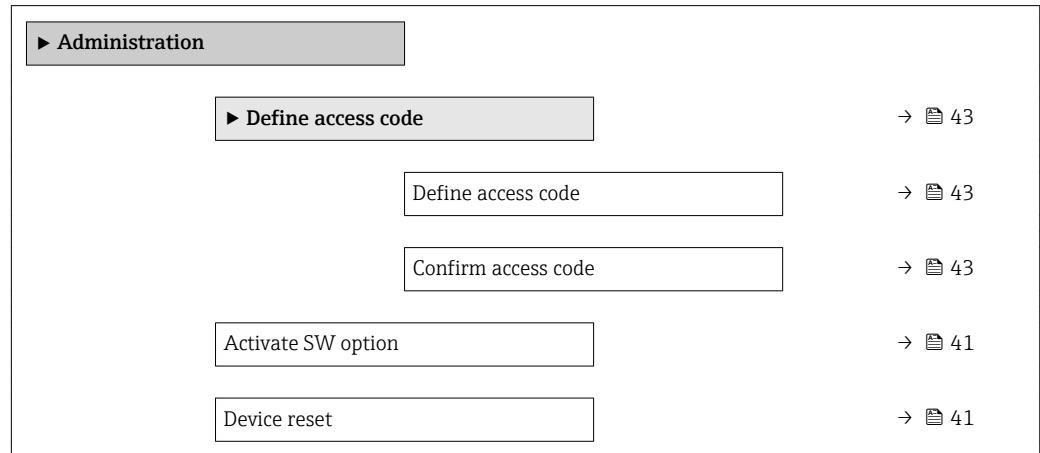
If the transmitter configuration has been duplicated from a different device by **Configuration management** (→  37) = **Duplicate**, the new device configuration in the HistoROM is only partially identical to the configuration stored in the display module: Sensor specific properties (e.g. the mapping curve) are not duplicated. Thus, the result of the comparison will be **Settings not identical**.

3.3.4 "Administration" submenu

The **Administration** submenu contains all parameters for the management of the device. Its structure depends on the user interface:

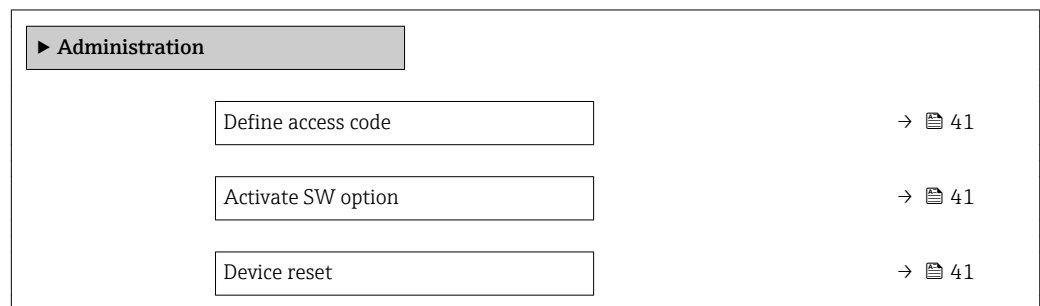
Structure of the submenu on the local display

Navigation  Expert → System → Administration




Structure of the submenu in an operating tool


Navigation  Expert → System → Administration



Description of parameters

Navigation  Expert → System → Administration

Define access code 










Navigation  Expert → System → Administration → Def. access code (0093)

Description Define release code for write access to parameters.

User entry 0 to 9999

Factory setting 0

Additional information

-  If the factory setting is not changed or 0 is defined as the access code, the parameters are not write-protected and the configuration data of the device can then always be modified. The user is logged on in the *Maintenance* role.
-  The write protection affects all parameters marked with the  symbol in this document. On the local display, the  symbol in front of a parameter indicates that the parameter is write-protected.
-  Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→  25).
-  Please contact your Endress+Hauser Sales Center if you lose your access code.
-  For display operation: The new access code is only valid after it has been confirmed in the **Confirm access code** parameter (→  43).


Activate SW option 



Navigation   Expert → System → Administration → Activate SW opt. (0029)

Description Enter code to unlock specific software options.

User entry Positive integer

Factory setting 0

Device reset 

Navigation   Expert → System → Administration → Device reset (0000)

Description Select to which state the device is to be reset.

Selection

- Cancel
- To factory defaults
- To delivery settings

- Of customer settings
- To transducer defaults
- Restart device

Factory setting

Cancel

Additional information**Meaning of the options****■ Cancel**

No action

■ To factory defaults

All parameters are reset to the order-code specific factory setting.

■ To delivery settings

All parameters are reset to the delivery setting. The delivery setting may differ from the factory default if customer specific settings have been ordered.

This option is only visible if customer specific settings have been ordered.

■ Of customer settings

All customer parameters are reset to their factory setting. Service parameters, however, remain unchanged.

■ To transducer defaults

Every measurement-related parameter is reset to its factory setting. Service parameters and communication-related parameters, however, remain unchanged.


■ Restart device

The restart resets every parameter which is stored in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.

"Define access code" wizard


Navigation  Expert → System → Administration → Def. access code

Define access code

Navigation  Expert → System → Administration → Def. access code → Def. access code

Description →  41

Confirm access code

Navigation  Expert → System → Administration → Def. access code → Confirm code

Description Confirm the entered access code.

User entry 0 to 9999

Factory setting 0

3.4 "Sensor" submenu

The **Sensor** submenu contains all parameters related to the measurement and the sensor settings.

3.4.1 Structure of the submenu

Navigation  Expert → Sensor

▶ Sensor	
Distance unit	→ 46
Temperature unit	→ 46
Tank type	→ 46
Tube diameter	→ 47
Bin type	→ 47
Max. filling speed liquid	→ 47
Max. draining speed liquid	→ 48
Max. filling speed solid	→ 48
Max. draining speed solid	→ 49
Advanced process conditions	→ 49
Application parameter	→ 50
▶ Medium	→ 51
▶ Level	→ 55
▶ Linearization	→ 66
▶ Information	→ 75
▶ Sensor properties	→ 81
▶ Distance	→ 84
▶ Gas phase compensation	→ 93
▶ Sensor diagnostics	→ 97
▶ Safety settings	→ 103

▶ Envelope curve	→ 111
▶ Mapping	→ 118
▶ Echo tracking	→ 128
▶ Tank bottom evaluation	→ 132

3.4.2 Description of parameters

Navigation  Expert → Sensor

Distance unit

Navigation  Expert → Sensor → Distance unit (0551)


Description Select distance unit.

Selection

<i>SI units</i>	<i>US units</i>
■ mm	■ ft
■ m	■ in

Factory setting m

Temperature unit

Navigation  Expert → Sensor → Temperature unit (0557)


Description Select temperature unit.

Selection

<i>SI units</i>	<i>US units</i>
■ °C	■ °F
■ K	■ °R

Factory setting °C

Tank type

Navigation  Expert → Sensor → Tank type (1175)


Prerequisite **Medium type** (→  52) = **Liquid**




Description Select tank type.


Selection




- Bypass / pipe
- Stilling well
- Workbench test
- Open channel
- Sphere
- Storage vessel
- Process vessel standard
- Process vessel with agitator
- Wave guide antenna


Factory setting	Depending on the antenna
Additional information	Depending on the antenna some of the options mentioned above may not be available or there may be additional options.




Tube diameter


Navigation	  Expert → Sensor → Tube diameter (1117)
Prerequisite	Tank type (→  46) = Bypass / pipe
Description	Specify diameter of bypass or stilling well.
User entry	0 to 9.999 m
Factory setting	0 m


Bin type




Navigation	  Expert → Sensor → Bin type (1176)
Prerequisite	Medium type (→  52) = Solid
Description	Specify bin type.
Selection	<ul style="list-style-type: none"> ■ Buffer silo (fast) ■ Bin / Pile ■ Crusher / belt ■ Silo ■ Workbench test
Factory setting	Silo

Max. filling speed liquid




Navigation	  Expert → Sensor → Max. fill liquid (1212)
Prerequisite	Medium type (→  52) = Liquid
Description	Select expected maximum filling speed.
Selection	<ul style="list-style-type: none"> ■ Slow < 1cm (0,4in) /min ■ Medium < 10cm (4in) /min ■ Standard < 1m (40in) /min

- Fast < 2m (80in) /min
- Very fast > 2m (80in) /min
- No filter / test

Factory setting Depending on the **Tank type** parameter (→  46)

Additional information **Max. filling speed liquid** is preset by **Tank type** (→  46). It can, however, be adjusted to the process in the vessel at any time. If **Tank type** (→  46) is changed again at a later point of time, it may be necessary to repeat the fine adjustment.


Max. draining speed liquid




Navigation   Expert → Sensor → Max drain liquid (1202)

Prerequisite **Medium type** (→  52) = **Liquid**

Description Select expected maximum draining speed.

- Selection**
- Slow < 1cm (0,4in) /min
 - Medium < 10cm (4in) /min
 - Standard < 1m (40in) /min
 - Fast < 2m (80in) /min
 - Very fast > 2m (80in) /min
 - No filter / test

Factory setting Depending on the **Tank type** parameter (→  46)

Additional information **Max. draining speed liquid** (→  48) is preset by **Tank type** (→  46). It can, however, be adjusted to the process in the vessel at any time. If **Tank type** (→  46) is changed again at a later point of time, it may be necessary to repeat the fine adjustment.

Max. filling speed solid

Navigation   Expert → Sensor → Max. fill. solid (1214)

Prerequisite **Medium type** (→  52) = **Solid**

Description Select expected maximum filling speed.

- Selection**
- Very slow < 0,5m (1,6ft) /h
 - Slow < 1m (3,3ft) /h
 - Standard < 2m (6,5ft) /h
 - Medium < 4m (13ft) /h
 - Fast < 8m (26ft) /h
 - Very fast > 8m (26ft) /h
 - No filter / test

Factory setting Standard < 2m (6,5ft) /h

Additional information It is strongly recommended to adjust this parameter to the actual maximum filling speed of the process.

Max. draining speed solid

Navigation   Expert → Sensor → Max.drain solid (1213)

Prerequisite **Medium type** (→  52) = **Solid**

Description Select expected maximum draining speed.



Selection

- Very slow < 0,5m (1,6ft) /h
- Slow < 1m (3,3ft) /h
- Standard < 2m (6,5ft) /h
- Medium < 4m (13ft) /h
- Fast < 8m (26ft) /h
- Very fast > 8m (26ft) /h
- No filter / test

Factory setting Standard < 2m (6,5ft) /h

Additional information It is strongly recommended to adjust this parameter to the actual maximum draining speed of the process.

Advanced process conditions

Navigation   Expert → Sensor → Adv. conditions (1177)


Description Specify additional process conditions (if required).

Selection

- Foam (>5cm/0,16ft)
- Changing DC values
- Many obstacles
- Small tanks (< 1m/3ft)
- Weak signal

Factory setting None

Additional information *"Foam (>5cm/0,16ft)" option*


This option makes sure that no tank history is used which has been recorded while foam was present at the surface and thus is no reliable map of the tank property. To achieve this, the setting **Evaluation mode** (→  129) = **Long time history** is deactivated.




The **Foam (>5cm/0,16ft)** option is only available for liquid applications (FMR50, FMR51, FMR52, FMR53, FMR54).

"Changing DC values" option


A tank history which has been recorded with **Evaluation mode** (→  129) = **Long time history** is only valid for a fixed dielectric constant. The **Changing DC values** option

disables the setting **Evaluation mode** (→  129) = **Long time history** and thus avoids wrong measuring values in the case of a changing dielectric constant.


 The **Changing DC values** option is only available for liquid applications (FMR50, FMR51, FMR52, FMR53, FMR54).

"Many obstacles" option

This option optimizes the signal evaluation for bulk solid applications with a large measuring range where obstacles generate many interference echos. With this selection the last echo in the envelope curve will always be evaluated. For strongly damping media this is always the level echo.


 The **Many obstacles** option is only available for bulk solid applications (FMR56, FMR57).

Preconditions for the application of the "Many obstacles" option

- **Medium type** (→  52) = **Solid**
 - Strongly damping medium (e.g. flour, wheat, cereals, ...)
 - No multiple echos if the tank is full
 - Interference echo suppression only in the near field (ringing area)
 - Expert → Sensor → Echo tracking → Evaluation mode (1112) = Short time history


"Small tanks (< 1m/3ft)" option

This option provides a simple possibility to reduce the echo width of the sensor module. This enables an improved detection of superimposed echos - especially in the near field. Internally, all parameters related to the echo width are adjusted by this option.






 The **Small tanks (< 1m/3ft)** option is only available for liquid measurements with 26 GHz HF module (FMR50, FMR51, FMR52).

"Weak signal" option

This option improves the detectability of small level echos in bulk solid applications with very weak signal amplitudes.

 The **Weak signal** option is only available for bulk solid measurements (FMR56, FMR57).


Application parameter





Navigation	  Expert → Sensor → Applicat. param. (1126)
Description	Indicates whether settings depending on the application parameters (e.g. Advanced process conditions (→  49), Tank type (→  46) and Tube diameter (→  47)) have been changed after the basic setup.
User interface	<ul style="list-style-type: none"> ▪ Changed ▪ Not changed
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ▪ Changed Parameters have been changed. The device is no longer in the state defined by the application parameters. ▪ Not changed There have been no changes. The device is still in the state defined by the application parameters.

3.4.3 "Medium" submenu


The **Medium** submenu is used to specify the relevant properties of the measured medium, especially the dielectric constant (DC).

Structure of the submenu



Navigation  Expert → Sensor → Medium

▶ Medium	
Medium type	→  52
Medium group	→  52
Medium property	→  53
Calculated DC value	→  53





Description of parameters


Navigation  Expert → Sensor → Medium


Medium type


Navigation	 Expert → Sensor → Medium → Medium type (1049)
Description	Specify type of medium.
User interface	<ul style="list-style-type: none"> ▪ Liquid ▪ Solid
Factory setting	<ul style="list-style-type: none"> ▪ FMR50, FMR51, FMR52, FMR53, FMR54: Liquid ▪ FMR56, FMR57: Solid
Additional information	 This parameter determines the value of several other parameters and strongly influences the complete signal evaluation. Therefore, it is strongly recommended not to change the factory setting.

Medium group

Navigation	 Expert → Sensor → Medium → Medium group (1208)
Prerequisite	Medium type (→  52) = Liquid
Description	Select medium group.
Selection	<ul style="list-style-type: none"> ▪ Others ▪ Water based (DC >= 4)
Factory setting	Others
Additional information	<p>This parameter roughly specifies the dielectric constant (DC) of the medium. For a more detailed definition of the DC use the Medium property parameter (→  53).</p> <p>The Medium group parameter presets the Medium property parameter (→  53) as follows:</p>

Medium group	Medium property (→  53)
Others	Unknown
Water based (DC >= 4)	DC 4 ... 7

 The **Medium property** parameter can be changed at a later point of time. However, when doing so, the **Medium group** parameter retains its value. Only the **Medium property** parameter is relevant for the signal evaluation.

 The measuring range may be reduced for small dielectric constants. For details refer to the Technical Information (TI) of the respective device.

Medium property



Navigation Expert → Sensor → Medium → Medium property (1165)

Description Specify relative dielectric constant ϵ_r of the medium.

- Selection**
- Unknown
 - DC 1.4 ... 1.6
 - DC 1.6 ... 1.9
 - DC 1.9 ... 2.5
 - DC 2.5 ... 4
 - DC 4 ... 7
 - DC 7 ... 15
 - DC > 15

Factory setting Dependent on **Medium type** (→ 52) and **Medium group** (→ 52).

Additional information *Dependency on "Medium type" and "Medium group"*

Medium type (→ 52)	Medium group (→ 52)	Medium property
Solid		Unknown
Liquid	Water based (DC >= 4)	DC 4 ... 7
	Others	Unknown

- For dielectric constants (DC values) of many media commonly used in various industries refer to:
- the Endress+Hauser DC manual (CP01076F)
 - the Endress+Hauser "DC Values App" (available for Android and iOS)

Calculated DC value


Navigation Expert → Sensor → Medium → Calc. DC value (1118)

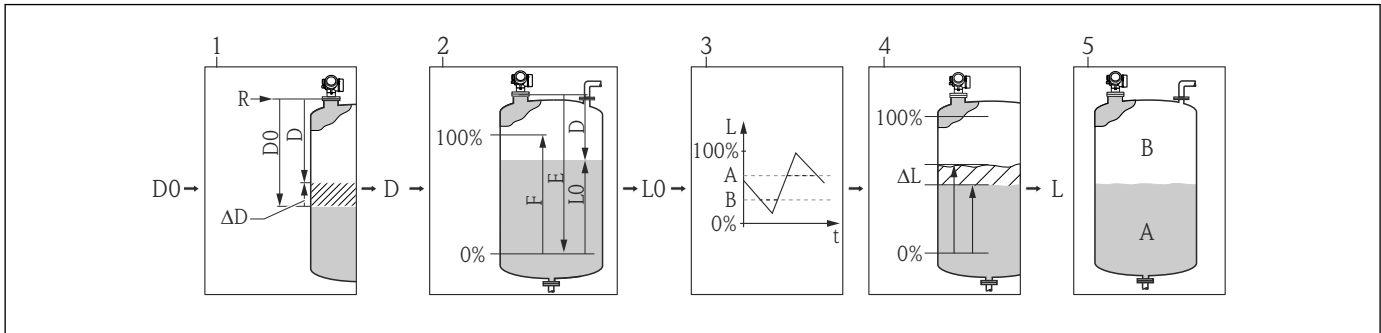
Description Displays the dielectric constant calculated by the device.

User interface 1.0 to 100.0

Additional information The calculation is only possible for small DC values as it requires the tank bottom signal.

3.4.4 "Level" submenu

The **Level** submenu (→  55) is used to configure the calculation of the level from the measured distance.
















A0016141

 6 Calculation of the level from the measured distance

- 1 Correction of the measured distance
- 2 Level calculation
- 3 Level limitation
- 4 Correction of the level
- 5 Definition of the output value: Level (A) or Ullage (B)


Structure of the submenu*Navigation*   Expert → Sensor → Level

► Level	
Distance offset	→  56
Distance	→  57
Empty calibration	→  57
Full calibration	→  58
Level unit	→  59
Level limit mode	→  60
High limit	→  60
Low limit	→  61
Level correction	→  61
Output mode	→  61
Level	→  62
Level linearized	→  63
Tank/silo height	→  63

Description of parameters

Navigation  Expert → Sensor → Level

Distance offset

Navigation  Expert → Sensor → Level → Distance offset (2309)

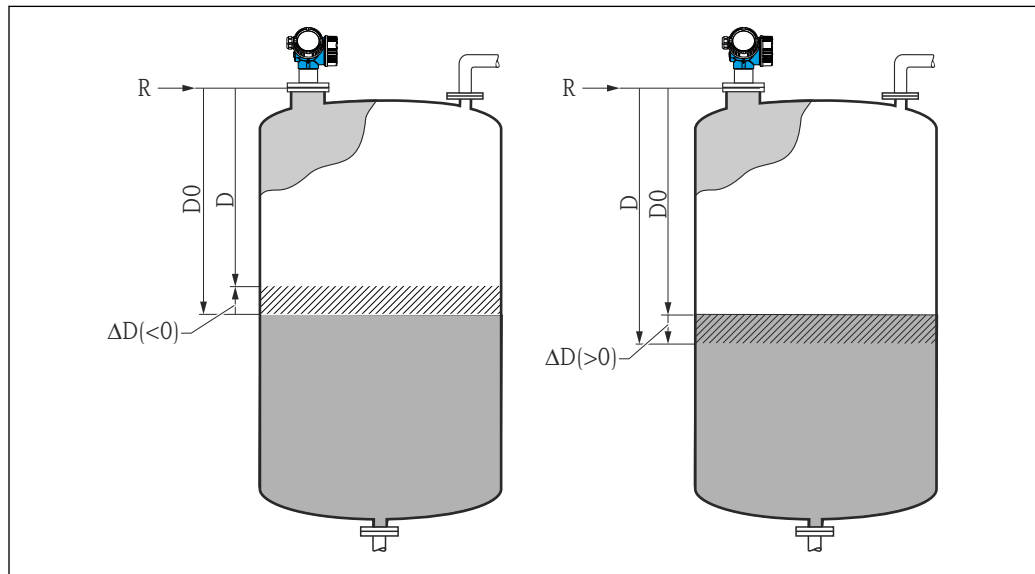
Description Specify distance offset.

User entry -200 to 200 m

Factory setting 0 m


Additional information The value specified in this parameter is added to the measured distance between the reference point of the measurement and the level echo.

- Positive values increase the distance and thus decrease the level.
- Negative values decrease the distance and thus increase the level.



 7 Effect of "Distance offset" (→  56)

ΔD Distance offset
 $D0$ Measured distance
 D Corrected distance (is used to calculate the level)
 R Reference point

-  ■ The value entered in this parameter changes the distance input into the level block and thus influences the measured level.
- The distance without offset is displayed in the following parameters:
 - Setup → Distance (1124)
 - Expert → Sensor → Distance → Distance (1124)
 - Expert → Sensor → Mapping → Distance (1124)
- The distance with offset is displayed in the following parameters:
 - Expert → Sensor → Level → Distance (2231)

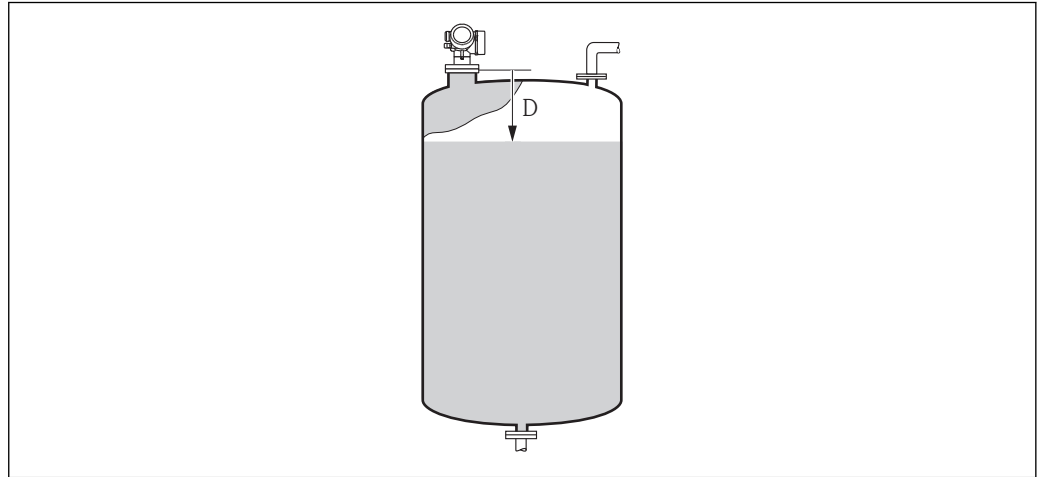
Distance

Navigation

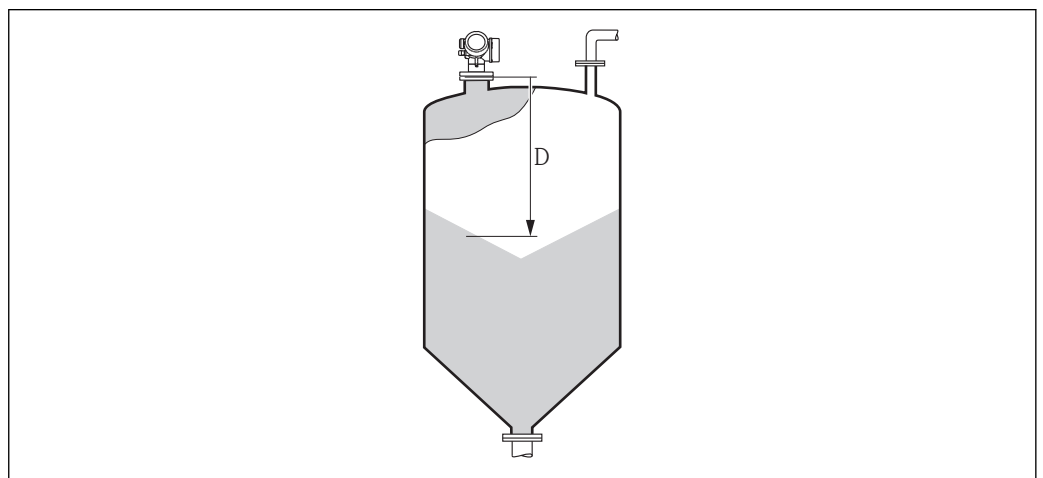
Expert → Sensor → Level → Distance (2231)

Description

Displays the measured distance D from the reference point (lower edge of the flange or threaded connection) to the level. The **Distance offset** parameter (→ 56) is included in the displayed value.

Additional information

A0019483

 8 *Distance for level measurements*


A0019485

 9 *Distance for bulk solid measurements*

The unit is defined by the **Distance unit** parameter (→ 46).

Empty calibration

**Navigation**

Expert → Sensor → Level → Empty calibr. (2343)

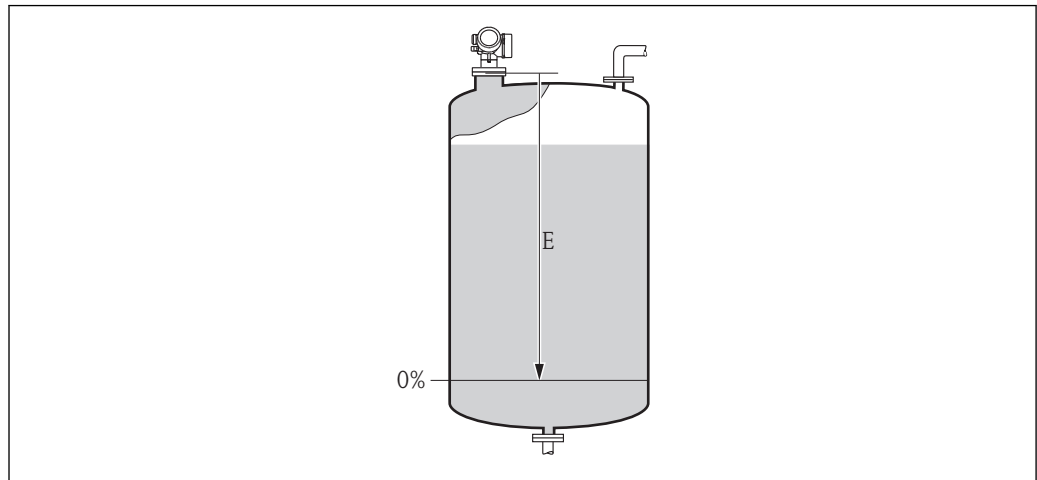
Description

Specify the distance E between the process connection and the minimum level (0%). This defines the starting point of the measuring range.


User entry Depending on the antenna

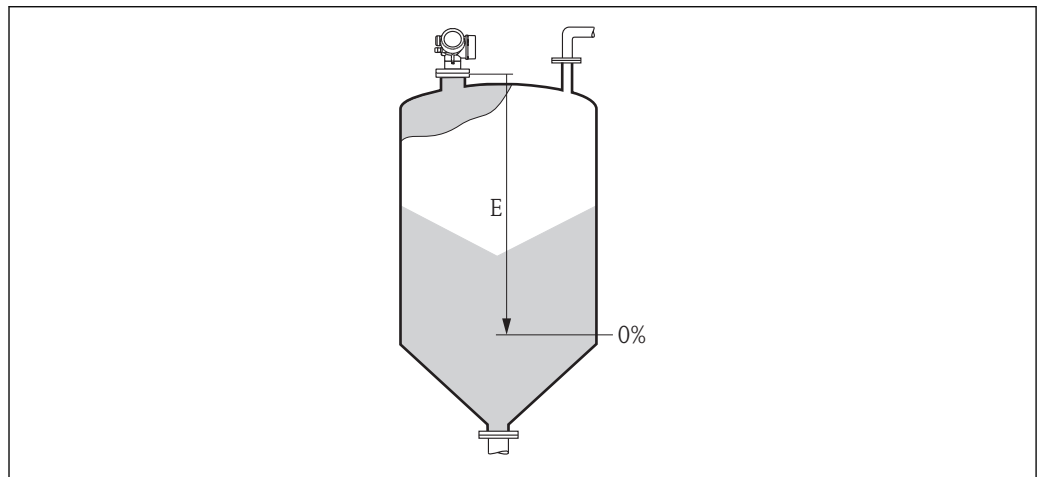
Factory setting Depending on the antenna

Additional information





A0019466

 10 Empty calibration (E) for level measurements in liquids



A0019468

 11 Empty calibration (E) for level measurements in bulk solids.

 The measuring range starts at the point at which the radar beam hits the tank or silo bottom. In the case of dished boiler ends or conical outlets levels below this point can not be measured.

Full calibration



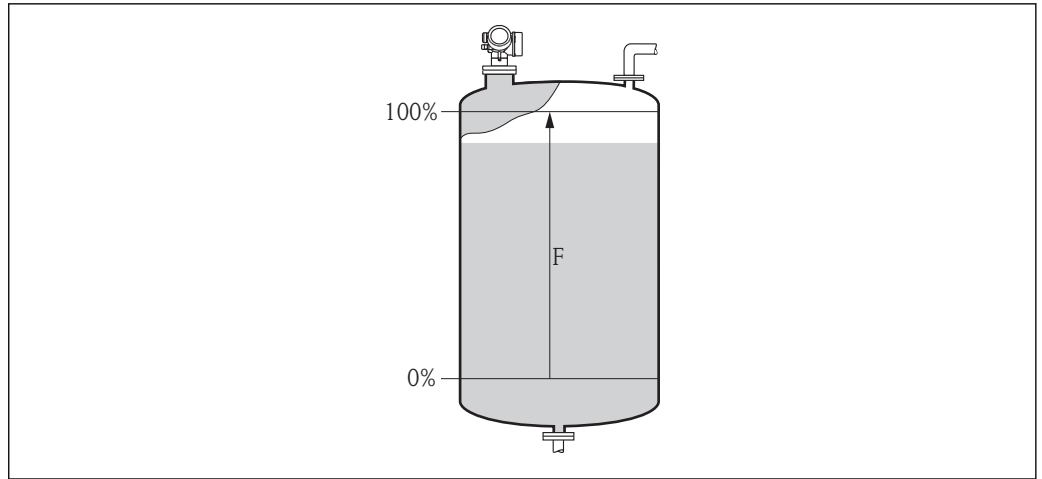
Navigation  Expert → Sensor → Level → Full calibr. (2308)

Description Specify the distance F between the minimum level (0%) and the maximum level (100%).

User entry Depending on the antenna

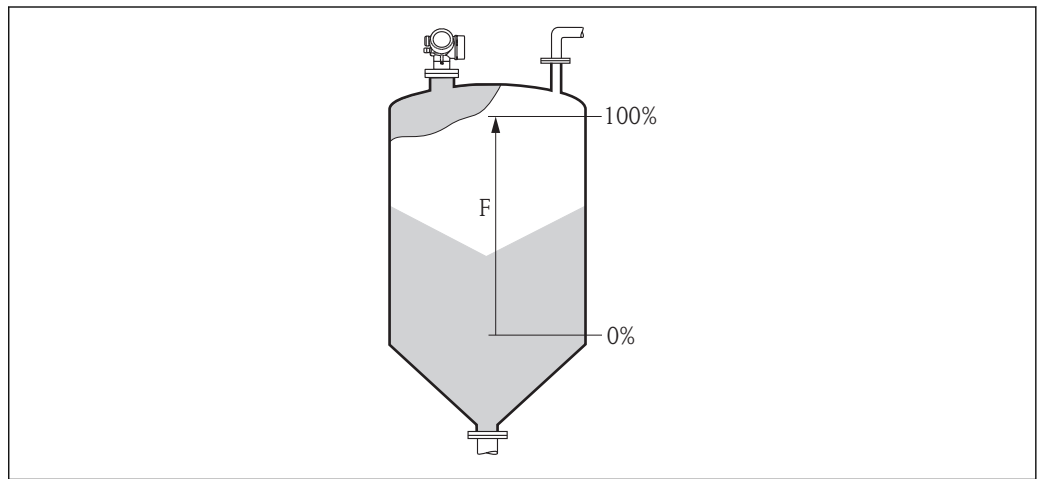
Factory setting Depending on the antenna

Additional information



A0019487

12 Full calibration (F) for level measurements in liquids



A0019489

13 Full calibration (F) for level measurements in bulk solids

Level unit



Navigation

Expert → Sensor → Level → Level unit (0576)

Description

Select level unit.

Selection

SI units

- %
- m
- mm

US units

- ft
- in

Factory setting

%

Additional information

The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 46):

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration** (→ 57) and **Full calibration** (→ 58)).
- The unit defined in the **Level unit** parameter is used to display the (nonlinearized) level.

Level limit mode
**Navigation**

Expert → Sensor → Level → Level limit mode (2314)

Description

Select the type of level limitation.

Selection

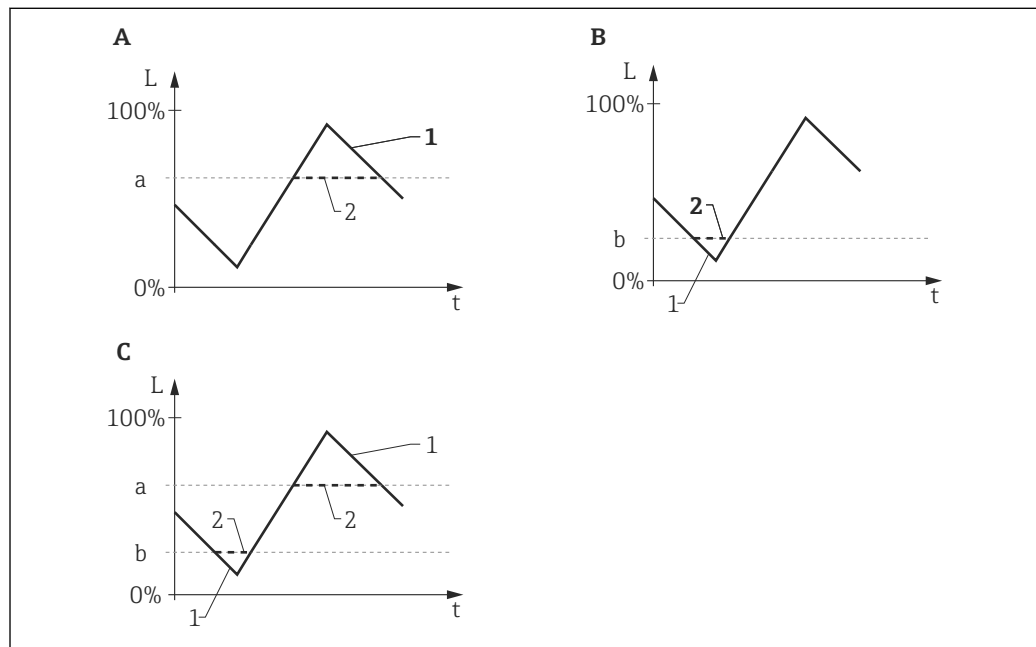
- Off
- Low limit
- High limit
- Low and High Limit

Factory setting

Low limit

Additional information

The parameter determines to which direction the level is limited. The exact limits are defined in the **High limit** (→ 60) und **Low limit** (→ 61) parameters.



A0016083

14 Effect of the "Level limit mode", "High limit" and "Low limit" parameters

- A "Level limit mode" = "High limit"
 B "Level limit mode" = "Low limit"
 C "Level limit mode" = "Low and High Limit"
 a "High limit"
 b "Low limit"
 1 Level before limitation
 2 Level after limitation

High limit
**Navigation**

Expert → Sensor → Level → High limit (2312)

Prerequisite**Level limit mode** (→ 60) = **High limit** or **Low and High Limit****Description**

Specify upper limit.

User entry	Signed floating-point number
Factory setting	0 %
Additional information	Levels exceeding the value specified in this parameter will be ignored. Instead, the device uses the maximum level specified in this parameter (for measured value transformation and output).

Low limit


Navigation	Expert → Sensor → Level → Low limit (2313)
Prerequisite	Level limit mode (→ 60) = Low limit or Low and High Limit
Description	Specify lower level limit.
User entry	-200 000.0 to 200 000.0 %
Factory setting	0.0 %
Additional information	Levels falling below the value specified in this parameter will be ignored. Instead, the device uses the minimum level specified in this parameter (for measured value transformation and output).

Level correction


Navigation	Expert → Sensor → Level → Level correction (2325)
Description	Specify level correction (if required).
User entry	-200 000.0 to 200 000.0 %
Factory setting	0.0 %
Additional information	The value specified in this parameter is added to the measured level (before linearization).

Output mode


Navigation	Expert → Sensor → Level → Output mode (2317)
Description	Select output mode.
Selection	<ul style="list-style-type: none"> ■ Ullage ■ Level linearized
Factory setting	Level linearized

Additional information

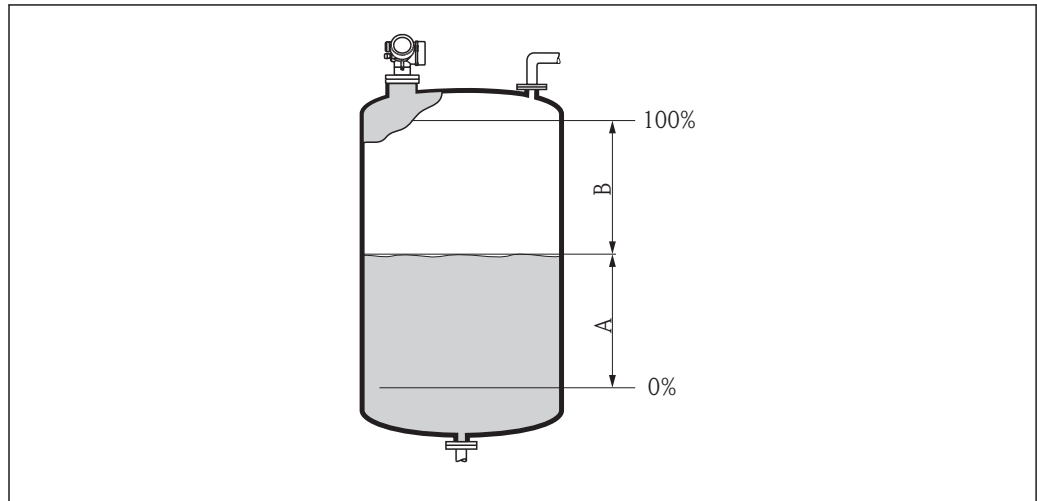
Meaning of the options

■ **Ullage**

The remaining space in the tank or silo is indicated.

■ **Level linearized**

The level is indicated (more precisely: the linearized value if a linearization has been activated).



A0016086

15 Definition of the "Output mode (→ 61)" parameter

A Level linearized

B Ullage

Level

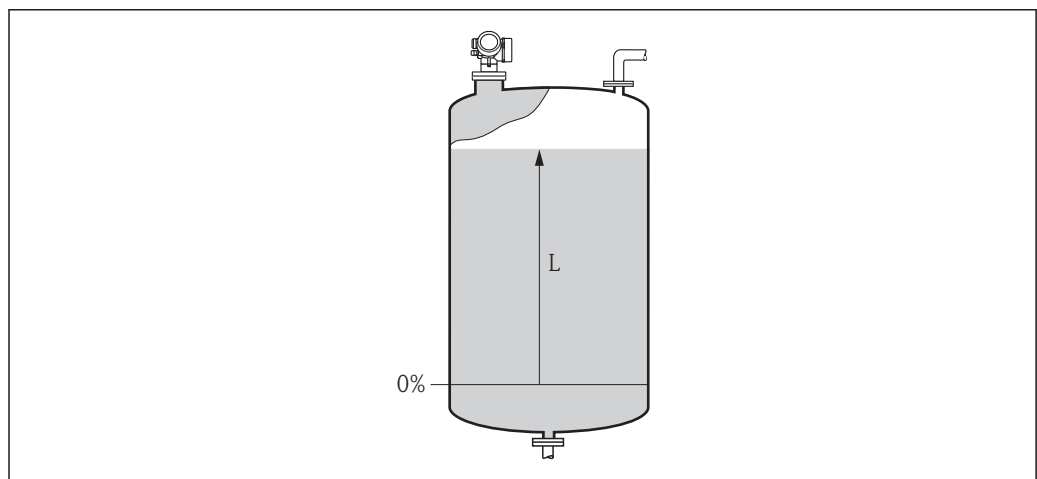
Navigation

Expert → Sensor → Level → Level (2319)

Description

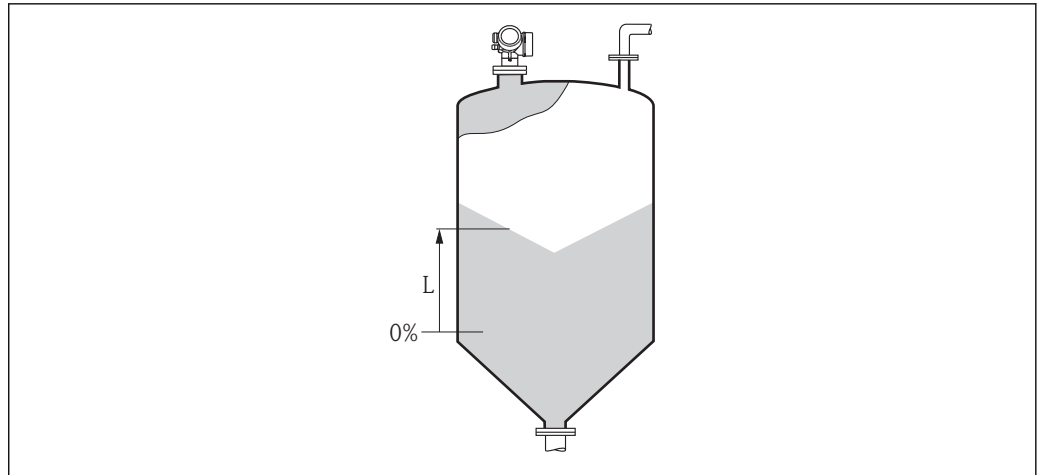
Displays measured level L (before linearization).

Additional information



A0019482

16 Level in case of liquid measurements



A0019484

17 Level in case of bulk solid measurements

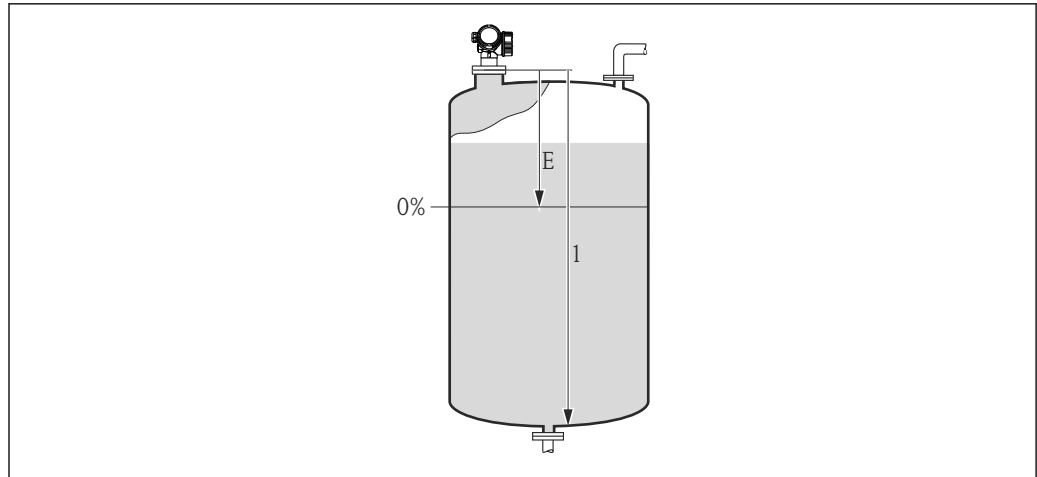
The unit is defined in the **Level unit** parameter (→ 59).

Level linearized

Navigation	Expert → Sensor → Level → Level linearized (2318)
Description	Displays linearized level.
Additional information	The unit is defined by the Unit after linearization parameter → 69.

Tank/silo height

Navigation	Expert → Sensor → Level → Tank/silo height (1148)
Description	Specify total height of the tank or silo as measured from the process connection.
User entry	-999.9999 to 999.9999 m
Factory setting	Empty calibration (→ 57)
Additional information	If the parametrized measuring range (Empty calibration (→ 57)) differs significantly from the tank or silo height, it is recommended to enter the tank or silo height. Example: Continuous level monitoring in the upper third of a tank or silo.

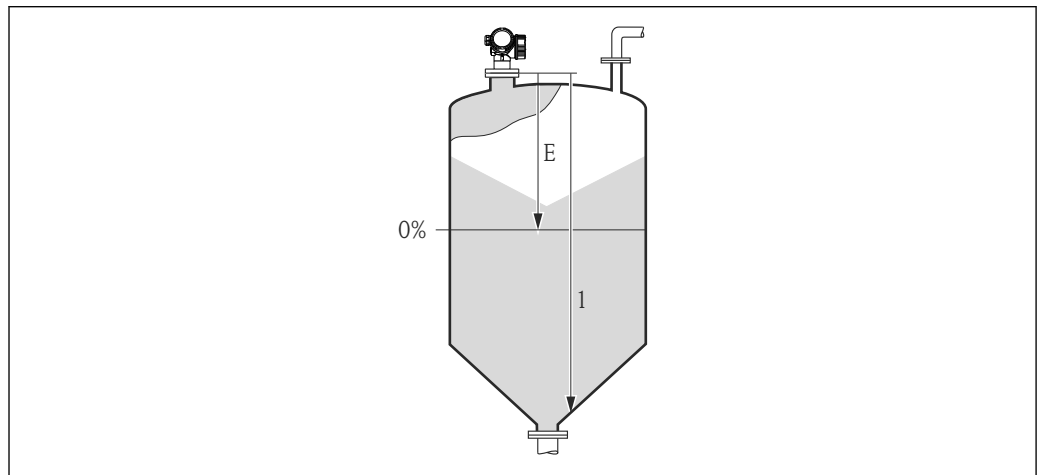


A0019867

18 "Tank/silo height" parameter (→ 63) for measurements in liquids

E Empty calibration (→ 57)

1 Tank/silo height (→ 63)



A0019868

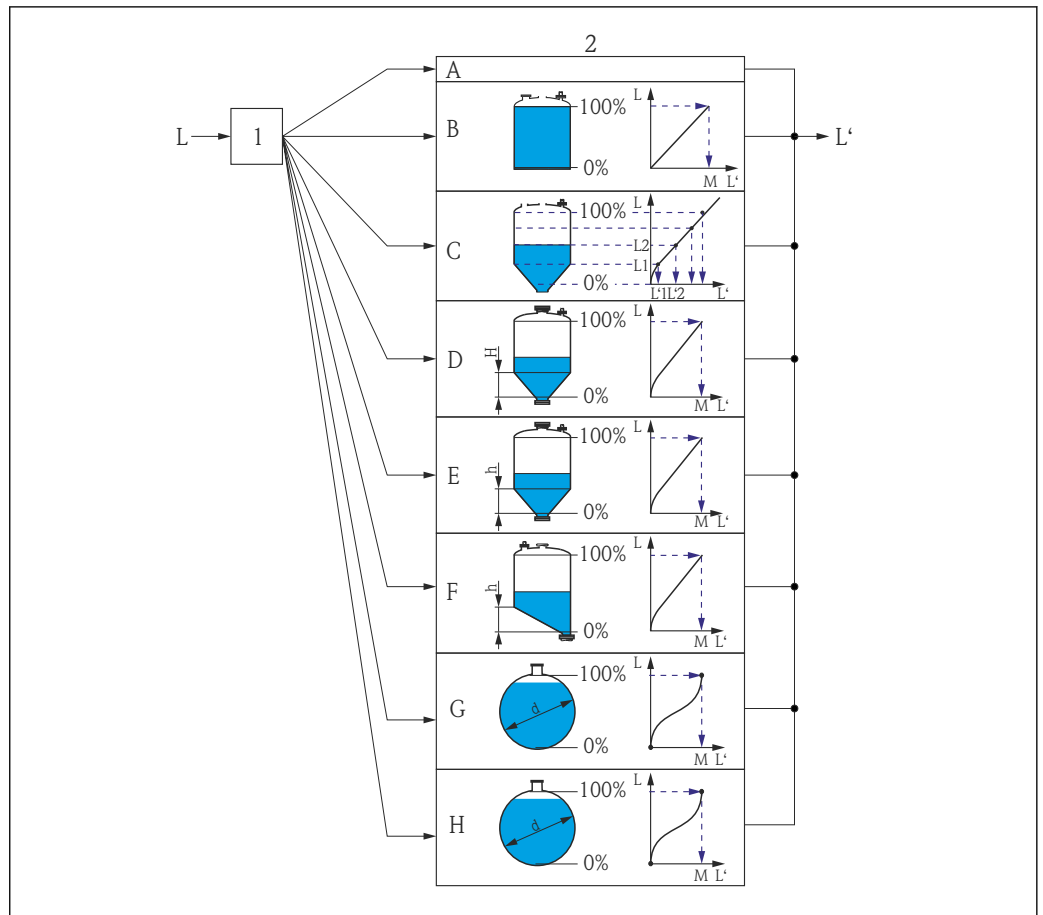
19 "Tank/silo height" parameter (→ 63) for measurements in bulk solids

E Empty calibration (→ 57)

1 Tank/silo height (→ 63)

i For tanks with conical outlet, **Tank/silo height** should not be changed as in this type of applications **Empty calibration** (→ 57) is usually **not** << the tank or silo height.


3.4.5 "Linearization" submenu











20 Linearization: Transformation of the level into a volume or weight; the transformation is dependent on the shape of the vessel.


- 1 Selection of linearization type and unit
- 2 Configuration of the linearization
- A Linearization type (→ 68) = None
- B Linearization type (→ 68) = Linear
- C Linearization type (→ 68) = Table
- D Linearization type (→ 68) = Pyramid bottom
- E Linearization type (→ 68) = Conical bottom
- F Linearization type (→ 68) = Angled bottom
- G Linearization type (→ 68) = Horizontal cylinder
- H Linearization type (→ 68) = Sphere
- L Level before linearization (measured in distance units)
- L' Level linearized (→ 63) (corresponds to volume or weight)
- M Maximum value (→ 71)
- d Diameter (→ 71)
- h Intermediate height (→ 71)














Structure of the submenu on the local display

Navigation  Expert → Sensor → Linearization

► Linearization	
Linearization type	→  68
Unit after linearization	→  69
Free text	→  70
Maximum value	→  71
Diameter	→  71
Intermediate height	→  71
Table mode	→  72
Activate table	→  74

Structure of the submenu in an operating tool (e.g. FieldCare)

Navigation  Expert → Sensor → Linearization

► Linearization	
Linearization type	→  68
Unit after linearization	→  69
Free text	→  70
Level linearized	→  70
Maximum value	→  71
Diameter	→  71
Intermediate height	→  71
Table mode	→  72
Table number	→  73
Level	→  73
Level	→  74
Customer value	→  74
Activate table	→  74

Description of parameters

Navigation Expert → Sensor → Linearization

Linearization type

Navigation

Expert → Sensor → Linearization → Lineariz. type (2339)

Description

Select linearization type.

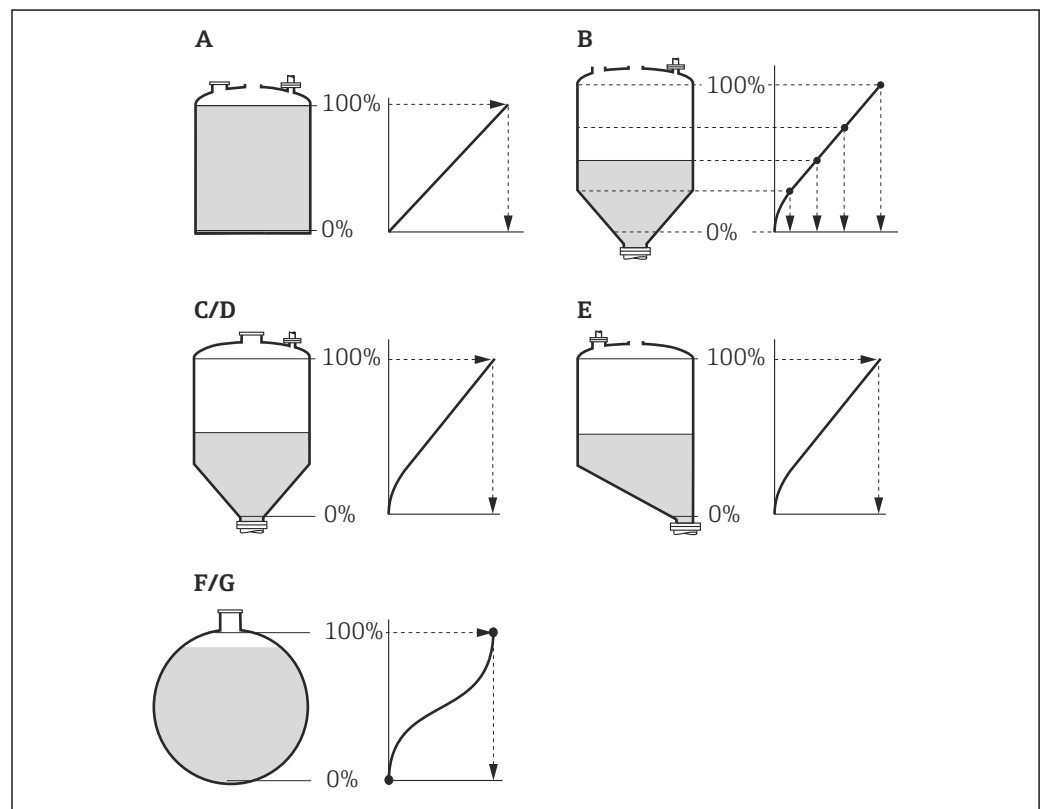
Selection

- None
- Linear
- Table
- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cylinder
- Sphere

Factory setting

None

Additional information



A0021476

21 Linearization types



- A None
- B Table
- C Pyramid bottom
- D Conical bottom
- E Angled bottom
- F Sphere
- G Horizontal cylinder

Meaning of the options**■ None**

The level is transmitted in the level unit without linearization.






■ Linear

The output value (volume/weight) is directly proportional to the level L. This is valid, for example, for vertical cylinders. The following additional parameters have to be specified:

- **Unit after linearization** (→  69)
- **Maximum value** (→  71): Maximum volume or weight




■ Table

The relationship between the measured level L and the output value (volume/weight) is given by a linearization table consisting of up to 32 pairs of values "level - volume" or "level - weight", respectively. The following additional parameters have to be specified:

- **Unit after linearization** (→  69)
- **Table mode** (→  72)
- For each table point: **Level** (→  73)
- For each table point: **Customer value** (→  74)
- **Activate table** (→  74)




■ Pyramid bottom

The output value corresponds to the volume or weight in a silo with pyramid bottom. The following additional parameters have to be specified:

- **Unit after linearization** (→  69)
- **Maximum value** (→  71): Maximum volume or weight
- **Intermediate height** (→  71): The height of the pyramid




■ Conical bottom

The output value corresponds to the volume or weight in a tank with conical bottom. The following additional parameters have to be specified:

- **Unit after linearization** (→  69)
- **Maximum value** (→  71): Maximum volume or weight
- **Intermediate height** (→  71): The height of the conical part of the tank




■ Angled bottom

The output value corresponds to the volume or weight in a silo with an angled bottom. The following additional parameters have to be specified:

- **Unit after linearization** (→  69)
- **Maximum value** (→  71): Maximum volume or weight
- **Intermediate height** (→  71): Height of the angled bottom




■ Horizontal cylinder

The output value corresponds to the volume or weight in a horizontal cylinder. The following additional parameters have to be specified:



- **Unit after linearization** (→  69)
- **Maximum value** (→  71): Maximum volume or weight
- **Diameter** (→  71)

■ Sphere


The output value corresponds to the volume or weight in a spherical tank. The following additional parameters have to be specified:

- **Unit after linearization** (→  69)
- **Maximum value** (→  71): Maximum volume or weight
- **Diameter** (→  71)

Unit after linearization**Navigation**

  Expert → Sensor → Linearization → Unit lineariz. (2340)

Prerequisite

Linearization type (→  68) ≠ None



Description

Select unit of the linearized value.


Selection	<i>SI units</i> <ul style="list-style-type: none"> ■ STon ■ t ■ kg ■ cm³ ■ dm³ ■ m³ ■ hl ■ l ■ % <i>Custom-specific units</i> Free text	<i>US units</i> <ul style="list-style-type: none"> ■ lb ■ UsGal ■ ft³ 	<i>Imperial units</i> impGal
------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------	---------------------------------

Factory setting %

Additional information The selected unit is only used to be indicated on the display. The measured value is **not** transformed according to the selected unit.

 It is also possible to configure a distance-to-distance linearization, i.e. a transformation from the level unit to a different distance unit. To do so, select the **Linear** linearization mode. In order to define the new level unit, select the **Free text** option in the **Unit after linearization** parameter and enter the required unit into the **Free text** parameter (→  70).

Free text

Navigation  Expert → Sensor → Linearization → Free text (2341)

Prerequisite **Unit after linearization** (→  69) = **Free text**

Description Enter unit symbol.

User entry Up to 32 alphanumerical characters (letters, numbers, special characters)

Factory setting Free text

Level linearized

Navigation  Expert → Sensor → Linearization → Level linearized (2318)

Description Displays linearized level.

Additional information  The unit is defined by the **Unit after linearization** parameter →  69.

Maximum value



Navigation	Expert → Sensor → Linearization → Maximum value (2315)
Prerequisite	Linearization type (→ 68) has one of the following values: <ul style="list-style-type: none"> ▪ Linear ▪ Pyramid bottom ▪ Conical bottom ▪ Angled bottom ▪ Horizontal cylinder ▪ Sphere
Description	Specify the maximum content of the vessel (100%) measured in the units after linearization.
User entry	-50 000.0 to 50 000.0 %
Factory setting	100.0 %

Diameter



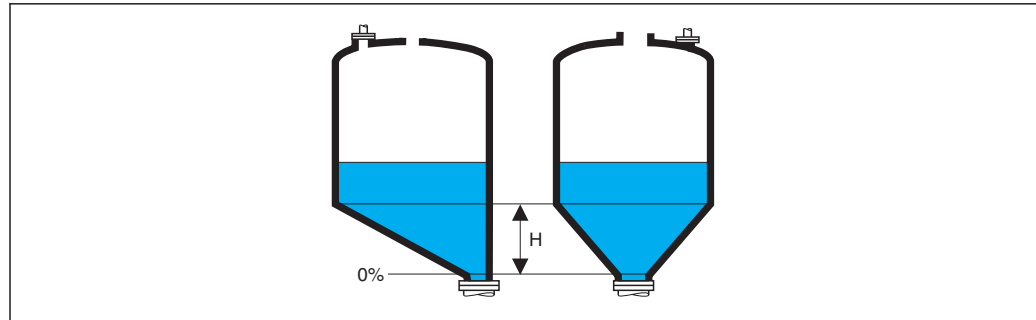
Navigation	Expert → Sensor → Linearization → Diameter (2342)
Prerequisite	Linearization type (→ 68) has one of the following values: <ul style="list-style-type: none"> ▪ Horizontal cylinder ▪ Sphere
Description	Specify tank diameter.
User entry	0 to 9 999.999 m
Factory setting	2 m
Additional information	The unit is defined in the Distance unit parameter (→ 46).

Intermediate height



Navigation	Expert → Sensor → Linearization → Intermed. height (2310)
Prerequisite	Linearization type (→ 68) has one of the following values: <ul style="list-style-type: none"> ▪ Pyramid bottom ▪ Conical bottom ▪ Angled bottom
Description	Specify intermediate height H.
User entry	0 to 200 m
Factory setting	0 m

Additional information



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H Intermediate height

The unit is defined in the **Distance unit** parameter (→ 46).

Table mode



Navigation

Expert → Sensor → Linearization → Table mode (2303)

Prerequisite

Linearization type (→ 68) = Table

Description

Select editing mode of the linearization table.

Selection

- Manual
- Semiautomatic ⁴⁾
- Clear table
- Sort table

Factory setting

Manual

Additional information




Meaning of the options


- **Manual**
The level and the associated linearized value are entered manually for each linearization point.
- **Semiautomatic**
The level is measured by the device for each linearization point. The associated linearized value is entered manually.
- **Clear table**
Deletes the existing linearization table.
- **Sort table**
Rearranges the linearization points into an ascending order.

4) Visibility depends on order options or device settings




Conditions the linearization table must meet:

- The table may consist of up to 32 pairs of values "Level - Linearized Value".
- The table must be monotonic (monotonically increasing or decreasing).
- The first linearization point must refer to the minimum level.
- The last linearization point must refer to the maximum level.

 Before entering a linearization table, the values for **Empty calibration** (→  57) and **Full calibration** (→  58) must be set correctly.

If values of the table need to be changed after the full or empty calibration have been changed, a correct evaluation is only ensured if the existing table is deleted and the complete table is entered again. To do so delete the existing table (**Table mode** (→  72) = **Clear table**). Then enter a new table.

How to enter the table

- Via FieldCare
The table points can be entered via the **Table number** (→  73), **Level** (→  73) and **Customer value** (→  74) parameters. As an alternative, the graphic table editor may be used: Device Operation → Device Functions → Additional Functions → Linearization (Online/Offline)
- Via local display
Select the **Edit table** submenu to call up the graphic table editor. The table is displayed and can be edited line by line.










 The factory setting for the level unit is "%". If you want to enter the linearization table in physical units, you must select the appropriate unit in the **Level unit** parameter (→  59) beforehand.

Table number		
<hr/>		
Navigation	 Expert → Sensor → Linearization → Table number (2370)	
Prerequisite	Linearization type (→  68) = Table	
Description	Select table point you are going to enter or change.	
User entry	1 to 32	
Factory setting	1	



Level (Manual)		
<hr/>		
Navigation	 Expert → Sensor → Linearization → Level (2383)	
Prerequisite	<ul style="list-style-type: none"> ▪ Linearization type (→  68) = Table ▪ Table mode (→  72) = Manual 	
Description	Enter level value of the table point (value before linearization).	
User entry	Signed floating-point number	

Factory setting 0 %

Level (Semiautomatic)

Navigation  Expert → Sensor → Linearization → Level (2389)


Prerequisite

- **Linearization type** (→  68) = **Table**
- **Table mode** (→  72) = **Semiautomatic**

Description Displays measured level (value before linearization). This value is transmitted to the table.

Customer value

Navigation  Expert → Sensor → Linearization → Customer value (2384)



Prerequisite **Linearization type** (→  68) = **Table**


Description Enter linearized value for the table point.

User entry Signed floating-point number

Factory setting 0 %

Activate table

Navigation   Expert → Sensor → Linearization → Activate table (2304)

Prerequisite **Linearization type** (→  68) = **Table**


Description Activate (enable) or deactivate (disable) the linearization table.

Selection


- **Disable**
- **Enable**

Factory setting Disable

Additional information **Meaning of the options**

- **Disable**
The measured level is not linearized.
If **Linearization type** (→  68) = **Table** at the same time, the device issues error message F435.

- **Enable**
The measured level is linearized according to the table.










 When editing the table, the **Activate table** parameter is automatically reset to **Disable** and must be reset to **Enable** after the table has been entered.

3.4.6 "Information" submenu

The **Information** submenu comprises all display parameters which give information about the current state of the measurement.

Structure of the submenu


Navigation  Expert → Sensor → Information

► Information	
Signal quality	→  76
Absolute echo amplitude	→  76
Relative echo amplitude	→  77
Tank bottom echo amplitude	→  78
Found echoes	→  78
Used calculation	→  78
Tank trace state	→  79
Measurement frequency	→  79
Electronic temperature	→  79

Description of parameters

Navigation  Expert → Sensor → Information

Signal quality

Navigation  Expert → Sensor → Information → Signal quality (1047)

Description Displays the signal quality of the level echo.

Additional information

Meaning of the display options

▪ **Strong**

The evaluated echo exceeds the threshold by at least 10 dB.

▪ **Medium**

The evaluated echo exceeds the threshold by at least 5 dB.


▪ **Weak**



The evaluated echo exceeds the threshold by less than 5 dB.

▪ **No signal**


The device does not find a usable echo.

The signal quality indicated in this parameter always refers to the currently evaluated echo: either the level echo or the tank bottom echo. To differentiate between these two, the quality of the tank bottom echo is always displayed in brackets.

 In case of a lost echo (**Signal quality = No signal**) the device generates the following error message:

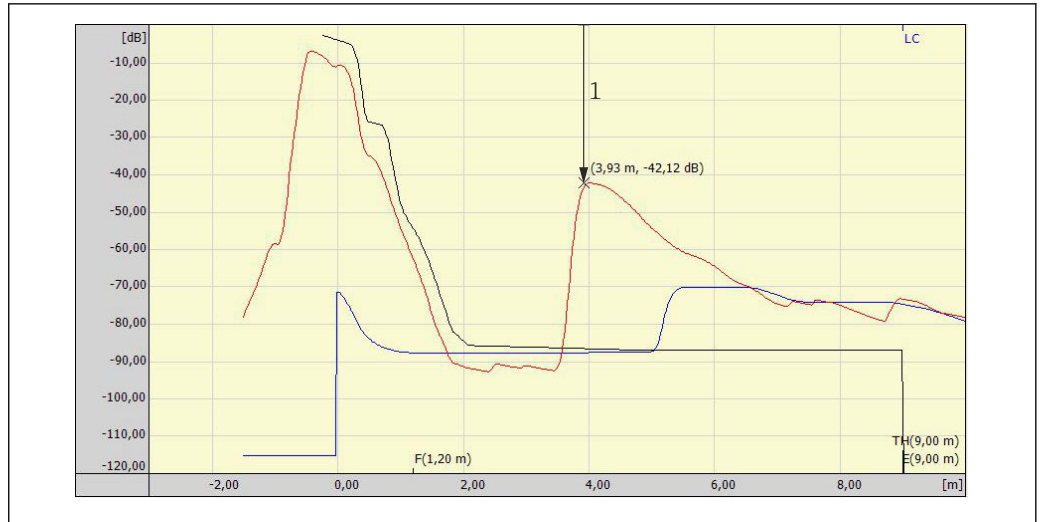
- F941, for **Output echo lost** (→  104) = **Alarm**.
- S941, if another option has been selected in **Output echo lost** (→  104).

Absolute echo amplitude

Navigation  Expert → Sensor → Information → Abs. echo ampl. (1127)

Description Displays the absolute amplitude of the level echo in the envelope curve.

Additional information



A0019961

1 Absolute echo amplitude in the envelope curve, measured in dB

Relative echo amplitude

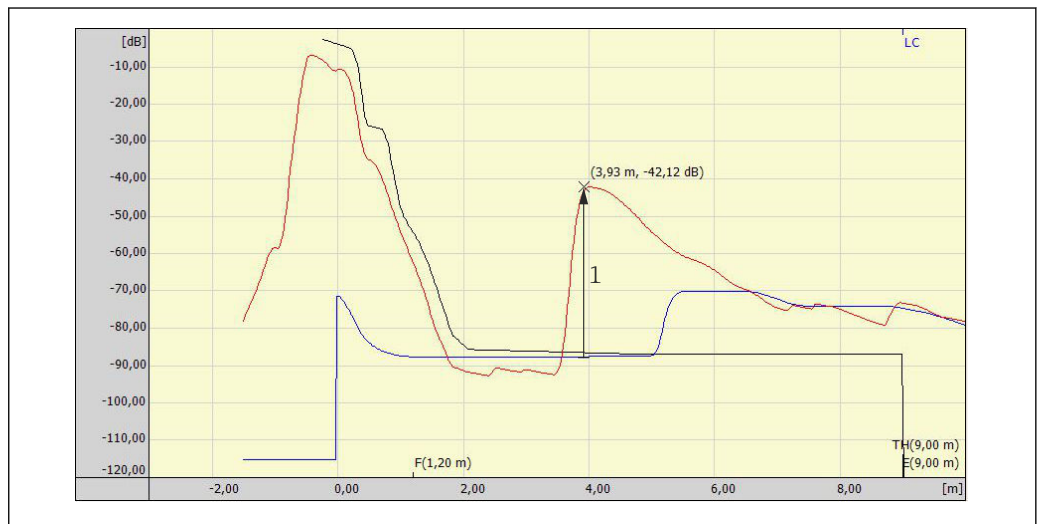
Navigation

🖨️ 📄 Expert → Sensor → Information → Relat.echo ampl. (1089)

Description

Displays the relative amplitude of the level echo, i.e. the distance between the level echo and the weighting curve.

Additional information




A0019962

1 The relative echo amplitude is the difference between the weighting curve (blue) and the peak in the envelope curve (red).




In the envelope curve display of FieldCare, the absolute echo amplitude is indicated instead of the relative amplitude (see the number on the top right of the echo peak in the example).


Tank bottom echo amplitude

Navigation	 Expert → Sensor → Information → Tank bottom ampl (1128)
Description	Indicates the amplitude of the tank bottom echo.
Additional information	The tank bottom echo amplitude is only evaluated for media with a small DC value.

Found echoes

Navigation	 Expert → Sensor → Information → Found echoes (1068)
Description	Indicates which echoes have been found.
User interface	<ul style="list-style-type: none"> ▪ None ▪ Level ▪ Level and TB ▪ EOP ▪ EOP (TT) ▪ EOP (LN) ▪ Level and EOP ▪ Multiple echo (TT)

Used calculation

Navigation	 Expert → Sensor → Information → Used calculation (1115)
Description	Indicates which echoes are used for the calculation of the measured value.
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ▪ None The measured value is not calculated (e.g. due to a lost echo) ▪ Level The level is calculated from the direct level echo. ▪ Tank bottom The level is calculated from the tank bottom echo. ▪ TB (TT) The level is calculated from the tank bottom echo taking into account the tank table (TT). ▪ Multiple echo (TT) The level is calculated from the multiple echo, taking into account the tank table (TT). ▪ Level and TB The level is calculated from the direct level echo. Its plausibility is checked by the tank bottom echo.

Tank trace state


Navigation  Expert → Sensor → Information → Tank trace state (1206)

Description Indicates the current state of the tank trace.

Additional information **Meaning of the options**


- **Not active**
A valid tank trace is not available.
- **EOP (TT)**
A valid EOP tank trace is available.
- **Multiple echo (TT)**
A valid multiple echo tank trace is available.
- **EOP + Multiple echo (TT)**
A valid EOP and multiple echo tank trace are available.

Measurement frequency

Navigation  Expert → Sensor → Information → Measurm. freq. (1180)

Description Displays the current measurement frequency (number of pulses per second).

Electronic temperature

Navigation  Expert → Sensor → Information → Electronic temp. (1062)

Description Displays the current temperature of the electronics.



Additional information The unit is defined in the **Temperature unit** parameter (→  46).

3.4.7 "Sensor properties" submenu

The **Sensor properties** submenu comprises all parameters which describe the measurement-related properties of the probe and the envelope curve.

Structure of the submenu


Navigation   Expert → Sensor → Sensor prop.

► Sensor properties	
Sensor module	→  82
Free field special	→  82

Description of parameters


Navigation  Expert → Sensor → Sensor prop.


Sensor module

Navigation  Expert → Sensor → Sensor prop. → Sensor module (1101)

Description Displays the type of sensor module.

Free field special

Navigation  Expert → Sensor → Sensor prop. → Free field spec. (1150)

Prerequisite **Sensor module (→  82) = SMR26L or SMR26S**

Description Switch the free field option on or off.

Selection

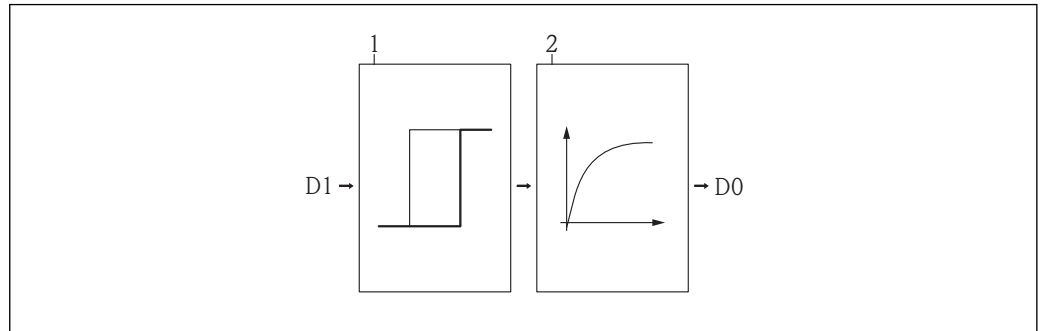
- No
- Yes

Factory setting No

Additional information This parameter can be switched on for free field applications (e.g. below bridges).

3.4.8 "Distance" submenu

The **Distance** submenu contains all parameters which control the filtering of the raw distance D1. The resulting distance D0 is used for the subsequent calculation of the level.



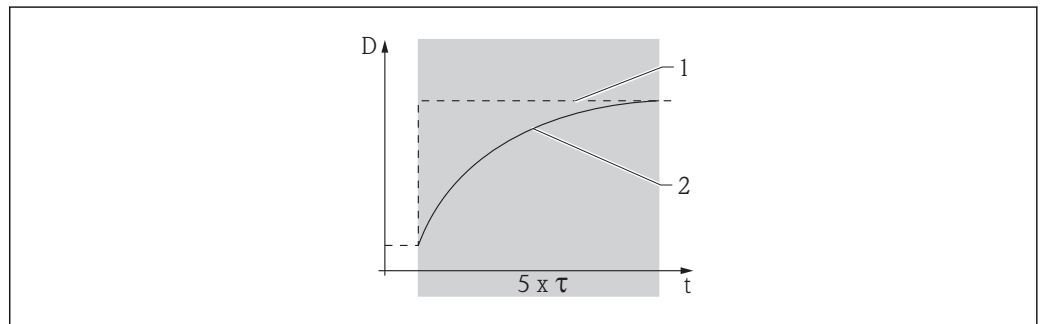
A0016175

22 The configurable distance filters

- 1 Dead time (\rightarrow 86)
- 2 Integration time (\rightarrow 87) (low pass filter)

Low pass filter

The low pass filter dampens the distance signal with a user defined integration time τ (**Integration time** parameter (\rightarrow 87)). After a sudden change of the level, it takes about $5 \times \tau$, until the new measured value is obtained.








A0016169

23 Low pass filter


- 1 Signal before the low pass filter
- 2 Signal after the low pass filter
- τ Integration time (\rightarrow 87)

Structure of the submenu

Navigation  Expert → Sensor → Distance

► Distance	
Distance	→  85
Dead time	→  86
Integration time	→  87
Blocking distance	→  88

Description of parameters

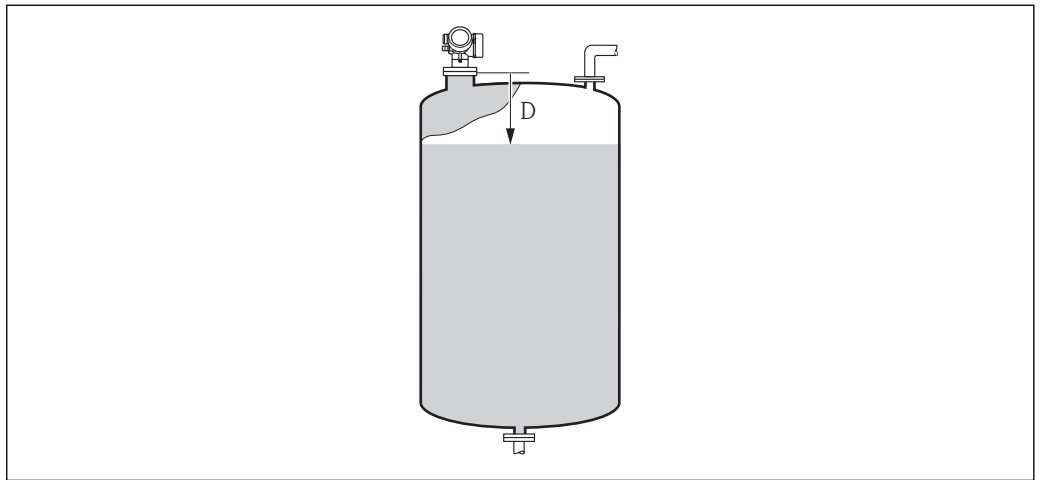
Navigation  Expert → Sensor → Distance

Distance


Navigation  Expert → Sensor → Distance → Distance (1124)

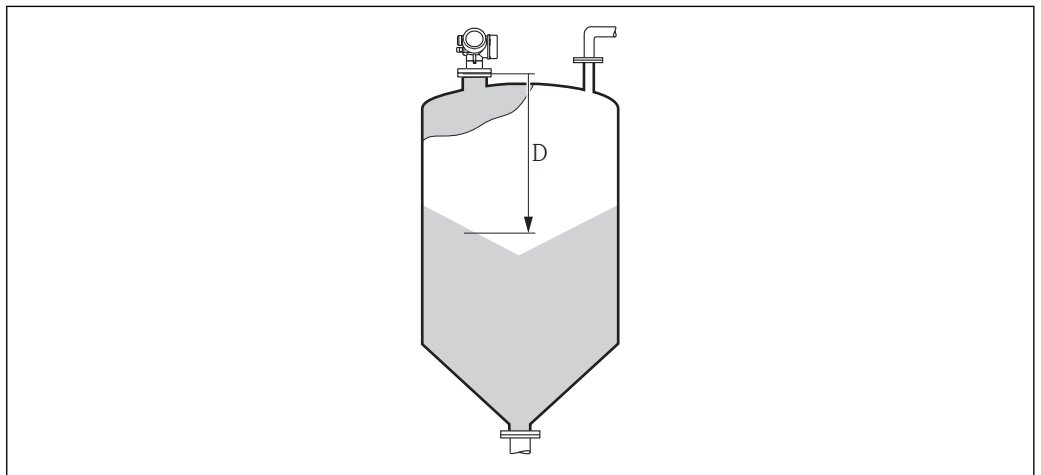
Description Displays the measured distance D between the reference point (lower edge of the flange or threaded connection) and the level.

Additional information





A0019483

 24 Distance for liquid measurements



A0019485

 25 Distance for bulk solid measurements

 The unit is defined in the **Distance unit** parameter (→  46).

Dead time



Navigation

Expert → Sensor → Distance → Dead time (1199)

Description

Define the dead time (in seconds).

User entry

0 to 600 s

Factory setting

Dependent on the following parameters:

- **Medium type** (→ 52)
- **Max. filling speed liquid** (→ 47) bzw. **Max. filling speed solid** (→ 48)
- **Max. draining speed liquid** (→ 48) bzw. **Max. draining speed solid** (→ 49)

Additional information

Factory setting for "Medium type" = "Liquid"

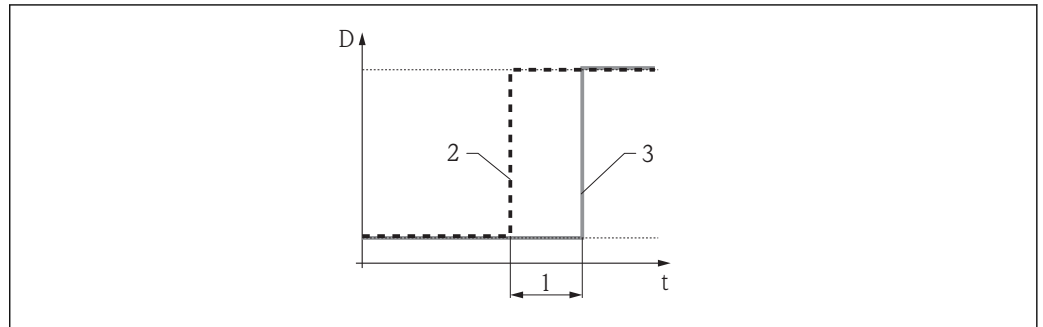
Max. filling speed liquid (→ 47)	Max. draining speed liquid (→ 48)					
	Slow < 1cm (0,4in) /min	Medium < 10cm (4in) /min	Standard < 1m (40in) /min	Fast < 2m (80in) /min	Very fast > 2m (80in) /min	No filter / test
Slow < 1cm (0,4in) /min	8 s	6 s	4 s	2 s	0 s	0 s
Medium < 10cm (4in) /min	6 s	6 s	4 s	2 s	0 s	0 s
Standard < 1m (40in) /min	4 s	4 s	4 s	2 s	0 s	0 s
Fast < 2m (80in) /min	2 s	2 s	2 s	2 s	0 s	0 s
Very fast > 2m (80in) /min	0 s	0 s	0 s	0 s	0 s	0 s
No filter / test	0 s	0 s	0 s	0 s	0 s	0 s

Factory setting for "Medium type" = "Solid"

Max. filling speed solid (→ 48)	Max. draining speed solid (→ 49)						
	Very slow < 0,5m (1,6ft) /h	Slow < 1m (3,3ft) /h	Standard < 2m (6,5ft) /h	Medium < 4m (13ft) /h	Fast < 8m (26ft) /h	Very fast > 8m (26ft) /h	No filter / test
Very slow < 0,5m (1,6ft) /h	180 s	180 s	120 s	60 s	40 s	0 s	0 s
Slow < 1m (3,3ft) /h	180 s	180 s	120 s	60 s	40 s	0 s	0 s
Standard < 2m (6,5ft) /h	120 s	120 s	60 s	60 s	40 s	0 s	0 s
Medium < 4m (13ft) /h	60 s	60 s	60 s	40 s	40 s	0 s	0 s
Fast < 8m (26ft) /h	40 s	40 s	40 s	40 s	20 s	0 s	0 s
Very fast > 8m (26ft) /h	0 s	0 s	0 s	0 s	0 s	0 s	0 s
No filter / test	0 s	0 s	0 s	0 s	0 s	0 s	0 s

Application

Sudden changes of the measured distance are ignored during the time span defined in this parameter. In this way it is possible to prevent short-term interferences from disturbing the output signal.



A0016164

26 Effect of the dead time

- 1 Dead time
- 2 Signal before the dead time filter
- 3 Signal after the dead time filter

Disadvantages

- The device slows down.
- Fast level changes are registered with a delay.

Integration time**Navigation**

Expert → Sensor → Distance → Integration time (1092)

Description

Define the integration time (in seconds).

User entry

0.0 to 200 000.0 s

Factory setting

Dependent on the following parameters:

- Medium type (→ 52)
- Max. filling speed liquid (→ 47) bzw. Max. filling speed solid (→ 48)
- Max. draining speed liquid (→ 48) bzw. Max. draining speed solid (→ 49)


Additional information

Factory setting for "Medium type" = "Liquid"

Max. filling speed liquid (→ 47)	Max. draining speed liquid (→ 48)					
	Slow < 1cm (0,4in) /min	Medium < 10cm (4in) /min	Standard < 1m (40in) /min	Fast < 2m (80in) /min	Very fast > 2m (80in) /min	No filter / test
Slow < 1cm (0,4in) /min	30 s	15 s	5 s	1 s	0 s	0 s
Medium < 10cm (4in) /min	15 s	15 s	5 s	1 s	0 s	0 s
Standard < 1m (40in) /min	5 s	5 s	5 s	1 s	0 s	0 s
Fast < 2m (80in) /min	1 s	1 s	1 s	1 s	0 s	0 s
Very fast > 2m (80in) /min	0 s	0 s	0 s	0 s	0 s	0 s
No filter / test	0 s	0 s	0 s	0 s	0 s	0 s

Factory setting for "Medium type" = "Solid"

Max. filling speed solid (→ 48)	Max. draining speed solid (→ 49)						
	Very slow < 0,5m (1,6ft) /h	Slow < 1m (3,3ft) /h	Standard < 2m (6,5ft) /h	Medium < 4m (13ft) /h	Fast < 8m (26ft) /h	Very fast > 8m (26ft) /h	No filter / test
Very slow < 0,5m (1,6ft) /h	250 s	200 s	200 s	100 s	50 s	1 s	0 s
Slow < 1m (3,3ft) /h	200 s	200 s	200 s	100 s	50 s	1 s	0 s
Standard < 2m (6,5ft) /h	200 s	200 s	100 s	100 s	50 s	1 s	0 s
Medium < 4m (13ft) /h	100 s	100 s	100 s	50 s	50 s	1 s	0 s
Fast < 8m (26ft) /h	50 s	50 s	50 s	50 s	20 s	1 s	0 s
Very fast > 8m (26ft) /h	1 s	1 s	1 s	1 s	1 s	1 s	0 s
No filter / test	0 s	0 s	0 s	0 s	0 s	0 s	0 s

 Increasing the integration time results in a calmer measuring signal. However, it also causes a delayed reaction to level changes.

Blocking distance



Navigation

 Expert → Sensor → Distance → Blocking dist. (1144)

Description

Specify blocking distance BD.

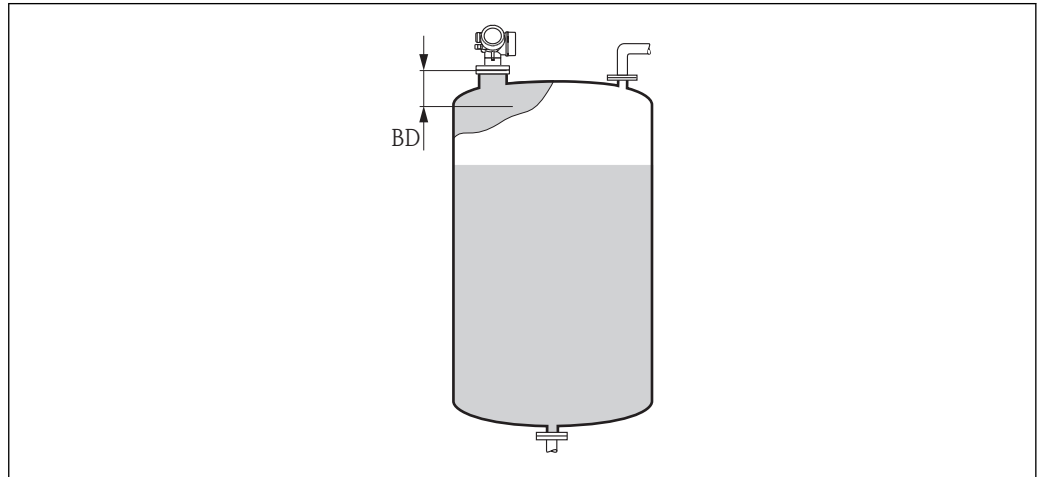
User entry 0 to 200 m

Factory setting

- FMR50, FMR51, FMR53, FMR54: antenna length
- FMR52: antenna length + 200 mm (7.9 in)
- FMR56, FMR57: antenna length + 400 mm (15.7 in)

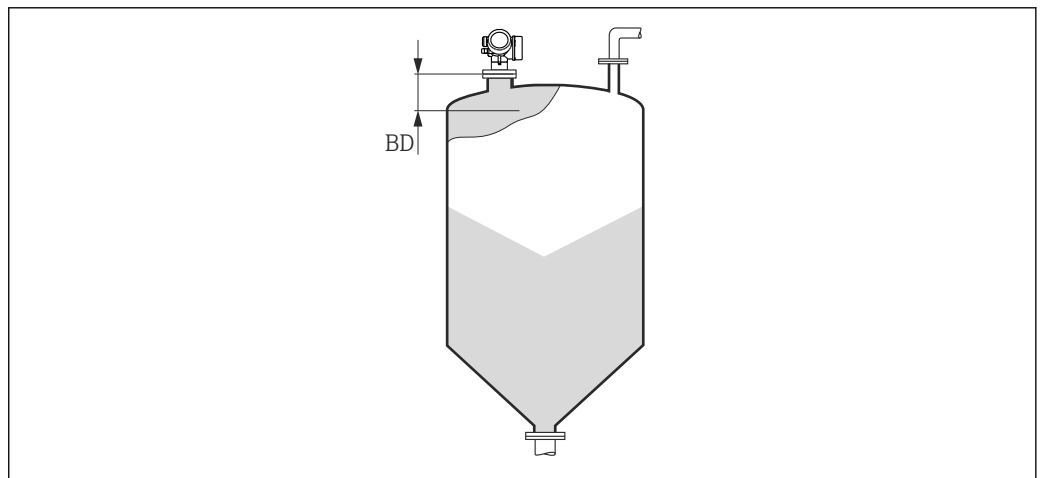
Additional information

No echos are evaluated within the blocking distance BD. Therefore, BD can be used to suppress interference echos in the vicinity of the antenna.



A0019492

27 Blocking distance (BD) for liquid measurements



A0023041

28 Blocking distance (BD) for bulk solid measurements

3.4.9 "Gas phase compensation" submenu

Einfluss der Gasphase

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the kind of gas/vapor and of its temperature. This results in a systematic measuring error that gets bigger as the distance increases between the reference point of the measurement (flange) and the product surface.

The following table illustrates this measured error for a few typical gases/vapors (with regard to distance; a positive value means that too large a distance is being measured):

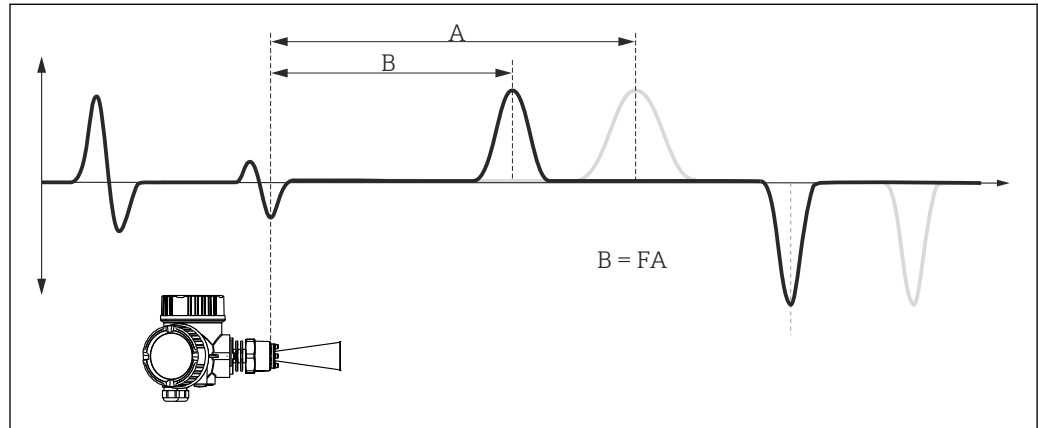
Gas layer	Temperature		Pressure				
	°C	°F	1 bar (14.5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	160 bar (2320 psi)
Air/ nitrogen	20	68	0.00 %	0.22 %	1.2 %	2.4 %	3.89 %
	200	392	-0.01 %	0.13 %	0.74 %	1.5 %	2.42 %
	400	752	-0.02 %	0.08 %	0.52 %	1.1 %	1.70 %
Hydrogen	20	68	-0.01 %	0.10 %	0.61 %	1.2 %	2.00 %
	200	392	-0.02 %	0.05 %	0.37 %	0.76 %	1.23 %
	400	752	-0.02 %	0.03 %	0.25 %	0.53 %	0.86 %
Water (saturated steam)	100	212	0.02 %	-	-	-	-
	180	356	-	2.1 %	-	-	-
	263	505.4	-	-	8.6 %	-	-
	310	590	-	-	-	22 %	-
	364	687	-	-	-	-	41.8 %

Gas phase compensation with reference signal

This type of gas phase compensation requires a reference signal at a defined distance from the process connection which must be above the maximum level. The current speed of propagation is determined from the shift of this reference signal. The envelope curve can be scaled accordingly.

Constant gas phase compensation factor

If the properties of the gas phase (pressure, temperature, composition) do not change over the time and are known, a gas phase compensation can also be performed without a reference signal. Instead, a constant, user-defined correction factor is applied in this case. This factor is used to scale the envelope curve (and thus the measured echo distance).











29 Gas phase compensation with a constant correction factor F

A Position of the level echo in the original envelope curve

B Position of the level echo in the corrected envelope curve.

Structure of the submenu


Navigation  Expert → Sensor → Gas phase comp.

► Gas phase compensation	
GPC mode	→  94
External pressure selector	→  94
External pressure	→  95
Gas phase compensation factor	→  95
Present reference distance	→  95
Reference distance	→  96
Reference echo threshold	→  96
Const. GPC factor	→  96

Description of parameters

Navigation  Expert → Sensor → Gas phase comp.

GPC mode

Navigation  Expert → Sensor → Gas phase comp. → GPC mode (1034)

Description Select gas phase compensation mode.

- Selection**
- Off
 - On
 - Without correction
 - External correction ⁵⁾
 - Const. GPC factor

Factory setting Off

Additional information **Meaning of the options**

- **Off**
The gas phase compensation is deactivated.
- **On**
This option can only be selected for probes with reference echo. The gas phase compensation is calculated from the position of this reference echo. In FieldCare, the displayed envelope curve does already contain the correction.
- **Without correction**
The correction factor is calculated from the reference echo but not applied to the measurement. In FieldCare, the envelope curve is displayed without the correction. This option is only used for diagnostic purposes and should not be selected in normal applications.
- **External correction**
The device receives the externally measured pressure through an AO block and uses it together with the gas phase compensation factor F to calculate the gas phase compensation. The displayed envelope curve does already contain the correction.
- **Const. GPC factor**
The correction factor is a constant defined by the user. A reference echo is not needed. In FieldCare, the displayed envelope curve does already contain the correction.

External pressure selector

Navigation  Expert → Sensor → Gas phase comp. → Ext. press.input (1073)

Prerequisite **GPC mode (→  94) = External correction**



Description Allocate an AO block to the gas phase compensation. The externally measured pressure is read via this AO block.

5) Visibility depends on communication



Selection	<ul style="list-style-type: none"> ▪ None ▪ Analog output 1 ▪ Analog output 2 ▪ Analog output 3 ▪ Analog output 4
------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------

Factory setting	None
------------------------	------



External pressure













Navigation	 Expert → Sensor → Gas phase comp. → External press. (1233)
Prerequisite	GPC mode (→  94) = External correction
Description	Indicates the measured pressure which is currently used for the gas phase compensation.

Gas phase compensation factor

Navigation	 Expert → Sensor → Gas phase comp. → Gas comp. factor (1209)
Prerequisite	GPC mode (→  94) = External correction
Description	Define gas phase compensation factor F .
User entry	Signed floating-point number
Factory setting	0
Additional information	Suitable value for saturated steam in the temperature range 100 to 350 °C (212 to 662 °F): $F = 0.00505 / \text{bar}$


Present reference distance

Navigation	 Expert → Sensor → Gas phase comp. → Pres. ref. dist. (1076)
Prerequisite	GPC mode (→  94) = On or Without correction
Description	Displays the currently measured distance of the reference echo.

Reference distance 	
Navigation	  Expert → Sensor → Gas phase comp. → Reference dist. (1033)
Prerequisite	GPC mode (→  94) = On or Without correction
Description	Enter actual distance of the reference echo.
User entry	0 to 200 m
Factory setting	0.3 m
Additional information	The distance of the artificially generated reference echo has to be entered into this parameter. The reference echo must always be in the gas phase; the level must never rise above the reference echo.
Reference echo threshold 	
Navigation	  Expert → Sensor → Gas phase comp. → Ref. echo thresh (1168)
Prerequisite	GPC mode (→  94) = On or Without correction
Description	Define threshold for the reference echo.
User entry	-999.0 to 999.0 dB
Factory setting	-80 dB
Additional information	Only echoes exceeding the defined threshold are accepted as reference echo.
Const. GPC factor 	
Navigation	  Expert → Sensor → Gas phase comp. → Const.GPC factor (1217)
Prerequisite	GPC mode (→  94) = Const. GPC factor
Description	Specify constant correction factor for the measured distance.
User entry	0.5 to 1.5
Factory setting	1



3.4.10 "Sensor diagnostics" submenu

The **Sensor diagnostics** submenu is used for the proof-test which is required for SIL applications in regular intervals. For details refer to the description of the test procedure C in the Functional Safety Manual, SD01087F.

For the self check, a test signal is generated in the sensor module and fed onto the analog signal path. The device software checks whether this test signal is within the admissible amplitude and distance ranges. The result of the self check is displayed in the **Result self check** parameter (→  98).

Structure of the submenu




Navigation   Expert → Sensor → Sensor diag.

▶ Sensor diagnostics	
Start self check	→  98
Result self check	→  98


Description of parameters

Navigation  Expert → Sensor → Sensor diag.

Start self check

Navigation	 Expert → Sensor → Sensor diag. → Start self check (1133)
Description	Start a self check of the device.
Selection	<ul style="list-style-type: none"> ▪ No ▪ Yes
Factory setting	No
Additional information	<p>For the self check, a test signal is generated in the sensor module and fed onto the analog signal path. The device software checks whether this test signal is within the admissible amplitude and distance ranges. The result of the self check is displayed in the Result self check parameter (→  98).</p> <p> The self check is used for the proof-test which is required for SIL applications in regular intervals. For details refer to the description of the test procedure C in the Functional Safety Manual SD01087F.</p>

Result self check

Navigation	 Expert → Sensor → Sensor diag. → Result selfcheck (1134)
Description	Displays the result of the self check.
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ▪ Ok The self check has been passed. ▪ Not ok The self check failed. ▪ Check not done A self check has not been performed.

3.4.11 "Safety settings" submenu

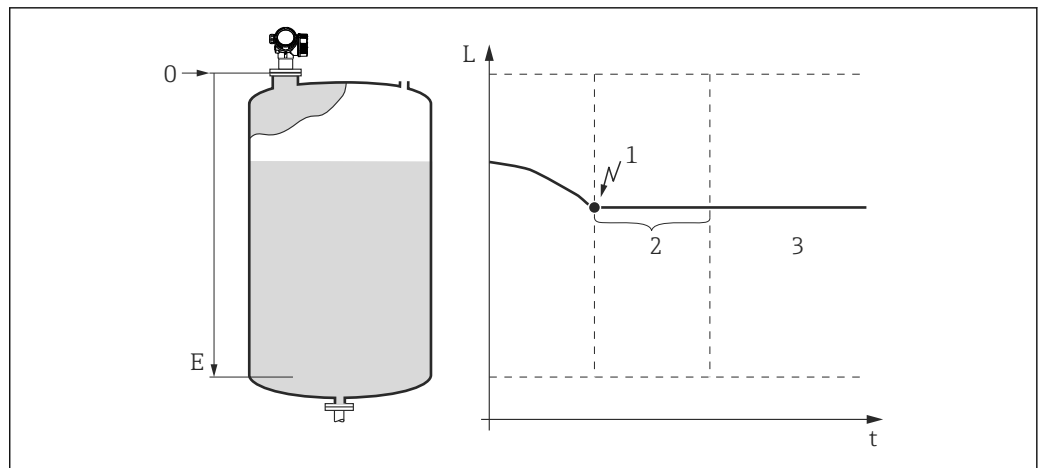
The **Safety settings** submenu contains all parameters which determine the behavior of the device in critical situations such as an echo loss or an undershooting of a user defined safety distance.

Behavior in the case of an echo loss

The behavior in case of an echo loss is defined in the **Output echo lost** parameter (→ 104). Depending on the selected option, suitable values must be selected in a number of additional parameters:

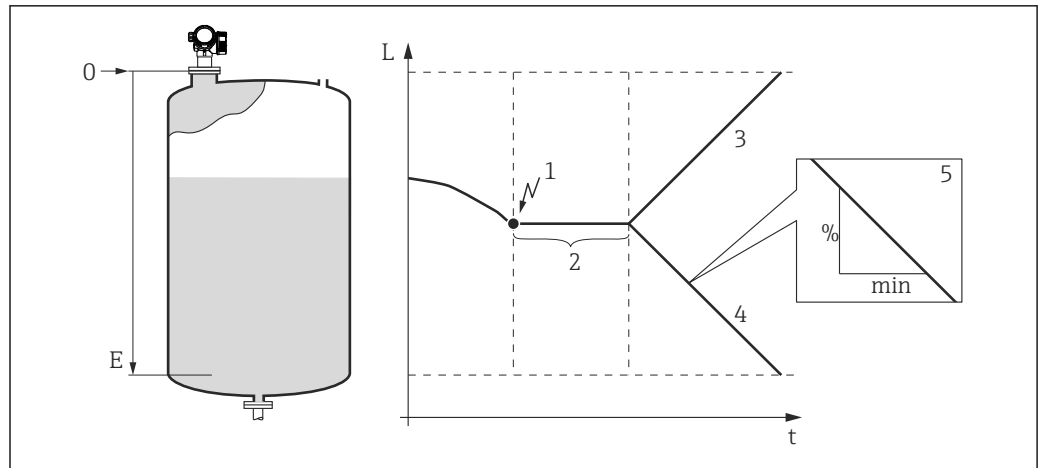
Option selected in in "Output echo lost (→ 104)"	Required additional parameters
Last valid value	Delay time echo lost (→ 106)
Ramp at echo lost	<ul style="list-style-type: none"> ▪ Ramp at echo lost (→ 106) ▪ Delay time echo lost (→ 106)
Value echo lost	<ul style="list-style-type: none"> ▪ Value echo lost (→ 104) ▪ Delay time echo lost (→ 106)
Alarm	1)

1) The alarm behavior is defined in the submenus "Current output" (HART) or "Analog input" (PROFIBUS PA, FOUNDATION Fieldbus).



30 "Output echo lost (→ 104)" = "Last valid value"

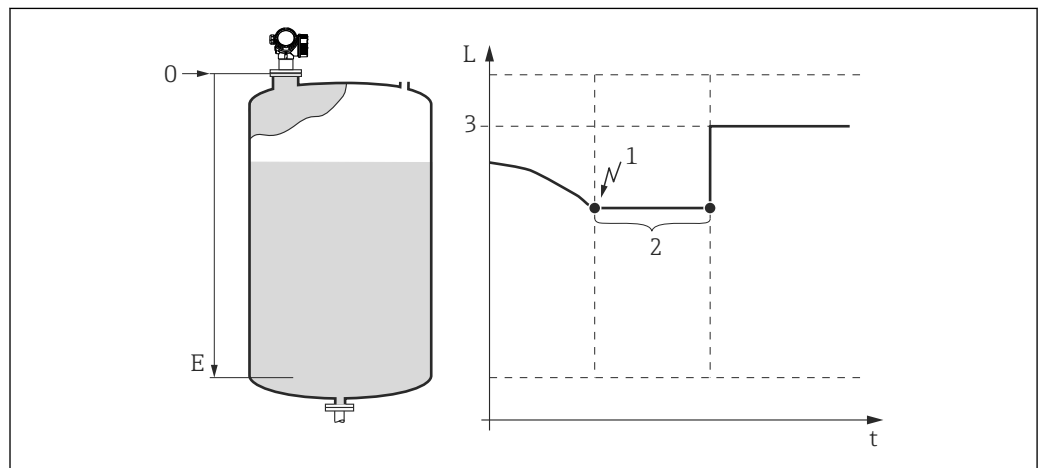
- 1 Echo loss
- 2 Delay time echo lost (→ 106)
- 3 The last valid measured value is held.



A0016207

31 "Output echo lost (→ 104)" = "Ramp at echo lost"

- 1 Echo loss
- 2 "Delay time echo lost (→ 106)"
- 3 For a positive ramp: The measured value is increased with a constant rate until it reaches the maximum value (100%).
- 4 For a negative ramp: The measured value is decreased with a constant rate until it reaches the minimum value (0%).
- 5 The ramp is specified as "percentage of the defined measuring span per minute".



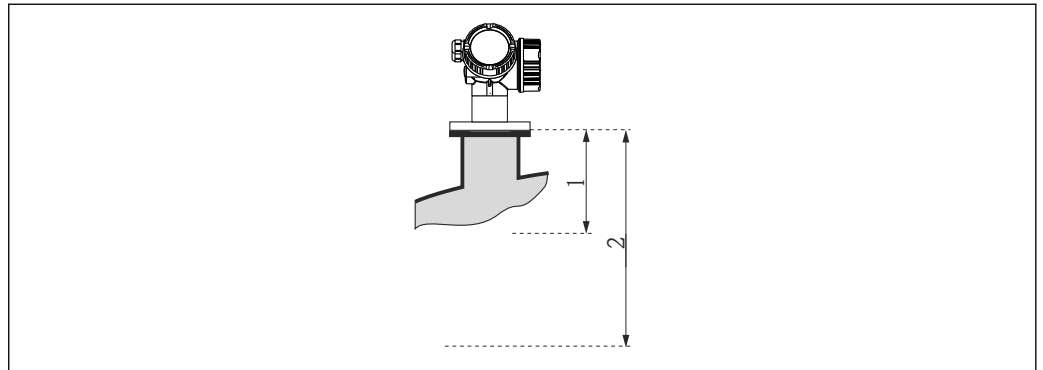
A0016208

32 "Output echo lost (→ 104)" = "Value echo lost"

- 1 Echo loss
- 2 Delay time echo lost (→ 106)
- 3 Value echo lost (→ 104)

Safety distance

In order to get a warning message if the level rises into the proximity of the upper blocking distance, a safety distance can be defined in the **Safety distance** parameter (→ [107](#)).



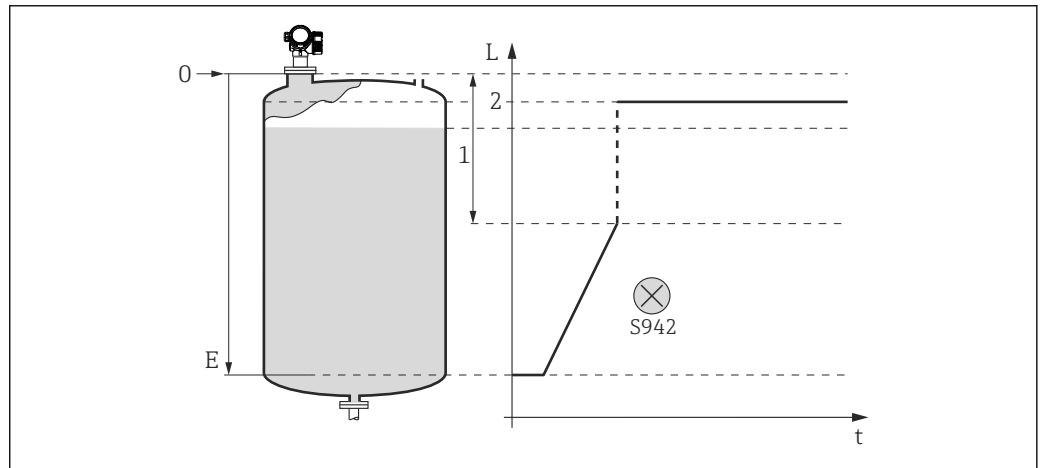
A0016210

33 Definition of the safety distance

- 1 Blocking distance (→ [88](#))
- 2 Safety distance (→ [107](#))

The behavior of the device in case the level rises into the safety distance is defined in the following parameters:

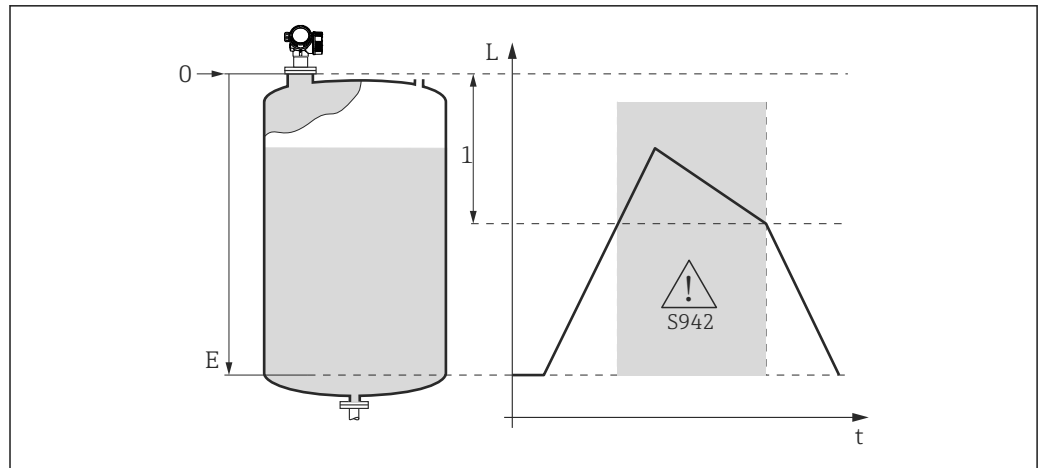
- In safety distance (→ [107](#))
- Acknowledge alarm (→ [108](#))



A0016211

34 "In safety distance" = "Alarm": If the safety distance is undershot, the device generates an alarm.

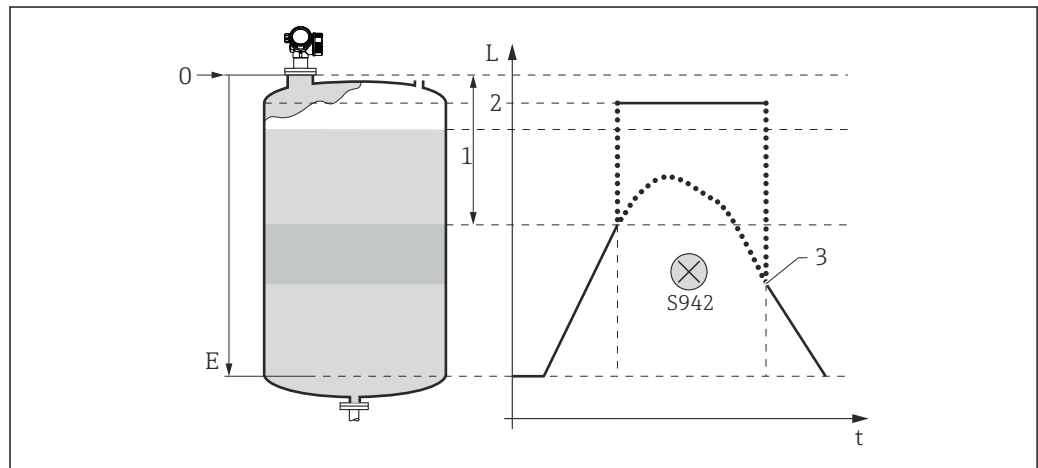
- 1 Safety distance (→ [107](#))
- 2 Value defined in "Failure mode"



A0016212

35 "In safety distance" = "Warning": If the safety distance is undershot, the device continues measuring but nevertheless generates a warning.

1 Safety distance (→ 107)



A0016213

36 "In safety distance" = "Self holding": If the safety distance is undershot, the device generates an alarm. The measurement is not resumed until this alarm has been acknowledged by the user.


1 Safety distance (→ 107)

2 Value defined in "Failure mode"

3 Acknowledge alarm (→ 108)

Structure of the submenu


Navigation   Expert → Sensor → Safety sett.

► Safety settings	
Output echo lost	→  104
Value echo lost	→  104
Diagnostics echo lost	→  105
Status echo lost	→  105
Ramp at echo lost	→  106
Delay time echo lost	→  106
Safety distance	→  107
In safety distance	→  107
Diagnostic in safety distance	→  107
Status in safety distance	→  108
Acknowledge alarm	→  108

Description of parameters

Navigation  Expert → Sensor → Safety sett.

Output echo lost

Navigation  Expert → Sensor → Safety sett. → Output echo lost (2307)



Description Define the behavior of the output signal in case of a lost echo.

Selection


- Last valid value
- Ramp at echo lost
- Value echo lost
- Alarm


Factory setting Last valid value

Additional information **Meaning of the options**

- **Last valid value**
The last valid value is kept in the case of a lost echo.
- **Ramp at echo lost**
In the case of a lost echo the output value is continuously shifted towards 0% or 100%.
The slope of the ramp is defined in the **Ramp at echo lost** parameter (→  106).
- **Value echo lost**
In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→  104).
- **Alarm**
In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter

Value echo lost

Navigation  Expert → Sensor → Safety sett. → Value echo lost (2316)



Prerequisite **Output echo lost (→  104) = Value echo lost**

Description Define output value in case of a lost echo.

User entry 0 to 200 000.0 %

Factory setting 0.0 %

Additional information Use the unit which has been defined for the measured value output:

- without linearization: **Level unit (→  59)**
- with linearization: **Unit after linearization (→  69)**

Diagnostics echo lost

Navigation	📁📁 Expert → Sensor → Safety sett. → Diagn. echo lost (1401)
Description	Define diagnostic category in case of a lost echo.
Selection	<ul style="list-style-type: none"> ▪ Off ▪ Maintenance required ▪ Maintenance demanded ▪ Maintenance alarm ▪ Invalid process condition
Factory setting	Invalid process condition
Additional information	The diagnostic category (diagnostic bit) is not contained in the cyclic data telegram. The PLC, however, can be parametrized in a way such that it requests the diagnostic bit every time the status has changed. For details refer to "PROFIBUS Profile for Process Control Devices, Version 3.02".

Status echo lost

Navigation	📁📁 Expert → Sensor → Safety sett. → Status echo lost (1416)
Description	Define status in case of a lost echo.
Selection	<ul style="list-style-type: none"> ▪ Good ▪ Good: Maintenance required (M) ▪ Good: Maintenance demanded (M) ▪ Uncertain: Maintenance demanded (M) ▪ Bad: Maintenance alarm (F) ▪ Uncertain: Process related/no maint. (S) ▪ Bad: Process related/no maintenance (F)
Factory setting	Depending on the Output echo lost parameter (→ 📁 104)
Additional information	<i>Dependence on the "Output echo lost" parameter</i>

Output echo lost (→ 📁 104)	Status echo lost (→ 📁 105)
Last valid value	Uncertain: Process related/no maint. (S)
Ramp at echo lost	Uncertain: Process related/no maint. (S)
Value echo lost	Uncertain: Process related/no maint. (S)
Alarm	Bad: Process related/no maintenance (F)

The status is transmitted to the PLC as a part of the cyclic data telegram. For details refer to "PROFIBUS Profile for Process Control Devices, Version 3.02".

Ramp at echo lost



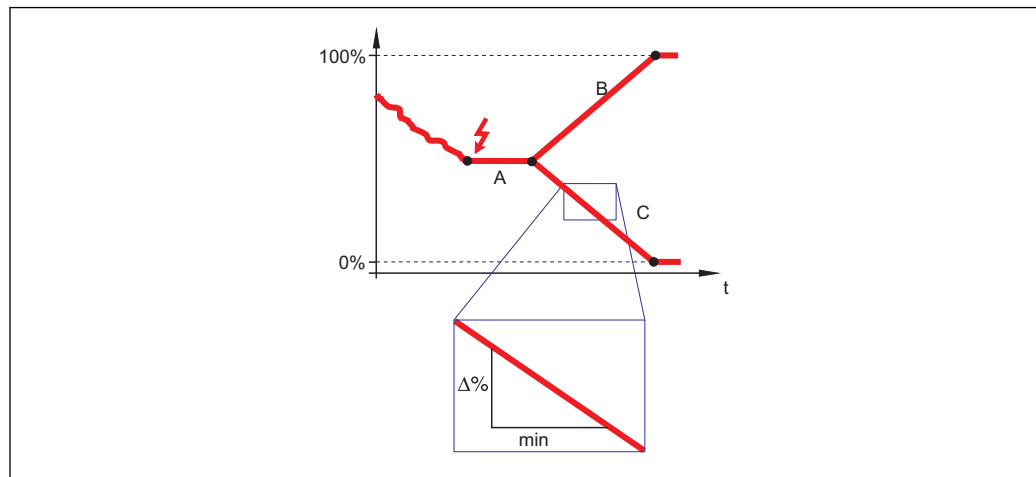
Navigation Expert → Sensor → Safety sett. → Ramp echo lost (2323)

Prerequisite **Output echo lost** (→ 104) = **Ramp at echo lost**

Description Define the slope of the ramp in the case of a lost echo.

User entry Signed floating-point number

Factory setting 0.0 %/min

Additional information

A0013269

- A Delay time echo lost (→ 106)
 B Ramp at echo lost (→ 106) (positive value)
 C Ramp at echo lost (→ 106) (negative value)

- The unit for the slope of the ramp is "percentage of the measuring range per minute" (%/min).
- For a negative slope of the ramp: The measured value is continuously decreased until it reaches 0%.
- For a positive slope of the ramp: The measured value is continuously increased until it reaches 100%.

Delay time echo lost



Navigation Expert → Sensor → Safety sett. → Delay echo lost (1193)

Description Define the delay in the case of an echo loss.

User entry 0 to 99 999.9 s

Factory setting 60.0 s

Additional information After an echo loss, the device waits for the time specified in this parameter before reacting as specified in the **Output echo lost** parameter (→ 104). This helps to avoid interruptions of the measurement by short-term interferences.

Safety distance


Navigation	Expert → Sensor → Safety sett. → Safety distance (1093)
Description	Define safety distance.
User entry	-200 to 200 m
Factory setting	0 m
Additional information	The safety distance is measured from the reference point of the measurement (lower edge of the flange or threaded connection). The safety distance can be used to generate a warning before the level rises into the blocking distance. The In safety distance parameter (→ 107) defines the reaction of the device if the level rises into the safety distance.

In safety distance


Navigation	Expert → Sensor → Safety sett. → In safety dist. (1018)
Description	Define reaction if the level rises into the safety distance.
Selection	<ul style="list-style-type: none"> ▪ Off ▪ Alarm ▪ Warning ▪ Self holding
Factory setting	Warning
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ▪ Off No reaction if the level rises into the safety distance ▪ Alarm The device assumes the alarm state and generates the diagnostic message In safety distance. ▪ Warning The device assumes the warning state and generates the diagnostic message In safety distance. ▪ Self holding The device assumes the defined alarm state. Additionally, the diagnostic message In safety distance is generated. If the level drops out of the safety distance, the alarm remains active. The measurement is continued only after a reset of the self holding via the Acknowledge alarm parameter (→ 108).

Diagnostic in safety distance


Navigation	Expert → Sensor → Safety sett. → Diag.safety dist (1415)
Description	Define the diagnostic category in case the safety distance is undershot.

- Selection**
- Off
 - Maintenance required
 - Maintenance demanded
 - Maintenance alarm
 - Invalid process condition

Factory setting Invalid process condition


Additional information The diagnostic category (diagnostic bit) is not contained in the cyclic data telegram. The PLC, however, can be parametrized in a way such that it requests the diagnostic bit every time the status has changed. For details refer to "PROFIBUS Profile for Process Control Devices, Version 3.02".

Status in safety distance



Navigation  Expert → Sensor → Safety sett. → Stat.safety dist (1417)

Description Define status in case the safety distance is undershot.

- Selection**
- Good
 - Good: Maintenance required (M)
 - Good: Maintenance demanded (M)
 - Uncertain: Maintenance demanded (M)
 - Bad: Maintenance alarm (F)
 - Uncertain: Process related/no maint. (S)
 - Bad: Process related/no maintenance (F)


Factory setting Dependent on the **In safety distance** parameter (→  107)

Additional information

In safety distance (→  107)	Status in safety distance (→  108)
Off	-
Alarm	Bad: Process related/no maintenance (F)
Warning	Uncertain: Process related/no maint. (S)
Self holding	p Bad: Process related/no maintenance (F)

The status is transmitted to the PLC as a part of the cyclic data telegram. For details refer to "PROFIBUS Profile for Process Control Devices, Version 3.02".

Acknowledge alarm 


Navigation  Expert → Sensor → Safety sett. → Acknowl. alarm (1130)

Prerequisite **In safety distance** (→  107) = **Self holding**

Description Reset the self holding alarm of the device.

Selection	<ul style="list-style-type: none">■ No■ Yes
Factory setting	No
Additional information	Meaning of the options <ul style="list-style-type: none">■ No The alarm is not rest.■ Yes The alarm is reset. The measurement is resumed.

3.4.12 "Envelope curve" submenu


 The **Envelope curve** submenu is only available on the display module (not in FieldCare). It is used to display the envelope curve on the display module. When operating via FieldCare, the envelope curve can be displayed in the envelope curve editor (**Device Operation** → **Device Functions** → **Additional Functions** → **Envelope Curve**).

Description of parameters

Navigation  Expert → Sensor → Env. curve

Envelope curve



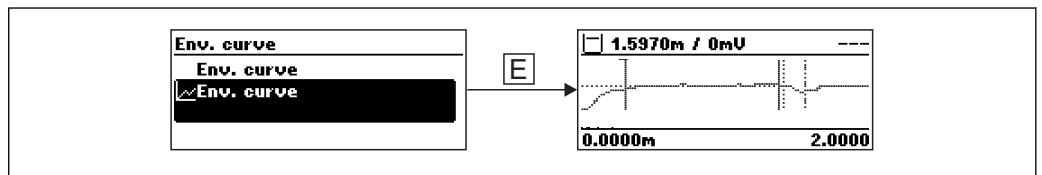
Navigation  Expert → Sensor → Env. curve → Env. curve (1207)

Description Define which curves are included in the envelope curve display on the display module.

- Selection
- Envelope curve
 - Envelope + Map
 - Envelope + Ref.
 - Raw envelope curve
 - Envelope + EWC

Factory setting Envelope curve

Additional information The display of the selected curve is called up as follows:



A0014279

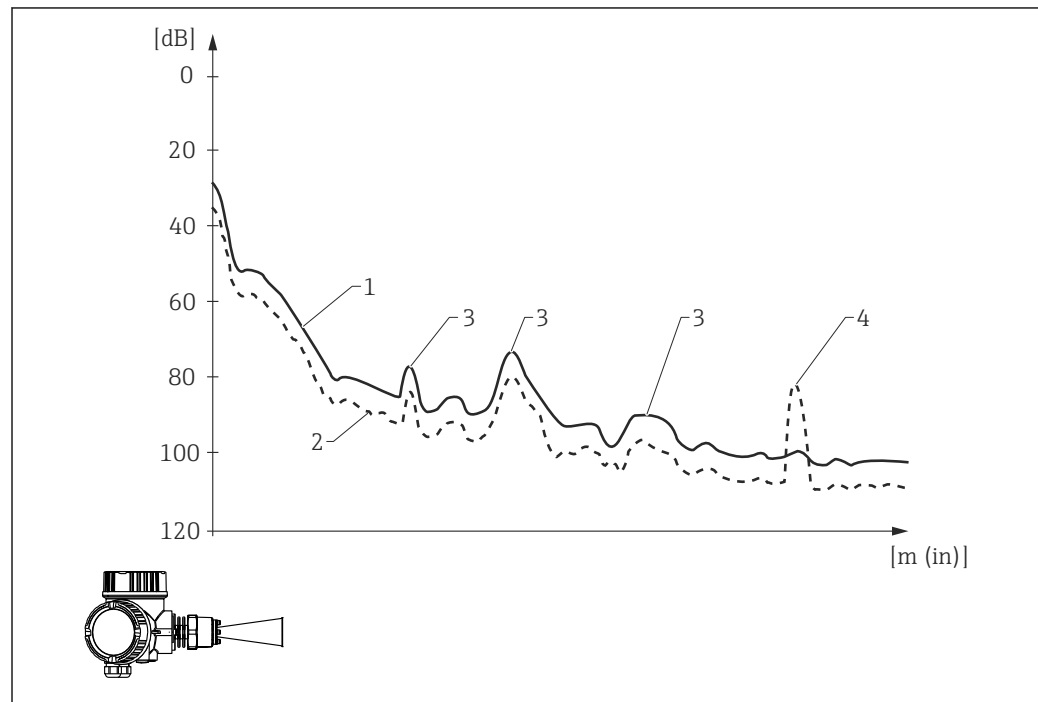
To quit the envelope curve display, press the "+" and "-" keys simultaneously.

 When operating via FieldCare, the envelope curve can be displayed in the envelope curve editor (**Device Operation → Device Functions → Additional Functions → Envelope Curve**).

3.4.13 "Mapping" submenu

The mapping is used to suppress static interference signals which may be generated by internal tank or silo fittings. A **mapping curve**, representing the **envelope curve** of an empty tank or silo as precisely as possible, is used for the mapping.

In the case of a **static envelope curve evaluation** ⁶⁾ all echos below the mapping curve are ignored in the signal evaluation.



- 1 Mapping curve
- 2 Envelope curve
- 3 Interference echos; covered by the mapping curve
- 4 Level echo; exceeds the envelope curve

In the case of a **dynamic envelope curve evaluation** ⁶⁾ echoes from below the map can also be taken into account. In this case the static envelope curve evaluation serves as a starting point as long as enough history information is not yet available.

6) For the difference between static and dynamic envelope curve evaluation refer to the "Expert → Sensor → Echo tracking" submenu.

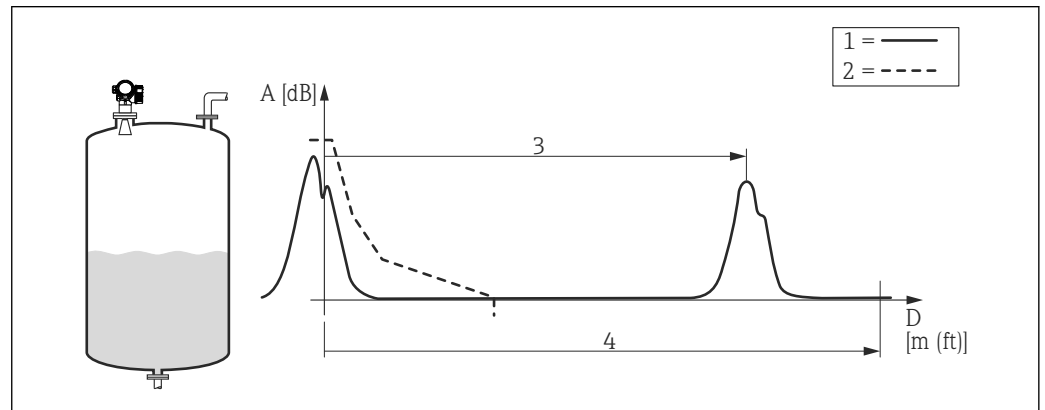
Recording the mapping curve

There are different methods of recording the mapping curve:

- Factory map
- Overlay map
- Record new map

Factory map

The factory map is adapted to the individual antenna and is therefore permanently stored in the device and not recorded by the user. It covers the near field of the antenna (ringing area).



A0020643

- 1 Envelope curve
- 2 Factory map
- 3 Level distance
- 4 Empty distance

If a new mapping is recorded, the factory map nevertheless remains in the device and can be reactivated when required by selecting the **Factory map** option in the **Confirm distance** parameter (→ 120).

Overlaying the map

In this case the existing mapping curve (i.e. the factory map or a previously recorded map) initially remains valid.

The envelope curve is observed during the defined **Mapping overlay time**. At each position the highest value reached during the mapping overlay time is used for the new mapping curve. Depending on the circumstances this may be the amplitude of the old mapping curve or an amplitude obtained during the **Mapping overlay time**.

With the help of the overlay mapping it is possible to map not only static but also dynamic signals (e.g. from an agitator).

Map overlaying will be used if one of the options **Distance ok** or **Tank empty** has been selected in the **Confirm distance** parameter (→ 120).

New recording of the mapping curve

In this case the existing map is deleted and a new map is recorded.

In contrast to the overlaying, only the current envelope curve is used here and there is no mapping overlay time. Therefore the new recording is faster than the overlaying. However, dynamic interference echoes can not be suppressed in this way.


A new recording of the map is started in the following way:

1. Go to the **Confirm distance** parameter (→ 120) and select the **Manual map** option.

2. Go to the **Record map** parameter (→  122) and select the **Record map** option.



Partial mapping / Deleting a map partially

The overlaying or new recording of the map does not necessarily cover the complete measuring range. Instead a partial mapping can be performed.

- The mapping starts at -0.25 m (-0.8 ft), i.e. above the reference point.
- The end point of the mapping range can be defined in the **Mapping end point** parameter (\rightarrow  121).

After these settings, the recording of the mapping curve is started as described above.

The map can also be partially deleted. This is performed as follows:

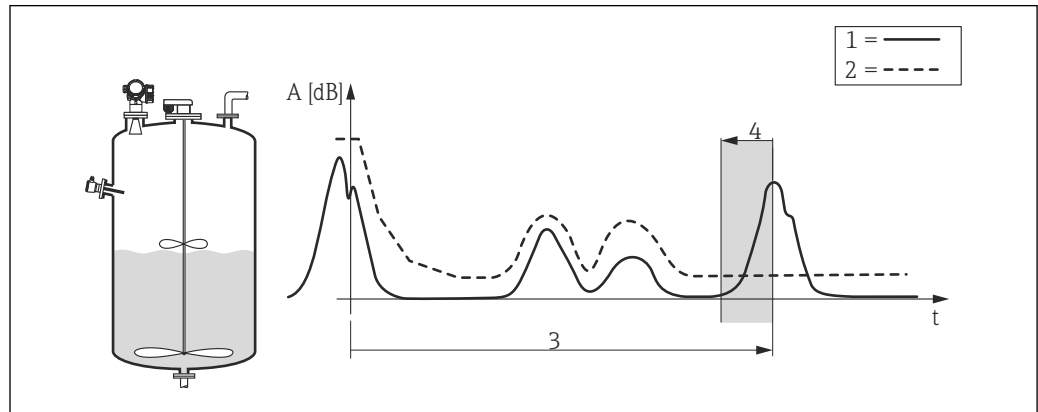
1. Enter the end point of the area to be deleted into the **Mapping end point** parameter (\rightarrow  121).
2. Go to the **Record map** parameter (\rightarrow  122) and select the **Delete partial map** option.

Mapping in the tank bottom area

Irrespective of the defined mapping range, no mapping is recorded near the end of the measuring range (defined in the **Tank/silo height** parameter (→ 63)). In this gap the map assumes a constant value as defined by the **End of mapping** (→ 122) and **End map. ampl.** (→ 122) parameters.

"End of mapping" = "Last map value"

With this setting the last value of the map remains valid within the tank bottom area.

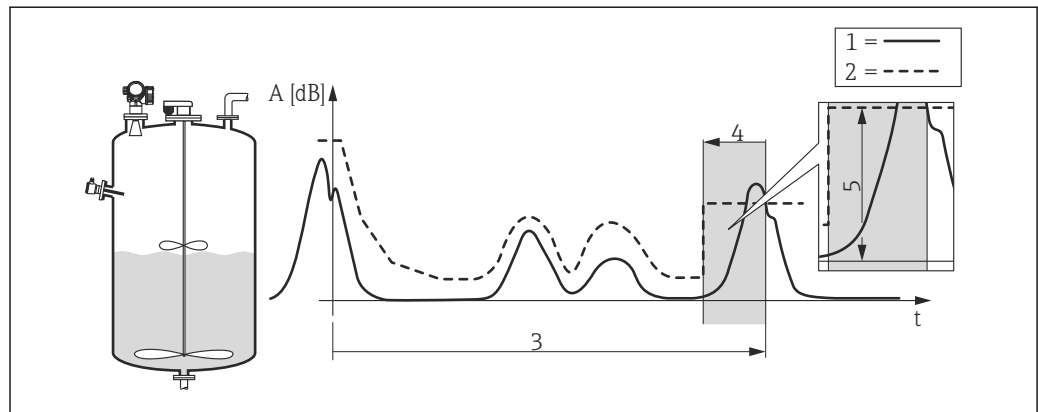


A0020647

- 1 Envelope curve
- 2 Map
- 3 Tank/silo height (→ 63)
- 4 Tank bottom area

"End of mapping" = "Adjustable"


With this setting the value of the mapping curve within the tank bottom area is defined in the **End map. ampl.** parameter (→ 122)

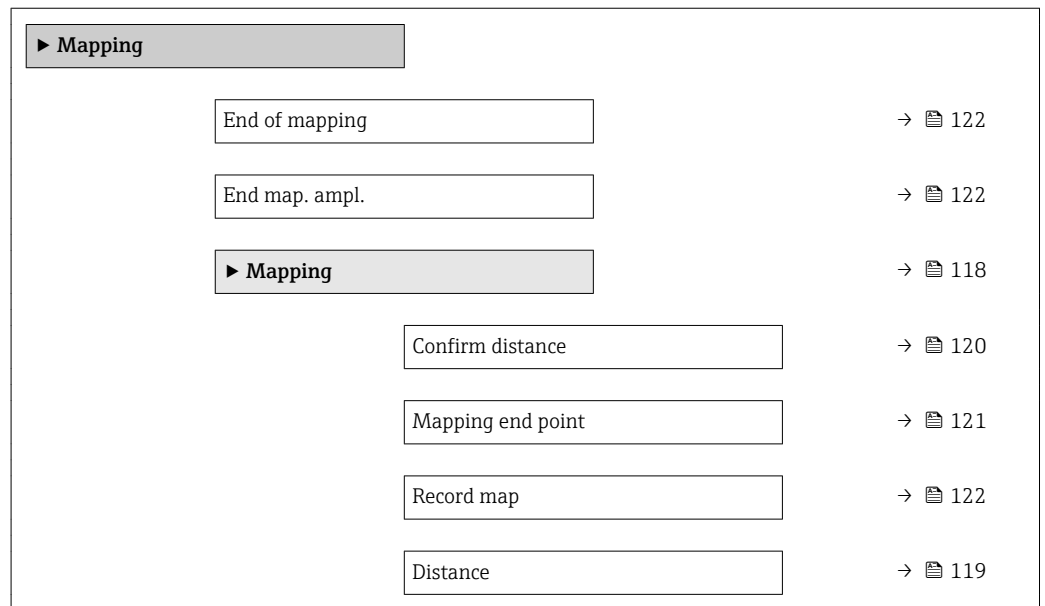


A0020648


- 1 Envelope curve
- 2 Map
- 3 Tank/silo height (→ 63)
- 4 Tank bottom area
- 5 End map. ampl. (→ 122)

Structure of the submenu on the local display








Navigation  Expert → Sensor → Mapping




Structure of the submenu in an operating tool

Navigation  Expert → Sensor → Mapping

"Mapping" submenu in an operating tool

► Mapping		
Distance	→	 119
Confirm distance	→	 120
Present mapping	→	 121
Mapping end point	→	 121
Record map	→	 122
End of mapping	→	 122
End map. ampl.	→	 122

Description of parameters

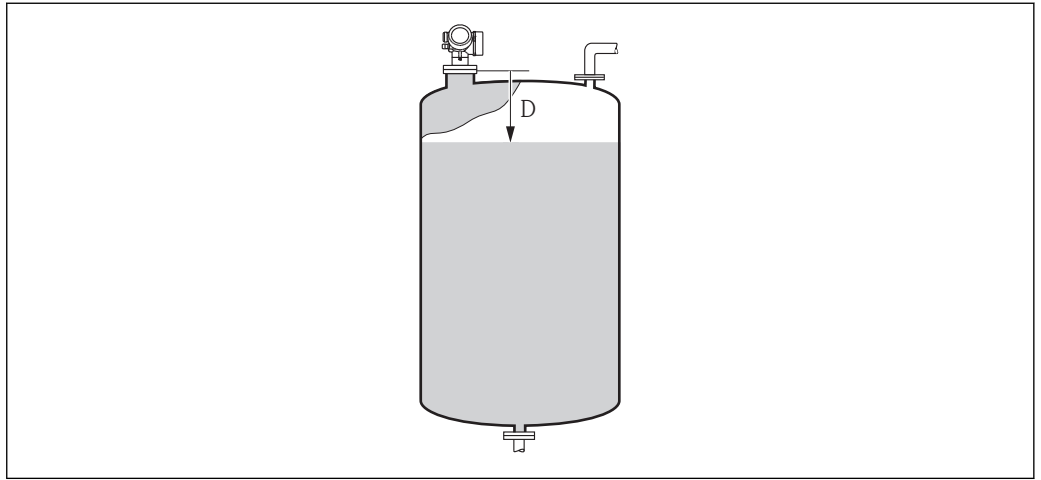
Navigation  Expert → Sensor → Mapping

Distance


Navigation  Expert → Sensor → Mapping → Distance (1124)

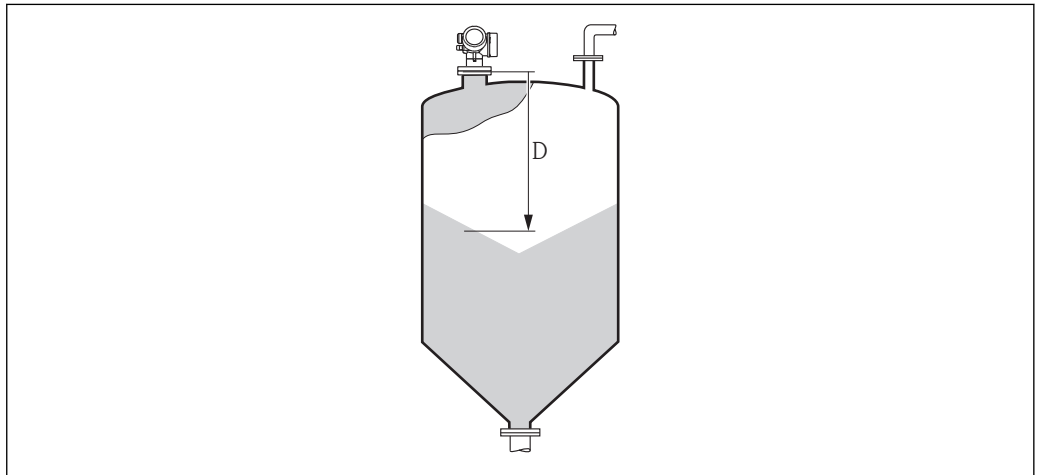
Description Displays the measured distance D between the reference point (lower edge of the flange or threaded connection) and the level.

Additional information




A0019483

 37 Distance for liquid measurements



A0019485

 38 Distance for bulk solid measurements

 The unit is defined in the **Distance unit** parameter (→  46).

Confirm distance
**Navigation**

Expert → Sensor → Mapping → Confirm distance (1045)

Description

Specify, whether the measured distance matches the real distance.
Depending on the selection the device automatically sets the range of mapping.

Selection

- Manual map
- Distance ok
- Distance unknown
- Distance too small ⁷⁾
- Distance too big ⁷⁾
- Tank empty
- Factory map

Factory setting

Distance unknown

Additional information**Meaning of the options**


- **Manual map**
To be selected if the range of mapping is to be defined manually in the **Mapping end point** parameter (→ 121). In this case it is not necessary to confirm the distance.
- **Distance ok**
To be selected if the measured distance matches the actual distance. The device performs a mapping.
- **Distance unknown**
To be selected if the actual distance is unknown. A mapping can not be performed in this case.
- **Distance too small**
To be selected if the measured distance is smaller than the actual distance. The device searches for the next echo and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.


7) Visibility depends on order options or device settings

- **Distance too big**⁸⁾

To be selected if the measured distance exceeds the actual distance. The device adjusts the signal evaluation and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.

- **Tank empty**

To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range as defined by the **Tank/silo height** parameter (→  63). By default, **Tank/silo height** = **Empty calibration**.

Take into account that in case of conical outlets, for example, a measurement is only possible up to the point at which the radar hits the bottom of the tank or silo. If the **Tank empty** option is used, **Empty calibration** (→  57) and **Tank/silo height** may not reach below this point as otherwise the empty signal is suppressed.

- **Factory map**

To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the **Confirm distance** parameter and a new mapping can be recorded.



When operating via the display module, the measured distance is displayed together with this parameter for reference purposes.



If the teaching procedure with the **Distance too small** option or the **Distance too big** option is quit before the distance has been confirmed, a map is **not** recorded and the teaching procedure is reset after 60 s.

Present mapping

Navigation

 Expert → Sensor → Mapping → Present mapping (1182)

Description

Indicates up to which distance a mapping has already been recorded.

Mapping end point

Navigation

 Expert → Sensor → Mapping → Map. end point (1022)

Prerequisite

Confirm distance (→  120) = **Manual map** or **Distance too small**

Description

Specify new end of the mapping.

User entry

0.1 to 999 999.9 m


Factory setting


0.1 m

Additional information





This parameter defines up to which distance the new mapping is to be recorded. The distance is measured from the reference point, i.e. from the lower edge of the mounting flange or the threaded connection.





For reference purposes the **Present mapping** parameter (→  121) is displayed together with this parameter. It indicates up to which distance a mapping has already been recorded.

8) Only available for "Expert → Sensor → Echo tracking → **Evaluation mode** parameter (→  129)" = "Short time history" or "Long time history"



Record map 

Navigation	 Expert → Sensor → Mapping → Record map (1069)
Prerequisite	Confirm distance (→  120) = Manual map or Distance too small
Description	Start recording of the map.
Selection	<ul style="list-style-type: none"> ▪ No ▪ Record map ▪ Overlay map ▪ Factory map ▪ Delete partial map
Factory setting	No
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ▪ No The map is not recorded. ▪ Record map The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing . ▪ Overlay map The new mapping curve is generated by overlaying the old and the current envelope curves. ▪ Factory map The factory map stored in the ROM of the device is used. ▪ Delete partial map The mapping curve is deleted up to Mapping end point (→  121).

End of mapping 


Navigation	  Expert → Sensor → Mapping → End of mapping (1224)
Description	Define behavior of the mapping curve in the tank bottom area.
Selection	<ul style="list-style-type: none"> ▪ Adjustable ▪ Last map value
Factory setting	Adjustable

End map. ampl. 

Navigation	  Expert → Sensor → Mapping → End map. ampl. (1109)
Description	Specify the amplitude of the mapping curve in the tank bottom area.
User entry	-99 999.0 to 99 999.0 dB

Factory setting -90 dB

3.4.14 "Echo tracking" submenu

The echo tracking algorithm takes into account the change in time of the individual echoes when evaluating the envelope curve. This improves the allocation of the echoes to the level or interface signal. Different types of echo tracking can be selected in the **Evaluation mode** parameter (→  129). A number of further parameters is used to configure the echo tracking more precisely.

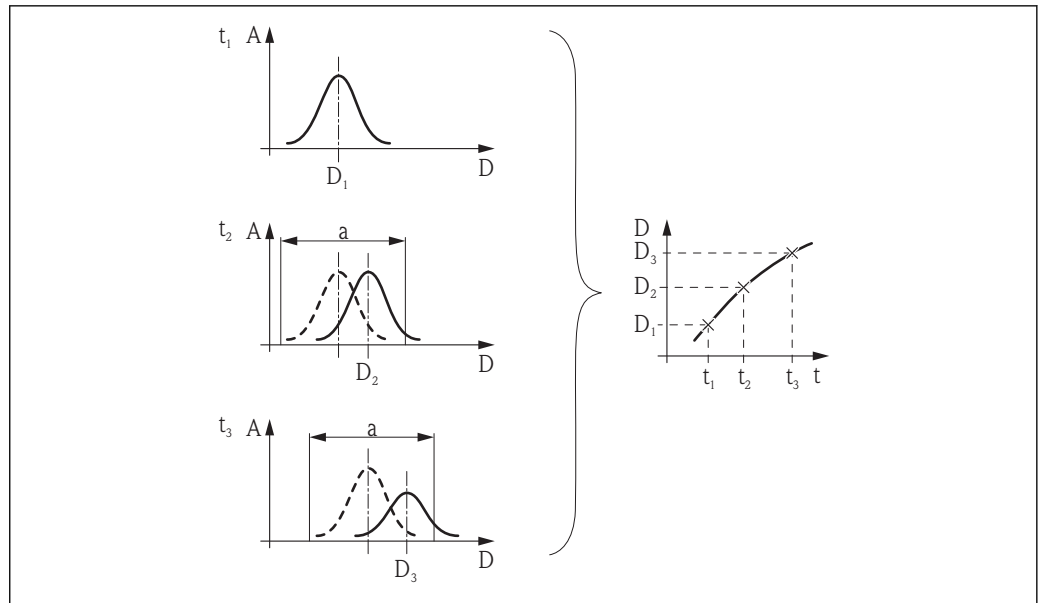
"Evaluation mode" = "History off"

The envelope curve is evaluated statically.

"Evaluation mode" = "Short time history"

The static envelope curve evaluation is taken as a starting point.

The position of the individual echoes is tracked. The track contains the position, the velocity, the relative and the absolute echo amplitude. Normally the strongest echo within a search window is selected and allocated to the track.



A0018587

- 39 *Definition of a track: In a new envelope curve, the echo is searched for in a window of width "a" centered around the echo position in the previous envelope curve. The change of the echo position in the course of time defines the track.*

- i** In this evaluation mode it is possible to activate the moving track recognition (**Moving track recognition** parameter).

The moving track recognition is used to distinguish the level echo from interference echoes. It makes use of the fact that an echo which moves in one direction for a certain time is likely to be the level echo. Interference echoes, on the other hand, normally stay at the same position within the envelope curve.

If the moving track recognition is switched on, this distinction is used as an additional criterion to identify the level echo.

- i** In firmware version 01.00.zz the allocation of the echoes to the track depends on the current position of the echo (for details refer to SI01373F-3):
- If the echo is within the tank bottom area (parameter **Tank bottom range** (→ **133**)), the first echon within th search window is allocated to the track.
 - If the echo is above the tank bottom area, the largest echo within the search window is allocated to the track.

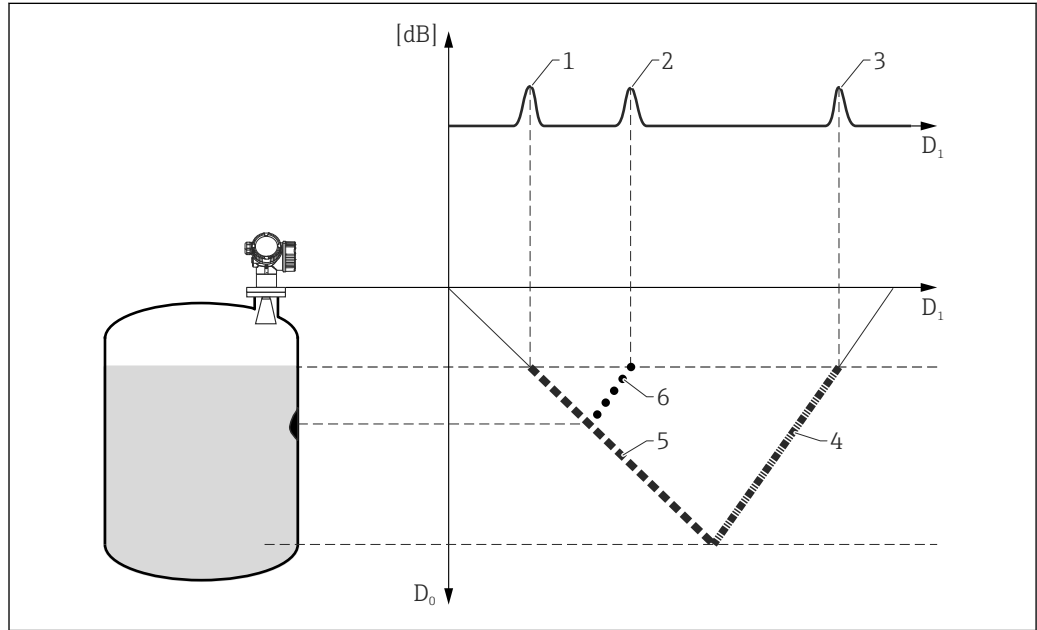
From firmware version 01.01.zz the largest echo within the search window is allocated to the track in any case.

"Evaluation mode" = "Long time history"

A so-called tank history is used for the determination of the level and a consistency check of the echoes.

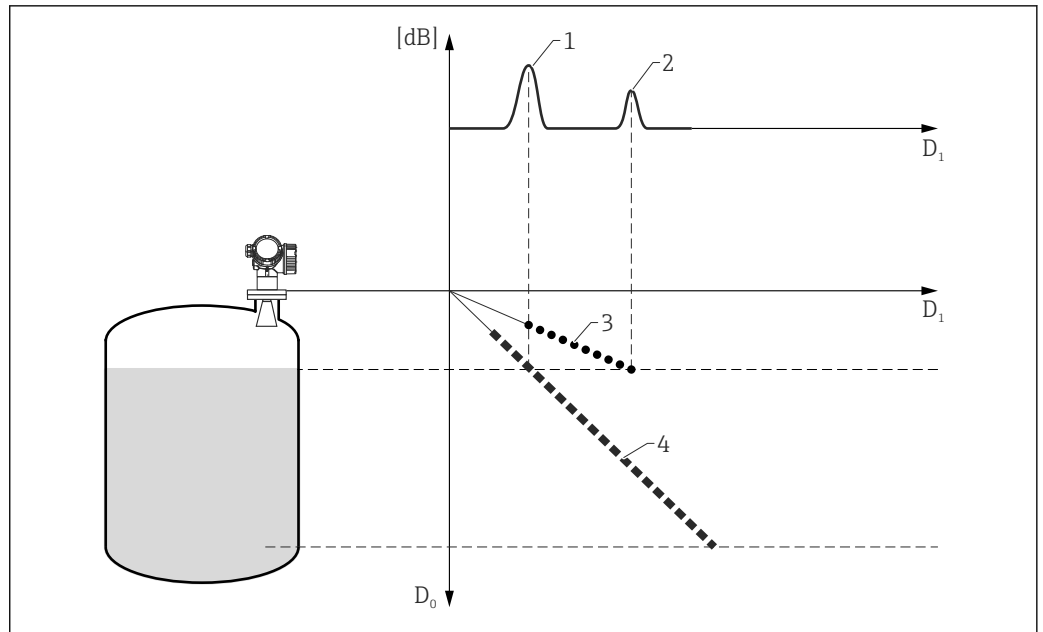
For a given tank with a given medium, the positions of the level, interface, multiple and end-of-probe or tank bottom echoes are in a defined relation to each other. This relationship is recorded during the operation of the device and stored in the tank history. On the basis of this tank history, echoes can be reliably allocated, even if one echo is lost temporarily or if the device was switched off for a while.

Schematic examples



40 Example 1: Tank history with interference echo and tank-bottom echo

- D_0 Actual level distance
- D_1 Distance of the signal in the envelope curve
- 1 Level echo
- 2 Interference echo
- 3 Tank-bottom echo
- 4 Track "Tank-bottom echo" (stored in the tank history)
- 5 Track "Level echo" (stored in the tank history)
- 6 Track "Interference echo" (stored in the tank history)



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41 Example 2: Tank history with a multiple echo

D_0 Actual level distance

D_1 Distance of the signal in the envelope curve

1 Level echo





2 Multiple echo

3 Track "Multiple echo" (stored in the tank history)

4 Track "Level echo" (stored in the tank history)

Structure of the submenu





Navigation  Expert → Sensor → Echo tracking

▶ Echo tracking	
Evaluation mode	→  129
History reset	→  129
History learning control	→  130
History learning	→  130


Description of parameters

Navigation  Expert → Sensor → Echo tracking

Evaluation mode

Navigation	 Expert → Sensor → Echo tracking → Evaluation mode (1112)
Description	Select evaluation mode for echo tracking.
Selection	<ul style="list-style-type: none"> ■ History off ■ Short time history ■ Long time history⁹⁾
Factory setting	Dependent on the Tank type (→  46) or Bin type (→  47) parameter, respectively.
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ■ History off The envelope curve is evaluated only statically. ■ Short time history In addition to the static algorithms a dynamic echo trace is continuously created. ■ Long time history (Only available for level measurements) In addition to the static algorithms and the dynamic echo trace a tank trace is continuously generated. Using the tank trace the device can determine the level even if the level echo is lost temporarily. <p> The Long time history option is not recommended if there are substantial changes of the medium or process conditions within a short period of time (e.g. in the case of changing dielectric constants or boiling media).</p>

History reset

Navigation	 Expert → Sensor → Echo tracking → History reset (1145)
Description	Reset history of the echo and tank tracking.
Selection	<ul style="list-style-type: none"> ■ Reset done ■ Restart echo tracking ■ Delete history
Factory setting	Reset done

9) Visibility depends on order options or device settings

Additional information	Meaning of the options <ul style="list-style-type: none"> ▪ Reset done Does not initiate an action but is only a display option. It is displayed as soon as the reset operation has been accomplished. ▪ Restart echo tracking The echo tracking is reset. The tank trace, however, is maintained. ▪ Delete history The echo tracking and tank trace are reset.
-------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

History learning control




Navigation	Expert → Sensor → Echo tracking → Hist. learn.ctrl (1074)
Prerequisite	Device with PROFIBUS PA or FOUNDATION Fieldbus
Description	Select DO block to be used for starting and stopping the recording of the track.
Selection	<ul style="list-style-type: none"> ▪ None ▪ Digital output 1 ▪ Digital output 2 ▪ Digital output 3 ▪ Digital output 4
Factory setting	None

History learning



Navigation	Expert → Sensor → Echo tracking → History learning (1094)
Prerequisite	Device with PROFIBUS PA or FOUNDATION Fieldbus
Description	Start or stop the recording of the echo track.
Selection	<ul style="list-style-type: none"> ▪ Off ▪ On
Factory setting	On
Additional information	This parameter is only relevant for History learning control (→ 130) = Manual .

3.4.15 "Tank bottom evaluation" submenu

The tank bottom evaluation is intended to prevent an echo loss if the tank is empty.

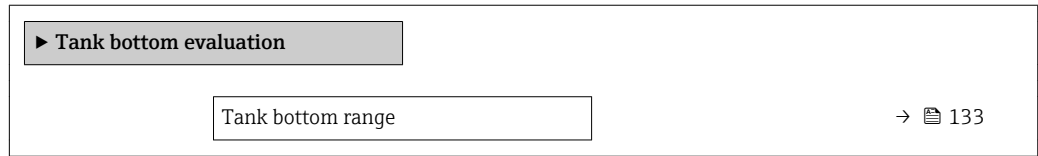
If no echo is found within the defined tank height (**Tank/silo height** (→  **63**)) the tank bottom searches beyond this distance in the **Tank bottom range** (→  **133**), to see whether an echo from the tank bottom exists.

If a tank bottom echo has been found, a level of 0% is assumed. If neither a direct level echo nor a tank bottom echo has been found, an echo loss is reported (error message S941).

-  ■ Level echoes from within the measuring range always have a higher priority than the tank bottom echo.
- The first echo factor is not applied to the tank bottom echo.

Structure of the "Tank bottom evaluation" submenu



Navigation   Expert → Sensor → Tank bottom eval



Description of parameters

Navigation  Expert → Sensor → Tank bottom eval

Tank bottom range

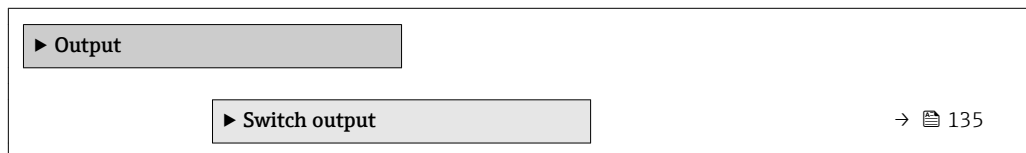
Navigation	 Expert → Sensor → Tank bottom eval → TB range (1149)
Description	Define range (starting from Tank/silo height (→  63)) in which the tank bottom echo is searched for.
User entry	0 to 99.999 m
Factory setting	1 m

3.5 "Output" submenu

The **Output** submenu contains all parameters needed to configure the current and switch outputs.

3.5.1 Structure of the submenu

Navigation  Expert → Output














3.5.2 "Switch output" submenu

The **Switch output** submenu is used to configure the switch output of the device.

Structure of the submenu


Navigation   Expert → Output → Switch output

► Switch output	
Switch output function	→  136
Assign diagnostic behavior	→  136
Assign limit	→  137
Switch-on value	→  137
Switch-off value	→  138
Assign status	→  139
Switch-on delay	→  139
Switch-off delay	→  140
Failure mode	→  140
Switch status	→  140
Invert output signal	→  140

Description of parameters

Navigation  Expert → Output → Switch output

Switch output function

Navigation  Expert → Output → Switch output → Switch out funct (0481)






Description Select function for switch output.


Selection

- Off
- On
- Diagnostic behavior
- Limit
- Digital Output

Factory setting Off


Additional information **Meaning of the options**

- **Off**
The output is always open (non-conductive).
- **On**
The output is always closed (conductive).
- **Diagnostic behavior**
The output is normally closed and is only opened if a diagnostic event is present. The **Assign diagnostic behavior** parameter (→  136) determines for which type of event the output is opened.
- **Limit**
The output is normally closed and is only opened if a measured variable exceeds or falls below a defined limit. The limit values are defined by the following parameters:
 - **Assign limit** (→  137)
 - **Switch-on value** (→  137)
 - **Switch-off value** (→  138)
- **Digital Output**
The switching state of the output tracks the output value of a DI function block. The function block is selected in the **Assign status** parameter (→  139).

 The **Off** and **On** options can be used to simulate the switch output.

Assign diagnostic behavior

Navigation  Expert → Output → Switch output → Assign diag. beh (0482)

Prerequisite **Switch output function** (→  136) = **Diagnostic behavior**



Description Select diagnostic behavior for switch output.


Selection

- Alarm
- Alarm or warning
- Warning

Factory setting Alarm

Assign limit

Navigation   Expert → Output → Switch output → Assign limit (0483)

Prerequisite **Switch output function** (→  136) = **Limit**



Description Select process variable for limit monitoring.


Selection

- Off
- Level linearized
- Distance
- Terminal voltage
- Electronic temperature
- Relative echo amplitude
- Area of incoupling

Factory setting Off

Switch-on value

Navigation   Expert → Output → Switch output → Switch-on value (0466)

Prerequisite **Switch output function** (→  136) = **Limit**

Description Enter measured value for the switch-on point.

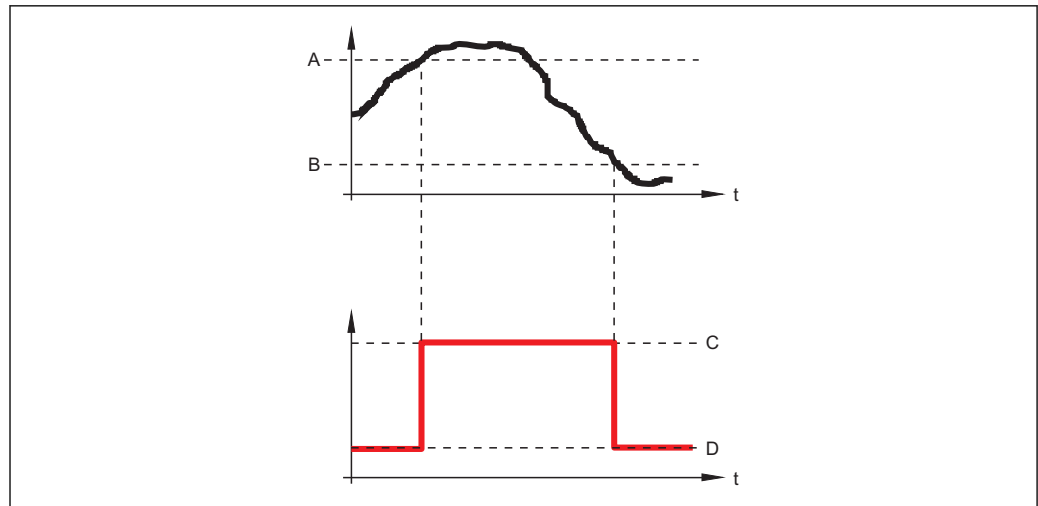
User entry Signed floating-point number

Factory setting 0

Additional information The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters:

Switch-on value > Switch-off value

- The output is closed if the measured value is larger than **Switch-on value**.
- The output is opened if the measured value is smaller than **Switch-off value**.

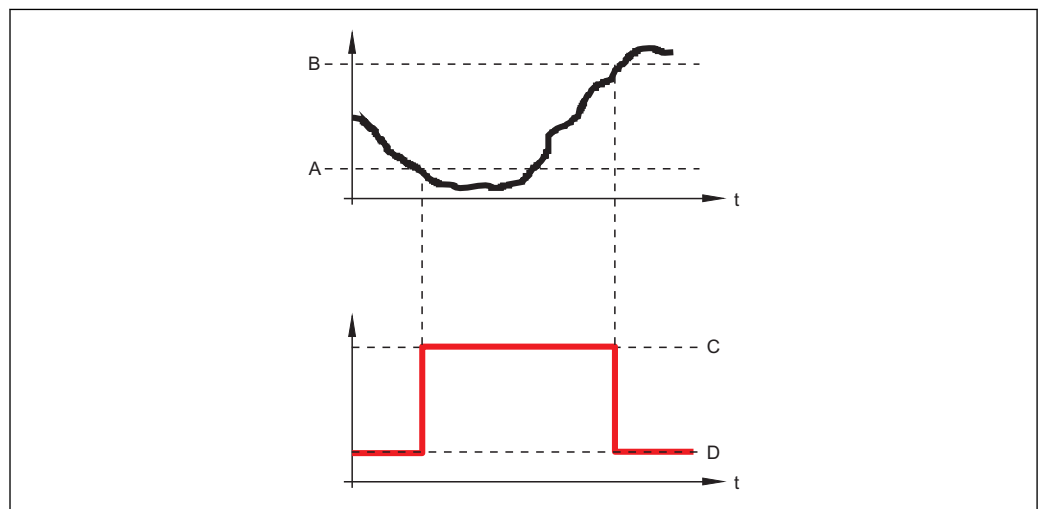


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- A Switch-on value
- B Switch-off value
- C Output closed (conductive)
- D Output opened (non-conductive)

Switch-on value < Switch-off value

- The output is closed if the measured value is smaller than **Switch-on value**.
- The output is opened if the measured value is larger than **Switch-off value**.



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- A Switch-on value
- B Switch-off value
- C Output closed (conductive)
- D Output opened (non-conductive)

Switch-off value



Navigation


🏠 Expert → Output → Switch output → Switch-off value (0464)

Prerequisite





Switch output function (→ 📄 136) = Limit

Description





Enter measured value for the switch-off point.

User entry	Signed floating-point number
Factory setting	0
Additional information	The switching behavior depends on the relative position of the Switch-on value and Switch-off value parameters; description: see the Switch-on value parameter (→  137).

Assign status

Navigation	  Expert → Output → Switch output → Assign status (0485)
Prerequisite	Switch output function (→  136) = Digital Output
Description	Select device status for switch output.
Selection	<ul style="list-style-type: none"> ▪ Off ▪ Digital output AD 1 ▪ Digital output AD 2 ▪ Digital output 1 ▪ Digital output 2 ▪ Digital output 3 ▪ Digital output 4
Factory setting	Off
Additional information	The Digital output AD 1 and Digital output AD 2 options refer to the Advanced Diagnostic Blocks →  240. A switch signal generated in these blocks can be transmitted via the switch output.

Switch-on delay

Navigation	  Expert → Output → Switch output → Switch-on delay (0467)
Prerequisite	<ul style="list-style-type: none"> ▪ Switch output function (→  136) = Limit ▪ Assign limit (→  137) ≠ Off
Description	Define switch-on delay.
User entry	0.0 to 100.0 s
Factory setting	0.0 s

Switch-off delay



Navigation	Expert → Output → Switch output → Switch-off delay (0465)
Prerequisite	<ul style="list-style-type: none"> ▪ Switch output function (→ 136) = Limit ▪ Assign limit (→ 137) ≠ Off
Description	Define switch-off delay.
User entry	0.0 to 100.0 s
Factory setting	0.0 s

Failure mode



Navigation	Expert → Output → Switch output → Failure mode (0486)
Description	Define output behavior in alarm condition.
Selection	<ul style="list-style-type: none"> ▪ Actual status ▪ Open ▪ Closed
Factory setting	Open

Switch status

Navigation	Expert → Output → Switch output → Switch status (0461)
Description	Displays the current state of the switch output.

Invert output signal



Navigation	Expert → Output → Switch output → Invert outp.sig. (0470)
Description	Specify whether the output signal is to be inverted.
Selection	<ul style="list-style-type: none"> ▪ No ▪ Yes
Factory setting	No

Additional information**Meaning of the options**■ **No**


The behavior of the switch output is as described above.




■ **Yes**

The states **Open** and **Closed** are inverted as compared to the description above.


3.6 "Communication" submenu

3.6.1 Structure of the submenu



Navigation  Expert → Communication




▶ Communication	
▶ PROFIBUS PA configuration	→  143
▶ PROFIBUS PA info	→  146
▶ Physical block	→  149

3.6.2 "PROFIBUS PA configuration" submenu

The **PROFIBUS PA configuration** submenu (→  143) contains the parameters needed to define the bus address and device ID number.

Structure of the submenu


Navigation   Expert → Communication → PROFIBUS PA conf

► PROFIBUS PA configuration	
Address mode	→  144
Device address	→  145
Ident number selector	→  145

Description of parameters

Navigation  Expert → Communication → PROFIBUS PA conf

Address mode

Navigation  Expert → Communication → PROFIBUS PA conf → Address mode (1468)


Description Displays the address mode.

Additional information **Meaning of the display options**
 The address mode is defined via address switch 8 in the connection compartment:

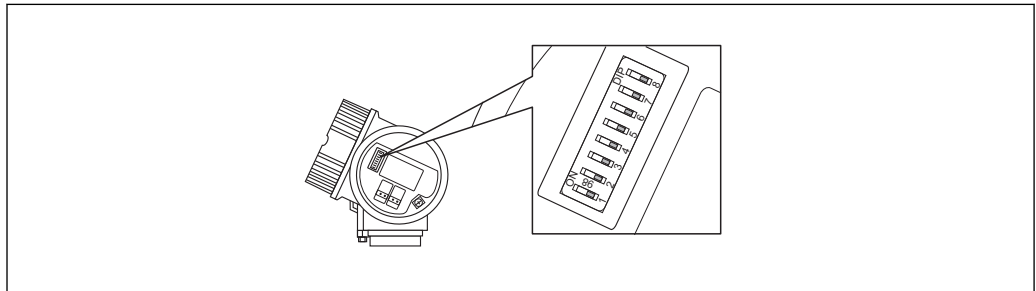
■ **Hardware**

Address switch 8 is in the "OFF" position. Hardware addressing is therefore active: the bus address of the device is configured via address switches 1 to 7


■ **Software**

Address switch 8 is in the "ON" position. Software addressing is therefore active: the bus address of the device is defined in the **Device address** parameter (→  145).

Information on hardware addressing



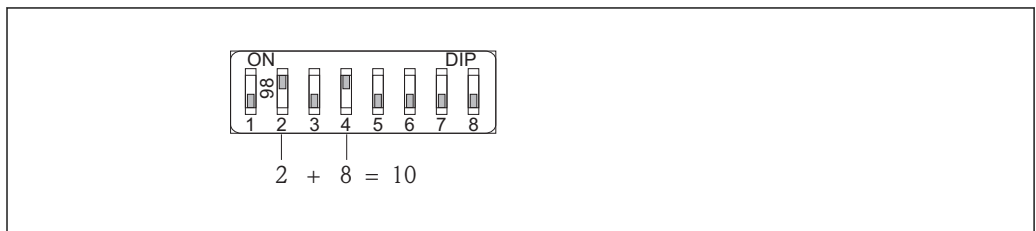
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 42 *Address switch in the connection compartment*

Address switches in the "OFF" position do not contribute to the address. Address switches in the "ON" position contribute to the address as defined in the following list:

- Switch 1: Value = 1
- Switch 2: Value = 2
- Switch 3: Value = 4
- Switch 4: Value = 8
- Switch 5: Value = 16
- Switch 6: Value = 32
- Switch 7: Value = 64

Example







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Address switches 2 and 4 are in the "ON" position; all other address switches are in the "OFF" position

⇒ Address = 2 + 8 = 10

Device address

Navigation	  Expert → Communication → PROFIBUS PA conf → Device address (1462)
Description	<ul style="list-style-type: none"> ■ for Address mode (→  144) = Software: Enter bus address. ■ for Address mode (→  144) = Hardware: Displays bus address.
User entry	0 to 126
Factory setting	126


Ident number selector









Navigation	  Expert → Communication → PROFIBUS PA conf → Ident num select (1461)
Description	Select ident number of the device.
Selection	<ul style="list-style-type: none"> ■ Profile ■ FMR5x (1559hex) ■ FMR2xx (1522hex) ■ Auto
Factory setting	Auto
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ■ Profile The ident number of the PROFIBUS profiles is used. ■ FMR5x (1559hex) The ident number of Micropilot FMR5x is used. ■ FMR2xx (1522hex) The ident number of the previous device type, Micropilot M FMR2xx, is used. ■ Auto The ident number can be adapted automatically by a Class I PROFIBUS master.

3.6.3 "PROFIBUS PA info" submenu


The **PROFIBUS PA info** submenu contains all parameters that provide information about the condition of the PROFIBUS PA interface.

Structure of the submenu


Navigation  Expert → Communication → PROFIBUS PA info

► PROFIBUS PA info	
Status PROFIBUS Master Config	→  147
PROFIBUS ident number	→  147
Profile version	→  147
CRC Count OK	→  147
CRC Count Failed	→  147
Number of good between bad telegrams	→  148
Base current	→  148
Terminal voltage 1	→  148



Description of parameters

Navigation  Expert → Communication → PROFIBUS PA info


Status PROFIBUS Master Config

Navigation	 Expert → Communication → PROFIBUS PA info → Stat Master Conf (1465)
Description	Indicates whether the cyclic data exchange with the master is currently active.
User interface	<ul style="list-style-type: none"> ■ Active ■ Not active


PROFIBUS ident number

Navigation	 Expert → Communication → PROFIBUS PA info → Ident number (1471)
Description	Indicates the ident number of the device.
Additional information	The Ident number selector parameter (→  145) can be used to define which ident number is used.


Profile version

Navigation	 Expert → Communication → PROFIBUS PA info → Profile version (1463)
Description	Displays the PROFIBUS profile version of the device.

CRC Count OK

Navigation	 Expert → Communication → PROFIBUS PA info → CRC Count OK (1469)
Description	Indicates how many times the checksum test of the cyclic data telegram was successful.

CRC Count Failed

Navigation	 Expert → Communication → PROFIBUS PA info → CRC Count Failed (1470)
Description	Indicates how many times the checksum test of the cyclic data telegram discovered an error.

Number of good between bad telegrams

Navigation Expert → Communication → PROFIBUS PA info → Good telegrams (1467)**Description**

Indicates how many error-free data telegrams were transmitted between the two last failed data telegrams.

Base current

Navigation Expert → Communication → PROFIBUS PA info → Base current (1466)**Description**

Displays the present current consumption at the PROFIBUS input of the device.

Terminal voltage 1


Navigation Expert → Communication → PROFIBUS PA info → Terminal volt. 1 (0662) Expert → Communication → PROFIBUS PA info → Base current (1466)**Description**





















Displays terminal voltage at the current output.

3.6.4 "Physical block" submenu

The **Physical block** submenu contains the parameters of the Physical block as per the PROFIBUS profiles.

Structure of the submenu

Navigation  Expert → Communication → Physical block

► Physical block	
Device tag	→  150
Static revision	→  150
Strategy	→  150
Alert key	→  151
Target mode	→  151
Mode block actual	→  151
Mode block permitted	→  151
Mode block normal	→  152
Alarm summary	→  152
Software revision	→  152
Hardware revision	→  152
Manufacturer ID	→  152
Device ID	→  153
Serial number	→  153
Diagnostics	→  153
Diagnostics mask	→  154
Device certification	→  154
Factory reset	→  154
Descriptor	→  155
Device message	→  155

Device install date	→ 155
Ident number selector	→ 155
Hardware lock	→ 156
Feature supported	→ 156
Feature enabled	→ 156
Condensed status diagnostic	→ 156

Descripton of parameters

Navigation Expert → Communication → Physical block

Device tag

Navigation	Expert → Communication → Physical block → Device tag (1496)
Description	Enter tag for measuring point.
User entry	Up to 32 alphanumerical characters
Factory setting	FMR5x

Static revision

Navigation	Expert → Communication → Physical block → Static revision (1495)
Description	Standard block parameter ST_REV according to the PROFIBUS profile
User interface	0 to 65 535
Factory setting	0

Strategy

Navigation	Expert → Communication → Physical block → Strategy (1494)
Description	Standard block parameter STRATEGY according to the PROFIBUS profile
User entry	0 to 65 535

Factory setting 0

Alert key

Navigation   Expert → Communication → Physical block → Alert key (1473)

Description Standard block parameter **ALERT_KEY** according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Target mode

Navigation   Expert → Communication → Physical block → Target mode (1497)



Description Standard block parameter **TARGET_MODE** according to the PROFIBUS profile

Selection

- Auto
- Out of service

Factory setting Auto

Mode block actual



Navigation   Expert → Communication → Physical block → Mode block act (1472)

Description Element **Actual** of the standard block parameter **MODE_BLK** according to the PROFIBUS profile

User interface

- Auto
- Out of service


Mode block permitted

Navigation   Expert → Communication → Physical block → Mode block perm (1493)


Description Element **Permitted** of the standard block parameter **MODE_BLK** according to the PROFIBUS profile

User interface 0 to 255


Mode block normal

Navigation	 Expert → Communication → Physical block → Mode blk norm (1492)
Description	Element Normal of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Auto ▪ Out of service


Alarm summary

Navigation	 Expert → Communication → Physical block → Alarm summary (1474)
Description	Standard block parameter ALARM_SUM according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Discrete alarm ▪ Alarm state HiHi limit ▪ Alarm state Hi limit ▪ Alarm state LoLo limit ▪ Alarm state Lo limit ▪ Update Event


Software revision

Navigation	 Expert → Communication → Physical block → Software rev. (1478)
Description	Standard parameter SOFTWARE_REVISION of the Physical block according to the PROFIBUS profile

Hardware revision

Navigation	 Expert → Communication → Physical block → Hardware rev. (1479)
Description	Standard parameter HARDWARE_REVISION of the Physical block according to the PROFIBUS profile

Manufacturer ID

Navigation	 Expert → Communication → Physical block → Manufacturer ID (1502)
Description	Standard parameter DEVICE_MAN_ID of the Physical block according to the PROFIBUS profile


User interface 0 to 65 535

Device ID

Navigation  Expert → Communication → Physical block → Device ID (1480)

Description Standard parameter **DEVICE_ID** of the Physical block according to the PROFIBUS profile

Serial number

Navigation  Expert → Communication → Physical block → Serial number (1481)

Description Standard parameter **DEVICE_SER_NUM** of the Physical block according to the PROFIBUS profile

Diagnostics


Navigation  Expert → Communication → Physical block → Diagnostics (1482)

Description Standard parameter **DIAGNOSIS** of the Physical block according to the PROFIBUS profile


User interface

- Hardware failure electronics
- Hardware failure mechanics
- Temperature motor
- Electronic temperature
- Memory checksum error
- Measurement error
- Device not initialized
- Initialization error
- Zero point error
- Power supply
- Configuration invalid
- On warmstart
- On coldstart
- Maintenance required
- Characterization invalid
- Ident number violation
- More information available
- Maintenance alarm
- Maintenance demanded
- Function check or simulation
- Invalid process condition

Diagnostics mask


Navigation	 Expert → Communication → Physical block → Diagnostics mask (1484)
Description	Standard parameter DIAGNOSIS_MASK of the Physical block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Hardware failure electronics ■ Hardware failure mechanics ■ Temperature motor ■ Electronic temperature ■ Memory checksum error ■ Measurement error ■ Device not initialized ■ Initialization error ■ Zero point error ■ Power supply ■ Configuration invalid ■ On warmstart ■ On coldstart ■ Maintenance required ■ Characterization invalid ■ Ident number violation ■ More information available ■ Maintenance alarm ■ Maintenance demanded ■ Function check or simulation ■ Invalid process condition

Device certification

Navigation	 Expert → Communication → Physical block → Dev certificate (1486)
Description	Standard parameter DEVICE_CERTIFICATION of the Physical block according to the PROFIBUS profile


Factory reset




Navigation	 Expert → Communication → Physical block → Factory reset (1488)
Description	Standard parameter FACTORY_RESET of the Physical block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ■ to defaults ■ warmstart device ■ reset bus address ■ Cancel
Factory setting	Cancel

Descriptor 	
Navigation	  Expert → Communication → Physical block → Descriptor (1489)
Description	Standard parameter DESCRIPTOR of the Physical block according to the PROFIBUS profile
Device message 	
Navigation	  Expert → Communication → Physical block → Device message (1490)
Description	Standard parameter DEVICE_MESSAGE of the Physical block according to the PROFIBUS profile
Device install date 	
Navigation	  Expert → Communication → Physical block → Device inst.date (1491)
Description	Standard parameter DEVICE_INSTAL_DATE of the Physical block according to the PROFIBUS profile
Ident number selector 	
Navigation	  Expert → Communication → Physical block → Ident num select (1461)
Description	Select ident number of the device.
Selection	<ul style="list-style-type: none"> ■ Profile ■ FMR5x (1559hex) ■ FMR2xx (1522hex) ■ Auto
Factory setting	Auto
Additional information	<p>Meaning of the options</p> <ul style="list-style-type: none"> ■ Profile The ident number of the PROFIBUS profiles is used. ■ FMR5x (1559hex) The ident number of Micropilot FMR5x is used. ■ FMR2xx (1522hex) The ident number of the previous device type, Micropilot M FMR2xx, is used. ■ Auto The ident number can be adapted automatically by a Class I PROFIBUS master.


Hardware lock

Navigation	 Expert → Communication → Physical block → Hardware lock (1499)
Description	Standard parameter HW_WRITE_PROTECTION of the Physical block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Unprotected ■ Protected

Feature supported


Navigation	 Expert → Communication → Physical block → Feature support (1477)
Description	Element Supported of the parameter HW_WRITE_PROTECTION in the Physical block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Condensed status ■ Classic status diagnosis ■ Data exchange broadcast ■ MS1 application relationship ■ PROFIsafe communication

Feature enabled

Navigation	 Expert → Communication → Physical block → Feature enabled (1476)
Description	Element Enabled of the parameter HW_WRITE_PROTECTION in the Physical block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Condensed status ■ Classic status diagnosis ■ Data exchange broadcast ■ MS1 application relationship ■ PROFIsafe communication

Condensed status diagnostic



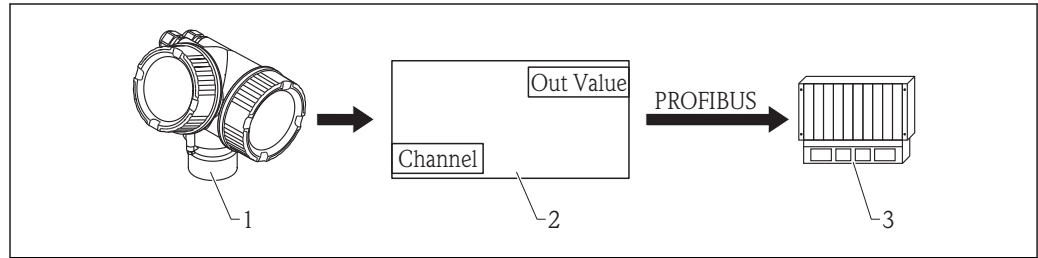
Navigation	 Expert → Communication → Physical block → Condensed status (1500)
Description	Parameter COND_STATUS_DIAG in the Physical block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ■ Off ■ On

Factory setting On

3.7 "Analog input 1 to 6" submenu

3.7.1 Overview

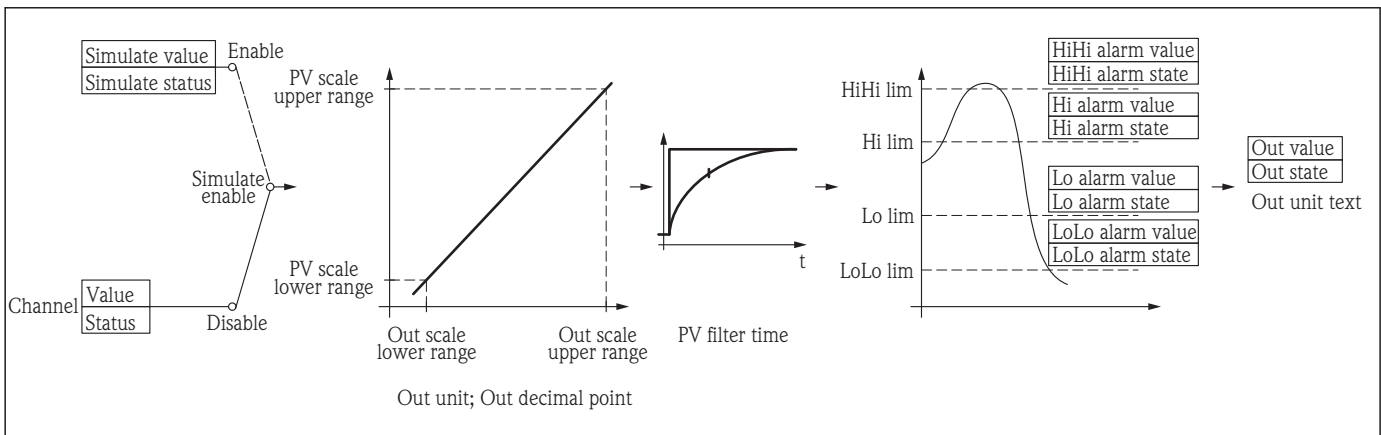
There is an **Analog input** submenu for each Analog Input block in the device. This submenu contains the block parameters of the individual block. The parameters of the Analog Input block are described in the PROFIBUS profile. The most important characteristics of the parameters are summarized below. An Analog Input block can be used to scale a measured variable of the device and transmit it via the bus to a PLC, for example.



43 Transmission of an analog value to a PLC via the Analog Input block


- 1 Transmitter
- 2 Analog Input block (part of the transmitter software)
- 3 PLC























Data processing in the Analog Input block



i The diagram describes the function of the Analog Input block in the normal operational state (**Mode block actual** (→ 162) = **Auto**). The block's behavior in other operational states is described in the Profibus profiles of the Profibus User Organization (PNO).


3.7.2 Structure of the submenu

Navigation  Expert → Analog inputs → Analog input 1 to 6


► Analog input 1 to 6	
Tag description	→  161
Static revision	→  161
Strategy	→  161
Alert key	→  161
Target mode	→  162
Mode block actual	→  162
Mode block permitted	→  162
Mode block normal	→  162
Alarm summary	→  163
Batch ID	→  163
Batch operation	→  163
Batch phase	→  163
Batch Recipe Unit Procedure	→  164
Out value	→  164
Out status	→  164
Out status HEX	→  165
PV scale lower range	→  165
PV scale upper range	→  165
Out scale lower range	→  166
Out scale upper range	→  166
Lin type	→  166
Channel	→  166

Out unit	→ 167
Out decimal point	→ 167
Out unit text	→ 167
PV filter time	→ 168
Fail safe type	→ 168
Fail safe value	→ 168
Alarm hysteresis	→ 169
Hi Hi Lim	→ 169
Hi Lim	→ 169
Lo Lim	→ 170
Lo Lo Lim	→ 170
Hi Hi alarm value	→ 171
Hi Hi alarm state	→ 171
Hi alarm value	→ 171
Hi alarm state	→ 171
Lo alarm value	→ 172
Lo alarm state	→ 172
Lo Lo alarm value	→ 172
Lo Lo alarm state	→ 172
Simulate enabled	→ 173
Simulate value	→ 173
Simulate status	→ 173

3.7.3 Description of parameters


Navigation  Expert → Analog inputs → Analog input 1 to 6

Tag description

Navigation  Expert → Analog inputs → Analog input 1 to 6 → Tag description (1562-1 to 6)

Description Standard block parameter **TAG_DESC** according to the PROFIBUS profile


Static revision

Navigation  Expert → Analog inputs → Analog input 1 to 6 → Static revision (1560-1 to 6)

Description Standard block parameter **ST_REV** according to the PROFIBUS profile

User interface 0 to 65 535

Strategy


Navigation  Expert → Analog inputs → Analog input 1 to 6 → Strategy (1559-1 to 6)

Description Standard block parameter **STRATEGY** according to the PROFIBUS profile

User entry 0 to 65 535

Factory setting 0

Alert key


Navigation  Expert → Analog inputs → Analog input 1 to 6 → Alert key (1522-1 to 6)

Description Standard block parameter **ALERT_KEY** according to the PROFIBUS profile


User entry 0 to 255

Factory setting 0


Target mode 

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Target mode (1563-1 to 6)
Description	Standard block parameter TARGET_MODE according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ■ Auto ■ Man ■ Out of service
Factory setting	Auto


Mode block actual

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Mode block act (1521-1 to 6)
Description	Element Actual of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Auto ■ Man ■ Out of service


Mode block permitted

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Mode block perm (1553-1 to 6)
Description	Element Permitted of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	0 to 255

Mode block normal


Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Mode blk norm (1546-1 to 6)
Description	Element Normal of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Auto ■ Man ■ Out of service

Alarm summary

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Alarm summary (1537-1 to 6)
Description	Standard block parameter ALARM_SUM according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Discrete alarm ▪ Alarm state HiHi limit ▪ Alarm state Hi limit ▪ Alarm state LoLo limit ▪ Alarm state Lo limit ▪ Update Event


Batch ID



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Batch ID (1533-1 to 6)
Description	Element Batch_ID of the standard block parameter BATCH according to the PROFIBUS profile
User entry	Positive integer
Factory setting	0


Batch operation



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Batch operation (1534-1 to 6)
Description	Element Operation of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch phase



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Batch phase (1535-1 to 6)
Description	Element Phase of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch Recipe Unit Procedure


Navigation	Expert → Analog inputs → Analog input 1 to 6 → Batch Recipe (1536-1 to 6)
Description	Element Rup (Recipe unit procedure) of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0


Out value

Navigation	Expert → Analog inputs → Analog input 1 to 6 → Out value (1552-1 to 6)
Description	Element Value of the standard parameter OUT in the Analog Input Block according to the PROFIBUS Profile.
User entry	Signed floating-point number
Factory setting	0
Additional information	<ul style="list-style-type: none"> ▪ For Mode block actual (→ 162) = Man: Enter the output value of the Analog Input Block. ▪ Else: Displays the output value of the Analog Input Block.

Out status


Navigation	Expert → Analog inputs → Analog input 1 to 6 → Out status (1564-1 to 6)
Description	Element Status of the standard parameter OUT in the Analog Input Block according to the PROFIBUS Profile.
User interface	<ul style="list-style-type: none"> ▪ Good ▪ Uncertain ▪ Bad
Additional information	Only the two quality bits are evaluated in this parameter.

Out status HEX

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Out status HEX (1549-1 to 6)
Description	Element Status of the standard parameter OUT in the Analog Input Block according to the PROFIBUS Profile.
User entry	0 to 255
Factory setting	128
Additional information	The complete status byte is displayed in the form of a two-digit hexadecimal number in this parameter.


PV scale lower range



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → PVscale lo range (1554-1 to 6)
Description	Element EU_at_0% of the standard parameter PV_SCALE in the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the 0% marker for the input value of the block.

PV scale upper range



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → PVscale up range (1555-1 to 6)
Description	Element EU_at_100% of the standard parameter PV_SCALE in the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	100.0
Additional information	This parameter defines the 100% marker for the input value of the block.

Out scale lower range



Navigation	Expert → Analog inputs → Analog input 1 to 6 → Out scale low (1548-1 to 6)
Description	Element EU_at_0% of the standard parameter OUT_SCALE in the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the 0% marker for the output value of the block.

Out scale upper range



Navigation	Expert → Analog inputs → Analog input 1 to 6 → Out scale up (1551-1 to 6)
Description	Element EU_at_100% of the standard parameter OUT_SCALE in the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	100.0
Additional information	This parameter defines the 100% marker for the output value of the block.

Lin type



Navigation	Expert → Analog inputs → Analog input 1 to 6 → Lin type (1523-1 to 6)
Description	Standard parameter LIN_TYPE of the Analog Input block according to the PROFIBUS profile
Selection	Off
Factory setting	Off

Channel




Navigation	Expert → Analog inputs → Analog input 1 to 6 → Channel (1561-1 to 6)
Description	Standard parameter CHANNEL of the Analog Input Block according to the PROFIBUS Profile.

Selection	<ul style="list-style-type: none"> ▪ Level linearized ▪ Distance ▪ Terminal voltage ▪ Electronic temperature ▪ Absolute echo amplitude ▪ Relative echo amplitude ▪ Sensor debug ▪ Analog output adv. diagnostics 1 ▪ Analog output adv. diagnostics 2
------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Factory setting Level linearized

Additional information Allocates a measured value to the AI block.

Out unit

Navigation  Expert → Analog inputs → Analog input 1 to 6 → Out unit (1550-1 to 6)


Description Element **Units_Index** of the standard parameter **OUT_SCALE** in the Analog Input block according to the PROFIBUS profile

User entry 0 to 65 535

Factory setting 1 997

Additional information This parameter defines the unit for the output value. The units are represented by a numeric code according to the PROFIBUS profile.

Out decimal point

Navigation  Expert → Analog inputs → Analog input 1 to 6 → Out dec_point (1547-1 to 6)


Description Element **Decimal_Point** of the standard parameter **OUT_SCALE** in the Analog Input block according to the PROFIBUS profile

User entry 0 to 7

Factory setting 0

Additional information This parameter defines up to which decimal the output value is to be considered valid.

Out unit text



Navigation  Expert → Analog inputs → Analog input 1 to 6 → Out unit text (1532-1 to 6)

Description Standard block parameter **OUT_UNIT_TEXT** in the Analog Input block according to the PROFIBUS profile

Factory setting NoUnit

Additional information This text is used as unit if **Out unit** (→  167) = **1995: Textual unit**.

PV filter time

Navigation   Expert → Analog inputs → Analog input 1 to 6 → PV filter time (1524-1 to 6)



Description Standard parameter **PV_FTIME** of the Analog Input Block according to the PROFIBUS profile.

User entry Positive floating-point number

Factory setting 0

Additional information This parameter defines the damping constant τ (in seconds) for the output of the Analog Input Block.

Fail safe type

Navigation   Expert → Analog inputs → Analog input 1 to 6 → Fail safe type (1525-1 to 6)

Description Standard parameter **FSAFE_TYPE** of the Analog Input Block according to the PROFIBUS profile.


Selection

- Fail safe value
- Fallback value
- Off

Factory setting Off

Additional information

Meaning of the options
This parameter specifies the output value of the Analog Input block in the event of an error.

- **Fail safe value**
The output value in the event of an error is defined in the **Fail safe value** parameter (→  168).
- **Fallback value**
The last output value that was valid before the error occurred is retained.
- **Off**
The output value follows the current measured value. The status is set to BAD.



Fail safe value

Navigation   Expert → Analog inputs → Analog input 1 to 6 → Fail safe value (1526-1 to 6)



Prerequisite **Fail safe type** (→  168) = **Fail safe value**

Description	Standard parameter FSAFE_VALUE of the Analog Input Block according to the PROFIBUS profile.
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the output value of the Analog Input Block in case of an error.


Alarm hysteresis


Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Alarm hysteresis (1527-1 to 6)
Description	Standard parameter ALARM_HYS of the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the hysteresis for limit violation of the output value in the Analog Input block. The hysteresis is specified in the same unit as the output value (Out unit parameter (→  167)).

Hi Hi Lim



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Hi Hi Lim (1528-1 to 6)
Description	Standard parameter HI_HI_LIM of the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	Positive floating-point number
Additional information	An alarm is generated if the output value of the Analog Input block rises above this value.  For a consistent evaluation of the output status, the limit values must be defined in ascending order: Lo Lo Lim < Lo Lim < Hi Lim < Hi Hi Lim

Hi Lim



Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Hi Lim (1529-1 to 6)
Description	Standard parameter HI_LIM in the Analog Input block according to the PROFIBUS profile

User entry	Signed floating-point number
Factory setting	Positive floating-point number
Additional information	An alarm is generated if the output value of the Analog Input block rises above this value.  For a consistent evaluation of the output status, the limit values must be defined in ascending order: Lo Lo Lim < Lo Lim < Hi Lim < Hi Hi Lim


Lo Lim

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Lo Lim (1530-1 to 6)
Description	Standard parameter LO_LIM of the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	Negative floating-point number
Additional information	An alarm is generated if the output value of the Analog Input block falls below this value.  For a consistent evaluation fo the output status, the limit values must be defined in ascending order: Lo Lo Lim < Lo Lim < Hi Lim < Hi Hi Lim


Lo Lo Lim

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Lo Lo Lim (1531-1 to 6)
Description	Standard parameter LO_LO_LIM of the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	Negative floating-point number
Additional information	An alarm is generated if the output value of the Analog Input block falls below this value.  For a consistent evaluation of the output status, the limit values must be defined in ascending order: Lo Lo Lim < Lo Lim < Hi Lim < Hi Hi Lim


Hi Hi alarm value

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → HiHi alarm value (1541-1 to 6)
Description	Element Value of the standard parameter HI_HI_ALM in the Analog Input block according to the PROFIBUS profile
User interface	Signed floating-point number
Additional information	This parameter displays the output value which caused the alarm.


Hi Hi alarm state

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → HiHi alarm state (1540-1 to 6)
Description	Element Alarm_State of the standard parameter HI_HI_ALM in the Analog Input block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ No alarm ■ Alarm state HiHi limit
Additional information	This parameter indicates whether an alarm caused by Hi Hi Lim violation is currently active.

Hi alarm value


Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Hi alarm value (1539-1 to 6)
Description	Element Value of the standard parameter HI_ALM in the Analog Input block according to the PROFIBUS profile
User interface	Signed floating-point number
Additional information	This parameter displays the output value which caused the alarm.

Hi alarm state

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Hi alarm state (1538-1 to 6)
Description	Element Alarm_State of the standard parameter HI_ALM in the Analog Input block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ No warning ■ Alarm state Hi limit

Additional information This parameter indicates whether an alarm caused by a Hi Lim violation is currently active.

Lo alarm value

Navigation  Expert → Analog inputs → Analog input 1 to 6 → Lo alarm value (1543-1 to 6)

Description Element **Value** of the standard parameter **LO_ALM** in the Analog Input block according to the PROFIBUS profile

User interface Signed floating-point number

Additional information This parameter displays the output value which caused the alarm.

Lo alarm state

Navigation  Expert → Analog inputs → Analog input 1 to 6 → Lo alarm state (1542-1 to 6)

Description Element **Alarm_State** of the standard parameter **LO_ALM** in the Analog Input block according to the PROFIBUS profile

User interface

- No warning
- Alarm state Lo limit

Additional information This parameter indicates whether an alarm caused by a Lo Lim violation is currently active.

Lo Lo alarm value

Navigation  Expert → Analog inputs → Analog input 1 to 6 → LoLo alarm value (1545-1 to 6)

Description Element **Value** of the standard parameter **LO_LO_ALM** in the Analog Input block according to the PROFIBUS profile

User interface Signed floating-point number

Additional information This parameter displays the output value which caused the alarm.





Lo Lo alarm state

Navigation  Expert → Analog inputs → Analog input 1 to 6 → LoLo alarm state (1544-1 to 6)


Description Element **Alarm_State** of the standard parameter **LO_LO_ALM** in the Analog Input block according to the PROFIBUS profile

User interface	<ul style="list-style-type: none"> ▪ No alarm ▪ Alarm state LoLo limit
Additional information	This parameter indicates whether an alarm caused by a Lo Lo Lim violation is currently active.


Simulate enabled 

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Simulate enabled (1556-1 to 6)
Description	Element Simulate_Enabled of the standard parameter SIMULATE in the Analog Input block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ▪ Disable ▪ Enable
Factory setting	Disable
Additional information	Enables or disables the simulation of the Analog Input block. If the simulation is enabled, the Analog Input block uses a constant simulation value instead of the measured value selected in Channel (→  166). This value is specified in Simulate value (→  173). The associated status is specified in Simulate status (→  173).

Simulate value 

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Simulate value (1558-1 to 6)
Description	Element Simulate_Value of the standard parameter SIMULATE in the Analog Input block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the simulation value.

Simulate status 

Navigation	 Expert → Analog inputs → Analog input 1 to 6 → Simulate status (1557-1 to 6)
Description	Element Simulate_Status of the standard parameter SIMULATE in the Analog Input block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	0

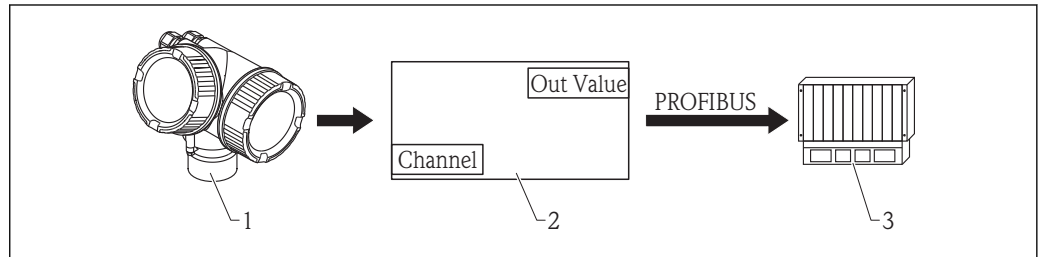
Additional information

This parameter defines the status of the simulation value.

3.8 "Discrete input 1 to 4" submenu

3.8.1 Übersicht

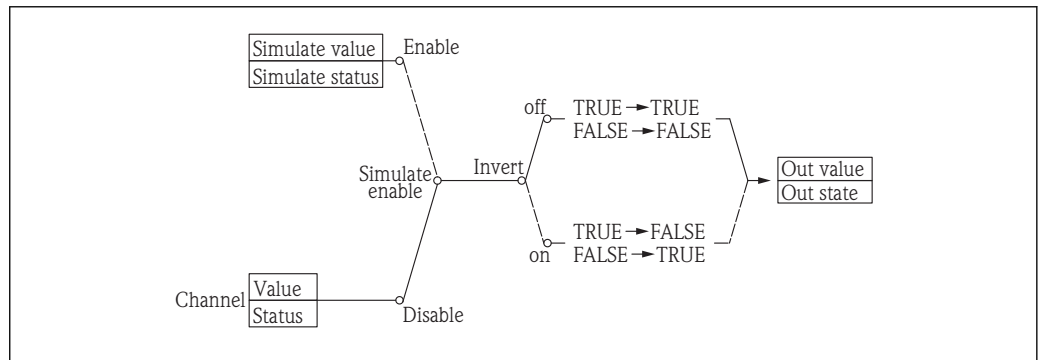
There is a **Discrete input** submenu for each Discrete Input block in the device. It contains the block parameters of the respective block. The parameters of the Discrete Input block are described in the PROFIBUS profile. The most important characteristics of the parameters are summarized below. A Discrete Input block can be used to transmit a discrete measured variable via the bus to a PLC, for example.



44 Transmission of a discrete value to a PLC via the Discrete Input block


- 1 Transmitter
- 2 Discrete Input block (part of transmitter software)
- 3 PLC






















Data processing in the Discrete Input block





i The diagram describes the function of the Discrete Input block in the normal operational state (**Mode block actual** (→ 179) = **Auto**). The block's behavior in other operational states is described in the Profibus profiles of the Profibus User Organization (PNO).


3.8.2 Structure of the submenu

Navigation  Expert → Discrete inputs → Discrete input 1 to 4

► Discrete input 1 to 4	
Tag description	→  178
Static revision	→  178
Strategy	→  178
Alert key	→  178
Target mode	→  179
Mode block actual	→  179
Mode block permitted	→  179
Mode block normal	→  179
Alarm summary	→  180
Batch ID	→  180
Batch operation	→  180
Batch phase	→  180
Batch Recipe Unit Procedure	→  181
Out value	→  181
Out status	→  181
Out status HEX	→  182
Channel	→  182
Invert	→  182
Fail safe type	→  183
Fail safe value	→  183
Simulate enabled	→  183

Simulate value	→  184
Simulate status	→  184

3.8.3 Description of parameters


Navigation  Expert → Discrete inputs → Discrete input 1 to 4

Tag description

Navigation  Expert → Discrete inputs → Discrete input 1 to 4 → Tag description (2201-1 to 4)

Description Standard block parameter **TAG_DESC** according to the PROFIBUS profile


Static revision

Navigation  Expert → Discrete inputs → Discrete input 1 to 4 → Static revision (2200-1 to 4)

Description Standard block parameter **ST_REV** according to the PROFIBUS profile

User interface 0 to 65 535

Strategy

Navigation  Expert → Discrete inputs → Discrete input 1 to 4 → Strategy (2199-1 to 4)

Description Standard block parameter **STRATEGY** according to the PROFIBUS profile

User entry 0 to 65 535

Factory setting 0

Alert key

Navigation  Expert → Discrete inputs → Discrete input 1 to 4 → Alert key (2182-1 to 4)

Description Standard block parameter **ALERT_KEY** according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Target mode



Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Target mode (2202-1 to 4)
Description	Standard block parameter TARGET_MODE according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ▪ Auto ▪ Man ▪ Out of service
Factory setting	Auto

Mode block actual

Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Mode block act (2181-1 to 4)
Description	Element Actual of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Auto ▪ Man ▪ Out of service


Mode block permitted

Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Mode block perm (2195-1 to 4)
Description	Element Permitted of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	0 to 255

Mode block normal


Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Mode blk norm (2192-1 to 4)
Description	Element Normal of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Auto ▪ Man ▪ Out of service

Alarm summary

Navigation	 Expert → Discrete inputs → Discrete input 1 to 4 → Alarm summary (2191-1 to 4)
Description	Standard block parameter ALARM_SUM according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Discrete alarm ■ Alarm state HiHi limit ■ Alarm state Hi limit ■ Alarm state LoLo limit ■ Alarm state Lo limit ■ Update Event


Batch ID



Navigation	 Expert → Discrete inputs → Discrete input 1 to 4 → Batch ID (2183-1 to 4)
Description	Element Batch_ID of the standard block parameter BATCH according to the PROFIBUS profile
User entry	Positive integer
Factory setting	0


Batch operation



Navigation	 Expert → Discrete inputs → Discrete input 1 to 4 → Batch operation (2184-1 to 4)
Description	Element Operation of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch phase



Navigation	 Expert → Discrete inputs → Discrete input 1 to 4 → Batch phase (2185-1 to 4)
Description	Element Phase of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch Recipe Unit Procedure


Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Batch Recipe (2186-1 to 4)
Description	Element Rup (Recipe unit procedure) of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0



Out value

Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Out value (2194-1 to 4)
Description	Element Value of the standard parameter OUT_D in the Discrete Input block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	0
Additional information	<ul style="list-style-type: none"> ▪ For Mode block actual (→ 179) = Man: Enter the output value of the Discrete Input block. ▪ Else: Displays the output value of the Discrete Input block. <p>The display or input format is a two-digit hexadecimal number. This corresponds to the output value of the DI block as follows:</p> <ul style="list-style-type: none"> ▪ Out value = 00 → FALSE ▪ Out value ≠ 00 → TRUE


Out status



Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Out status (2203-1 to 4)
Description	Element Status of the standard parameter OUT_D in the Discrete Input Block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Good ▪ Uncertain ▪ Bad
Additional information	Only the two quality bits are evaluated in this parameter.

Out status HEX

Navigation	  Expert → Discrete inputs → Discrete input 1 to 4 → Out status HEX (2193-1 to 4)
Description	Element Status of the standard parameter OUT in the Discrete Input block according to the PROFIBUS profile.
User entry	0 to 255
Factory setting	128
Additional information	The complete status byte is displayed in this parameter in the form of a two-digit hexadecimal number.



Channel



Navigation	  Expert → Discrete inputs → Discrete input 1 to 4 → Channel (2187-1 to 4)
Description	Standard parameter CHANNEL of the Discrete Input Block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ▪ None ▪ Switch output ▪ Digital output AD 1 ▪ Digital output AD 2
Factory setting	None
Additional information	This parameter allocates a switching variable to the Discrete Input Block.

Invert



Navigation	  Expert → Discrete inputs → Discrete input 1 to 4 → Invert (2188-1 to 4)
Description	Standard parameter INVERT of the Discrete Input block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ▪ Off ▪ On
Factory setting	Off
Additional information	<p>The discrete output signal can be inverted by this parameter (permutation of the logical states FALSE and TRUE)</p> <p>Meaning of the options:</p> <ul style="list-style-type: none"> ▪ Off No inversion ▪ On The switching signal is inverted before the transmission to the bus.

Fail safe type



Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Fail safe type (2189-1 to 4)
Description	Standard parameter FSAFE_TYPE of the Discrete Input block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ■ Fail safe value ■ Fallback value ■ Off
Factory setting	Off
Additional information	<p>Meaning of the options</p> <p>This parameter defines the output value of the Discrete Input block in case of a failure.</p> <ul style="list-style-type: none"> ■ Fail safe value The output value in case of a failure is defined in the Fail safe value parameter (→ 183). ■ Fallback value The last output value before occurrence of the failure is kept. ■ Off The output follows the measuring value. The status is set to BAD.

Fail safe value





Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Fail safe value (2190-1 to 4)
Prerequisite	Fail safe type (→ 183) = Fail safe value
Description	Standard parameter FSAFE_VAL_D of the Discrete Input block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	0
Additional information	This parameter defines the output value of the Discrete Input block in case of a failure.


Simulate enabled



Navigation	Expert → Discrete inputs → Discrete input 1 to 4 → Simulate enabled (2196-1 to 4)
Description	Element Simulate_Enabled of the standard parameter SIMULATE_D in the Discrete Input block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ■ Disable ■ Enable
Factory setting	Disable

Additional information This parameter activates or deactivates the simulation of the Discrete Input block. If the simulation is active, the Discrete Input block does not use the measured value selected in **Channel** (→  **182**) but a constant simulation value. This value is defined in **Simulate value** (→  **184**).

Simulate value


Navigation  Expert → Discrete inputs → Discrete input 1 to 4 → Simulate value (2198–1 to 4)

Description Element **Simulate_Value** of the standard parameter **SIMULATE_D** in the Discrete Input block according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Additional information This parameter defines the simulation value.

Simulate status


Navigation  Expert → Discrete inputs → Discrete input 1 to 4 → Simulate status (2197–1 to 4)

Description Element **Simulate_Status** of the standard parameter **SIMULATE_D** in the Discrete Input block according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0



Additional information This parameter defines the status of the simulation value.

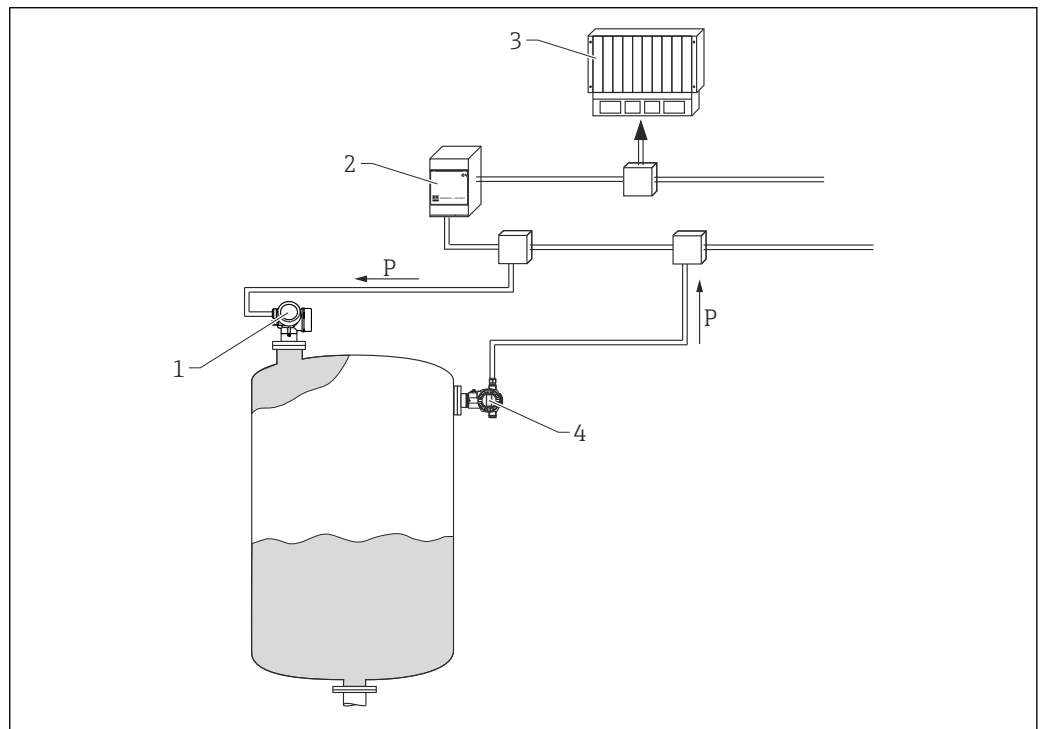
3.9 "Analog output 1 to 4" submenu

3.9.1 Overview


There is an **Analog output** submenu for each Analog Output block in the device. This submenu contains the parameters of the individual block. The parameters of the Analog Output block are described in the PROFIBUS profile. The most important characteristics of the parameters are summarized below.

i The device uses the Analog Output block to read in a value, which has been measured externally, via the bus. This value can be used

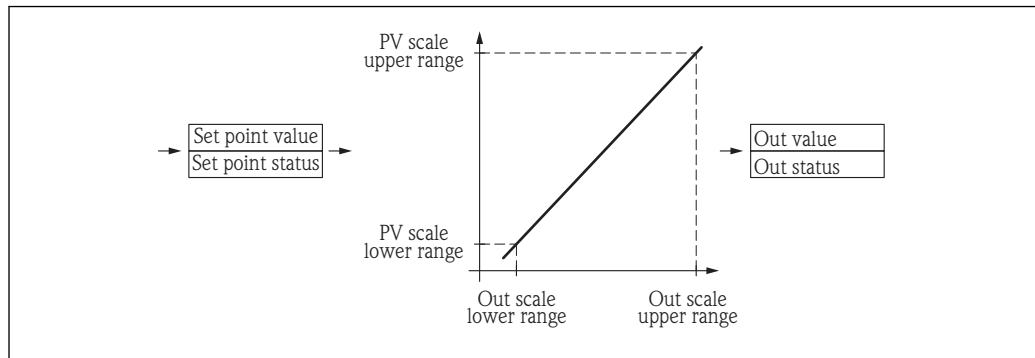
- for display on the display module (**Display** submenu (→  27))
- in the case of a pressure value: for the automatic gas phase compensation (**External pressure selector** parameter (→  94))



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 45 The level transmitter reads the externally measured pressure via the Analog output block.


- 1 Level transmitter
- 2 Segment coupler
- 3 PLC
- 4 Absolute pressure transmitter























Data processing in the Analog Output block



















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- i** The diagram describes the function of the Analog Output block in the normal operational state (**Mode block actual** (→ **190**) = **Auto**). The block's behavior in other operational states is described in the Profibus profiles of the Profibus User Organization (PNO).

3.9.2 Structure of the submenu

Navigation  Expert → Analog outputs → Analog output 1 to 4

► Analog output 1 to 4	
Tag description	→  189
Static revision	→  189
Strategy	→  189
Alert key	→  189
Target mode	→  190
Mode block actual	→  190
Mode block permitted	→  190
Mode block normal	→  190
Alarm summary	→  191
Batch ID	→  191
Batch operation	→  191
Batch phase	→  192
Batch Recipe Unit Procedure	→  192
Set point value	→  192
Set point status	→  192
PV scale lower range	→  193
PV scale upper range	→  193
Readback value	→  193
Readback status	→  193
RCAS in value	→  194
RCAS in status	→  194
Input channel	→  194

Output channel	→  194
Fail safe time	→  195
Fail safe type	→  195
Fail safe value	→  195
RCAS out value	→  196
RCAS out status	→  196
Position value	→  196
Position status	→  196
Setpoint deviation	→  197
Simulate enabled	→  197
Simulate value	→  197
Simulate status	→  197
Increase close	→  198
Out value	→  198
Out status	→  198
Out status HEX	→  199
Out scale upper range	→  199
Out scale lower range	→  199

3.9.3 Description of parameters

Navigation  Expert → Analog outputs → Analog output 1 to 4

Tag description

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Tag description (1667-1 to 4)

Description Standard block parameter **TAG_DESC** according to the PROFIBUS profile


Static revision

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Static revision (1666-1 to 4)

Description Standard block parameter **ST_REV** according to the PROFIBUS profile

User interface 0 to 65 535

Strategy

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Strategy (1665-1 to 4)

Description Standard block parameter **STRATEGY** according to the PROFIBUS profile

User entry 0 to 65 535

Factory setting 0

Alert key

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Alert key (1632-1 to 4)

Description Standard block parameter **ALERT_KEY** according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Target mode


Navigation Expert → Analog outputs → Analog output 1 to 4 → Target mode (1668-1 to 4)

Description Standard block parameter **TARGET_MODE** according to the PROFIBUS profile

Selection

- Auto
- Local override
- Man
- Out of service
- Remote Cascaded

Factory setting Auto

Mode block actual

Navigation Expert → Analog outputs → Analog output 1 to 4 → Mode block act (1631-1 to 4)

Description Element **Actual** of the standard block parameter **MODE_BLK** according to the PROFIBUS profile

User interface

- Auto
- Local override
- Man
- Out of service
- Remote Cascaded

Mode block permitted

Navigation Expert → Analog outputs → Analog output 1 to 4 → Mode block perm (1648-1 to 4)

Description Element **Permitted** of the standard block parameter **MODE_BLK** according to the PROFIBUS profile

User interface 0 to 255


Mode block normal

Navigation Expert → Analog outputs → Analog output 1 to 4 → Mode blk norm (1643-1 to 4)


Description Element **Normal** of the standard block parameter **MODE_BLK** according to the PROFIBUS profile

User interface	<ul style="list-style-type: none"> ■ Auto ■ Local override ■ Man ■ Out of service ■ Remote Cascaded
-----------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------


Alarm summary

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Alarm summary (1642-1 to 4)
Description	Standard block parameter ALARM_SUM according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Discrete alarm ■ Alarm state HiHi limit ■ Alarm state Hi limit ■ Alarm state LoLo limit ■ Alarm state Lo limit ■ Update Event

Batch ID

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Batch ID (1633-1 to 4)
Description	Element Batch_ID of the standard block parameter BATCH according to the PROFIBUS profile
User entry	Positive integer
Factory setting	0

Batch operation

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Batch operation (1639-1 to 4)
Description	Element Operation of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch phase



Navigation	Expert → Analog outputs → Analog output 1 to 4 → Batch phase (1640-1 to 4)
Description	Element Phase of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch Recipe Unit Procedure



Navigation	Expert → Analog outputs → Analog output 1 to 4 → Batch Recipe (1641-1 to 4)
Description	Element Rup (Recipe unit procedure) of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Set point value



Navigation	Expert → Analog outputs → Analog output 1 to 4 → Set point val (1661-1 to 4)
Description	Input value of the AO block
User entry	Signed floating-point number
Factory setting	0
Additional information	This value is normally written via PROFIBUS by a linked device (e.g. a pressure transmitter). It can be scaled by the AO block before being transmitted to Out value (→ 198) and is then used for the display or for additional calculations.


Set point status



Navigation	Expert → Analog outputs → Analog output 1 to 4 → Set point status (1660-1 to 4)
Description	Hexidecimal representation of the status of the input value
User entry	0 to 255
Factory setting	0

Additional information Normally, this value is written via PROFIBUS by a linked device (e.g. a pressure transmitter).

PV scale lower range

Navigation  Expert → Analog outputs → Analog output 1 to 4 → PVscale lo range (1651-1 to 4)

Description Element **EU_at_0%** of the standard parameter **PV_SCALE** in the Analog Output block according to the PROFIBUS profile

User entry Signed floating-point number

Factory setting 0

Additional information This parameter defines the 0% marker for the input value.

PV scale upper range

Navigation  Expert → Analog outputs → Analog output 1 to 4 → PVscale up range (1652-1 to 4)

Description Element **EU_at_100%** of the standard parameter **PV_SCALE** in the Analog Output block according to the PROFIBUS profile

User entry Signed floating-point number

Factory setting 100.0

Additional information This parameter defines the 100% marker for the input value.

Readback value

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Readback value (1659-1 to 4)

Description Element **Value** of the standard parameter **READBACK** in the Analog Output block

User interface Signed floating-point number


Readback status

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Readback status (1658-1 to 4)

Description Element **Status** of the standard parameter **READBACK** in the Analog Output block

User interface 0 to 255

RCAS in value


Navigation  Expert → Analog outputs → Analog output 1 to 4 → RCAS in value (1655-1 to 4)

Description Element **Value** of the standard parameter **RCAS_IN** in the Analog Output block according to the PROFIBUS profile

User entry Signed floating-point number

Factory setting 0

RCAS in status


Navigation  Expert → Analog outputs → Analog output 1 to 4 → RCAS in status (1654-1 to 4)

Description Element **Status** of the standard parameter **RCAS_IN** in the Analog Input block according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Input channel

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Input channel (1670-1 to 4)

Description Standard parameter **IN_CHANNEL** of the Analog Output block according to the PROFIBUS profile

Selection None

Factory setting None

Output channel



Navigation  Expert → Analog outputs → Analog output 1 to 4 → Output channel (1671-1 to 4)

Description Standard parameter **OUT-CHANNEL** of the Analog Output block according to the PROFIBUS profile

Selection None

Factory setting None


Fail safe time 

Navigation   Expert → Analog outputs → Analog output 1 to 4 → Fail safe time (1635-1 to 4)



Description Standard parameter **FSAFE_TIME** of the Analog Output block according to the PROFIBUS profile

User entry 0 to 999.0

Factory setting 0

Additional information Defines the time (in seconds) between the occurrence of an error in the set point (**Set point status** (→  192) = **BAD**) and the corresponding reaction of the AO block.

Fail safe type 


Navigation   Expert → Analog outputs → Analog output 1 to 4 → Fail safe type (1636-1 to 4)

Description Standard parameter **FSAFE_TYPE** of the Analog Output block according to the PROFIBUS profile

- Selection**
- Fail safe value
 - Fallback value
 - Off


Factory setting Fallback value

Additional information **Meaning of the options**
 This parameter defines the output value of the Analog Output block in case of an error.

- **Fail safe value**
 The output value in case of an error is defined in the **Fail safe value** parameter (→  195).
- **Fallback value**
 The last valid output value before the occurrence of the error is maintained.
- **Off**
 The output value corresponds to the current measured value. The status, however, is set to **BAD**.


Fail safe value 

Navigation   Expert → Analog outputs → Analog output 1 to 4 → Fail safe value (1637-1 to 4)


Prerequisite **Fail safe type** (→  195) = **Fail safe value**

Description	Standard parameter FSAFE_VALUE of the Analog Output block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the output value of the Analog Output block in case of an error.


RCAS out value

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → RCAS out value (1657-1 to 4)
Description	Element Value of the standard parameter RCAS_OUT in the Analog Output block according to the PROFIBUS profile
User interface	Signed floating-point number


RCAS out status

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → RCAS out status (1656-1 to 4)
Description	Element Status of the standard parameter RCAS_OUT in the Analog Input block according to the PROFIBUS profile
User interface	0 to 255

Position value


Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Pos value (1650-1 to 4)
Description	Element Value of the standard parameter POS_D in the Analog Output block according to the PROFIBUS profile
User interface	0 to 255

Position status

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Position status (1649-1 to 4)
Description	Element Status of the standard parameter POS_D in the Analog Output block according to the PROFIBUS profile

User interface 0 to 255

Setpoint deviation

Navigation  Expert → Analog outputs → Analog output 1 to 4 → Setp. deviation (1653-1 to 4)

Description Standard parameter **SETP_DEVIATION** of the Analog Output block according to the PROFIBUS profile

User interface Signed floating-point number

Simulate enabled



Navigation  Expert → Analog outputs → Analog output 1 to 4 → Simulate enabled (1662-1 to 4)

Description Element **Simulate_Enabled** of the standard parameter **SIMULATE** in the Analog Input block according to the PROFIBUS profile

Selection

- Disable
- Enable

Factory setting Disable

Simulate value



Navigation  Expert → Analog outputs → Analog output 1 to 4 → Simulate value (1664-1 to 4)

Description Element **Simulate_Value** of the standard parameter **SIMULATE** in the Analog Output block according to the PROFIBUS profile.

User entry Signed floating-point number

Factory setting 0

Simulate status



Navigation  Expert → Analog outputs → Analog output 1 to 4 → Simulate status (1663-1 to 4)

Description Element **Simulate_Status** of the standard parameter **SIMULATE** in the Analog Output block according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Increase close



Navigation Expert → Analog outputs → Analog output 1 to 4 → Increase close (1638-1 to 4)

Description Standard parameter INCREASE_CLOSE of the Analog Input block according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Out value

Navigation Expert → Analog outputs → Analog output 1 to 4 → Out value (1647-1 to 4)

Description Element **Value** of the standard parameter **OUT** in the Analog Output block according to the PROFIBUS profile

User entry Signed floating-point number

Factory setting 0

Additional information

- For **Mode block actual** (→ 190) = **Man**:
Enter the output value of the Analo Output block.
- Else:
Indicates the output value of the Analog Output block.

Out status

Navigation Expert → Analog outputs → Analog output 1 to 4 → Out status (1669-1 to 4)


Description Element **Status** of the standard parameter **OUT** in the Analog Output block according to the PROFIBUS profile

User interface

- Good
- Uncertain
- Bad


Additional information Only the two quality bits are evaluated in this parameter.

Out status HEX

Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Out status HEX (1645-1 to 4)
Description	Element Status of the standard parameter OUT in the Analog Output block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	128
Additional information	The complete status byte is displayed in this parameter in the form of a two-digit hexadecimal number.


Out scale upper range



Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Out scale up (1646-1 to 4)
Description	Element EU_at_100% of the standard parameter OUT_SCALE in the Analog Output block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	100.0
Additional information	This parameter defines the 100% marker for the output value of the block.

Out scale lower range



Navigation	 Expert → Analog outputs → Analog output 1 to 4 → Out scale low (1644-1 to 4)
Description	Element EU_at_0% of the standard parameter OUT_SCALE in the Analog Output block according to the PROFIBUS profile
User entry	Signed floating-point number
Factory setting	0
Additional information	This parameter defines the 0% marker for the output value of the block.

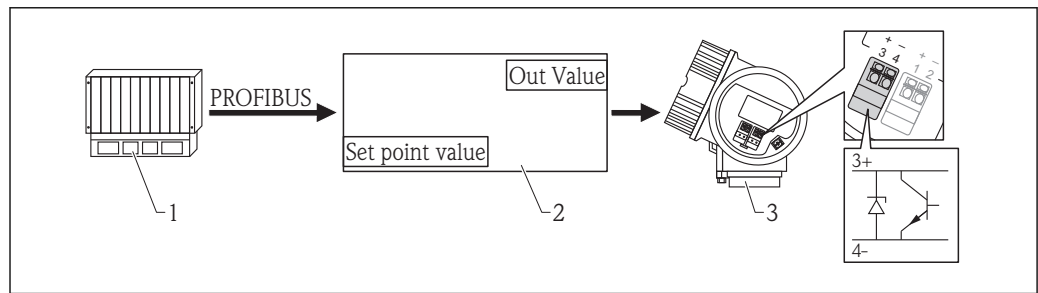
3.10 "Discrete output 1 to 4" submenu

3.10.1 Overview

There is a Discrete output 1 to 4 for each Discrete Output block in the device. This submenu contains the parameters of the individual block. The parameters of the Discrete Output block are described in the PROFIBUS profile. The most important characteristics of the parameters are summarized below.

i The device uses the Discrete Output block to read in a discrete value (0-False / 1-TRUE). This discrete value can be used:

- for transmission via the switch output (terminals 3 and 4 in the connection compartment). This is controlled by:
 - Assign status (→ 139)
- to switch the measurement on and off. This is controlled by:
 - Control measurement
- to transmit a permanently defined level or interface value, regardless of the measurement. This is controlled by:
 - Level external input 1

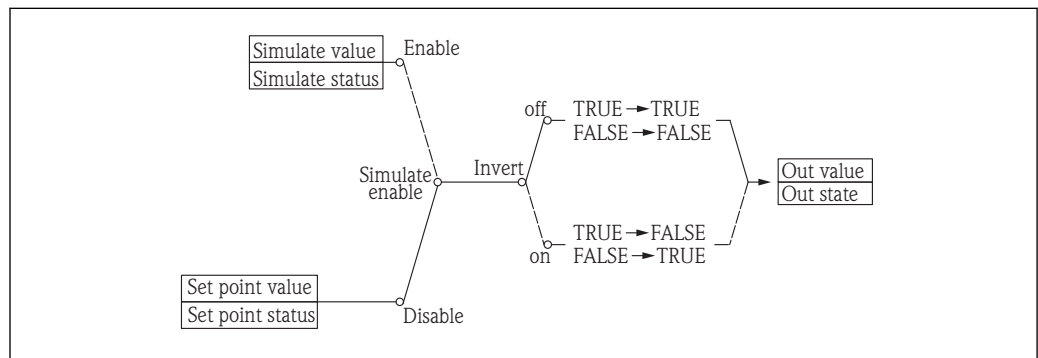


46 Transmission of an external discrete value via the switch output of the device

- 1 PLC
- 2 Discrete Output block (part of transmitter software)
- 3 Transmitter


Data processing in the Discrete Output block























i The diagram describes the function of the Discrete Output block in the normal operational state (**Mode block actual** (→ 204) = **Auto**). The block's behavior in other operational states is described in the Profibus profiles of the Profibus User Organization (PNO).














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3.10.2 Structure of the submenu

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4


► Discrete output 1 to 4	
Tag description	→  203
Static revision	→  203
Strategy	→  203
Alert key	→  203
Target mode	→  204
Mode block actual	→  204
Mode block permitted	→  204
Mode block normal	→  204
Alarm summary	→  205
Batch ID	→  205
Batch operation	→  205
Batch phase	→  206
Batch Recipe Unit Procedure	→  206
Set point value	→  206
Set point status	→  206
Out value	→  207
Out status	→  207
Out status HEX	→  207
Readback value	→  208
Readback status	→  208
RCAS in value	→  208
RCAS in status	→  208

Input channel	→  209
Output channel	→  209
Invert	→  209
Fail safe time	→  210
Fail safe type	→  210
Fail safe value	→  210
RCAS out value	→  211
RCAS out status	→  211
Simulate enabled	→  211
Simulate value	→  211
Simulate status	→  212

3.10.3 Description of parameters


Navigation  Expert → Discrete outputs → Discr. out. 1 to 4

Tag description

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Tag description (1721-1 to 4)

Description Standard block parameter **TAG_DESC** according to the PROFIBUS profile

Static revision

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Static revision (1720-1 to 4)

Description Standard block parameter **ST_REV** according to the PROFIBUS profile

User interface 0 to 65 535

Strategy

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Strategy (1719-1 to 4)

Description Standard block parameter **STRATEGY** according to the PROFIBUS profile

User entry 0 to 65 535

Factory setting 0



Alert key


Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Alert key (1694-1 to 4)


Description Standard block parameter **ALERT_KEY** according to the PROFIBUS profile


User entry 0 to 255

Factory setting 0

Target mode		
<hr/>		
Navigation		Expert → Discrete outputs → Discr. out. 1 to 4 → Target mode (1722-1 to 4)
Description		Standard block parameter TARGET_MODE according to the PROFIBUS profile
Selection		<ul style="list-style-type: none"> ■ Local override ■ Remote Cascaded ■ Man ■ Out of service ■ Auto
Factory setting		Auto


Mode block actual		
<hr/>		
Navigation		Expert → Discrete outputs → Discr. out. 1 to 4 → Mode block act (1691-1 to 4)
Description		Element Actual of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface		<ul style="list-style-type: none"> ■ Local override ■ Remote Cascaded ■ Man ■ Out of service ■ Auto

Mode block permitted		
<hr/>		
Navigation		Expert → Discrete outputs → Discr. out. 1 to 4 → Mode block perm (1705-1 to 4)
Description		Element Permitted of the standard block parameter MODE_BLK according to the PROFIBUS profile
User interface		0 to 255


Mode block normal		
<hr/>		
Navigation		Expert → Discrete outputs → Discr. out. 1 to 4 → Mode blk norm (1702-1 to 4)
Description		Element Normal of the standard block parameter MODE_BLK according to the PROFIBUS profile

User interface	<ul style="list-style-type: none"> ■ Local override ■ Remote Cascaded ■ Man ■ Out of service ■ Auto
-----------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------


Alarm summary

Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → Alarm summary (1701-1 to 4)
Description	Standard block parameter ALARM_SUM according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ■ Discrete alarm ■ Alarm state HiHi limit ■ Alarm state Hi limit ■ Alarm state LoLo limit ■ Alarm state Lo limit ■ Update Event

Batch ID

Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → Batch ID (1695-1 to 4)
Description	Element Batch_ID of the standard block parameter BATCH according to the PROFIBUS profile
User entry	Positive integer
Factory setting	0

Batch operation

Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → Batch operation (1698-1 to 4)
Description	Element Operation of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch phase



Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Batch phase (1699–1 to 4)
Description	Element Phase of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Batch Recipe Unit Procedure



Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Batch Recipe (1700–1 to 4)
Description	Element Rup (Recipe unit procedure) of the standard block parameter BATCH according to the PROFIBUS profile
User entry	0 to 65 535
Factory setting	0

Set point value






Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Set point val (1715–1 to 4)
Description	Input value of the DO block
User entry	0 to 255
Factory setting	0
Additional information	Normally, this value is transmitted via PROFIBUS by a PLC or another device.

Set point status





Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Set point status (1714–1 to 4)
Description	Hexadecimal representation of the status of the input value
User entry	0 to 255
Factory setting	0
Additional information	Normally, this value is transmitted via PROFIBUS from a PLC or another device.



Out value

Navigation	  Expert → Discrete outputs → Discr. out. 1 to 4 → Out value (1704–1 to 4)
Description	Element Value of the standard parameter OUT in the Discrete Output block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	0
Additional information	<ul style="list-style-type: none"> ▪ For Mode block actual (→  204) = Man: Enter the output value of the Discrete Output block ▪ Else: Displays the output value of the Discrete Output block.


Out status

Navigation	  Expert → Discrete outputs → Discr. out. 1 to 4 → Out status (1723–1 to 4)
Description	Element Status of the standard parameter OUT in the Discrete Output block according to the PROFIBUS profile
User interface	<ul style="list-style-type: none"> ▪ Good ▪ Uncertain ▪ Bad
Additional information	Only the two quality bits are evaluated in this parameter.


Out status HEX

Navigation	  Expert → Discrete outputs → Discr. out. 1 to 4 → Out status HEX (1703–1 to 4)
Description	Element Status of the standard parameter OUT in the Discrete Output block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	128
Additional information	The complete status byte is displayed in this parameter in the form of a hexadecimal number.

Readback value


Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → Readback value (1713-1 to 4)
Description	Element Value of the standard parameter READBACK in the Discrete Output block
User interface	0 to 255

Readback status

Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → Readback status (1712-1 to 4)
Description	Element Status of the standard parameter READBACK in the Discrete Output block
User interface	0 to 255


RCAS in value



Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → RCAS in value (1707-1 to 4)
Description	Element Value of the standard parameter RCAS_IN in the Discrete Output block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	0

RCAS in status



Navigation	 Expert → Discrete outputs → Discr. out. 1 to 4 → RCAS in status (1706-1 to 4)
Description	Element Status of the standard parameter RCAS_IN in the Discrete Output block according to the PROFIBUS profile
User entry	0 to 255
Factory setting	0

Input channel



Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Input channel (1724-1 to 4)
Description	Standard parameter IN_CHANNEL of the Discrete Output block according to the PROFIBUS profile
Selection	None
Factory setting	None

Output channel











Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Output channel (1725-1 to 4)
Description	Standard parameter OUT-CHANNEL of the Discrete Output block according to the PROFIBUS profile
Selection	None
Factory setting	None





Invert



Navigation	Expert → Discrete outputs → Discr. out. 1 to 4 → Invert (1692-1 to 4)
Description	Standard parameter INVERT of the Discrete Output block according to the PROFIBUS profile
Selection	<ul style="list-style-type: none"> ■ Off ■ On
Factory setting	Off
Additional information	<p>Enables the inversion of the discrete output signal (permutation of the logical states FALSE and TRUE).</p> <p>Meaning of the options</p> <ul style="list-style-type: none"> ■ Off No inversion ■ On The switch signal is inverted before being used in the device.

Fail safe time		
Navigation	  Expert → Discrete outputs → Discr. out. 1 to 4 → Fail safe time (1697–1 to 4)	
Description	Standard parameter FSAFE_TIME in the Discrete Input block according to the PROFIBUS profile	
User entry	Signed floating-point number	
Factory setting	0	
Additional information	Defines the time (in seconds) between the occurrence of a set point error (Set point status (→  206) = BAD) and the corresponding response of the DO block.	

Fail safe type		
Navigation	  Expert → Discrete outputs → Discr. out. 1 to 4 → Fail safe type (1696–1 to 4)	
Description	Standard parameter FSAFE_TYPE in the Discrete Output block according to the PROFIBUS profile	
Selection	<ul style="list-style-type: none"> ■ Fail safe value ■ Fallback value ■ Off 	
Factory setting	Fallback value	
Additional information	<p>Meaning of the options</p> <p>This parameter specifies the output value of the Discrete Input block in the event of an error.</p> <ul style="list-style-type: none"> ■ Fail safe value The value output in the event of an error is defined in the Fail safe value parameter (→  210). ■ Fallback value The last output value that was valid before the error occurred is maintained. ■ Off The output value follows the current measured value. The status is set to BAD. 	

Fail safe value		
Navigation	  Expert → Discrete outputs → Discr. out. 1 to 4 → Fail safe value (1693–1 to 4)	
Prerequisite	Fail safe type (→  210) = Fail safe value	
Description	Standard parameter FSAFE_VALUE in the Discrete Output block according to the PROFIBUS profile	
User entry	0 to 255	

Factory setting 0

Additional information This parameter specifies the output value of the Discrete Output block in the event of an error.

RCAS out value

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → RCAS out value (1711-1 to 4)

Description Element **Value** of the standard parameter **RCAS_OUT** in the Discrete Output block according to the PROFIBUS profile

User interface 0 to 255


RCAS out status

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → RCAS out status (1708-1 to 4)

Description Element **Status** of the standard parameter **RCAS_OUT** in the Discrete Output block according to the PROFIBUS profile

User interface 0 to 255

Simulate enabled 

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Simulate enabled (1716-1 to 4)


Description Element **Simulate_Enabled** of the standard parameter **SIMULATE** in the Discrete Output block according to the PROFIBUS profile

Selection

- Disable
- Enable

Factory setting Disable

Simulate value 

Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Simulate value (1718-1 to 4)

Description Element **Simulate_Value** of the standard parameter **SIMULATE** in the Discrete Output block according to the PROFIBUS profile

User entry 0 to 255

Factory setting 0

Simulate status



Navigation  Expert → Discrete outputs → Discr. out. 1 to 4 → Simulate status (1717-1 to 4)

Description Element **Simulate_Status** of the standard parameter **SIMULATE** in the Discrete Output block according to the PROFIBUS profile














User entry 0 to 255

Factory setting 0

3.11 "Diagnostics" submenu



3.11.1 Structure of the submenu on the local display
















Navigation  Expert → Diagnostics

► Diagnostics	
Actual diagnostics	→  215
Previous diagnostics	→  215
Operating time from restart	→  216
Operating time	→  216
► Diagnostic list	→  217
► Event logbook	→  219
► Device information	→  222
► Data logging	→  225
► Min/max values	→  229
► Simulation	→  234
► Device check	→  237
► Advanced diagnostics 1 to 2	→  247
► Envelope diagnostics	→  256

3.11.2 Structure of the submenu in an operating tool

Navigation





  Expert → Diagnostics

▶ Diagnostics	
Actual diagnostics	→  215
Timestamp	→  215
Previous diagnostics	→  215
Timestamp	→  216
Operating time from restart	→  216
Operating time	→  216
▶ Diagnostic list	→  217
▶ Event logbook	→  219
▶ Device information	→  222
▶ Data logging	→  225
▶ Min/max values	→  229
▶ Simulation	→  234
▶ Device check	→  237
▶ Advanced diagnostics 1 to 2	→  247
▶ Envelope diagnostics	→  256



3.11.3 Description of parameters

Navigation  Expert → Diagnostics




Actual diagnostics

Navigation	 Expert → Diagnostics → Actual diagnos. (0691)
Description	Displays current diagnostic message.
Additional information	<p>The display consists of:</p> <ul style="list-style-type: none"> ■ Symbol for event behavior ■ Code for diagnostic behavior ■ Operating time of occurrence ■ Event text <p> If several messages are active at the same time, the messages with the highest priority is displayed.</p> <p> Information on what is causing the message, and remedy measures, can be viewed via the  symbol on the display.</p>



Timestamp

Navigation	 Expert → Diagnostics → Timestamp (0667)
Description	Displays timestamp for the Actual diagnostics parameter (→  215).
User interface	Days (d), hours (h), minutes (m), seconds (s)



Previous diagnostics

Navigation	 Expert → Diagnostics → Prev.diagnostics (0690)
Description	Displays the last diagnostic message which has been active before the current message.
Additional information	<p>The display consists of:</p> <ul style="list-style-type: none"> ■ Symbol for event behavior ■ Code for diagnostic behavior ■ Operating time of occurrence ■ Event text <p> The condition displayed may still apply. Information on what is causing the message, and remedy measures, can be viewed via the  symbol on the display.</p>



Timestamp

Navigation	 Expert → Diagnostics → Timestamp (0672)
Description	Displays timestamp for the Previous diagnostics parameter (→  215).
User interface	Days (d), hours (h), minutes (m), seconds (s)

Operating time from restart

Navigation	  Expert → Diagnostics → Time fr. restart (0653)
Description	Displays the time the device has been in operation since the last device restart.
User interface	Days (d), hours (h), minutes (m), seconds (s)

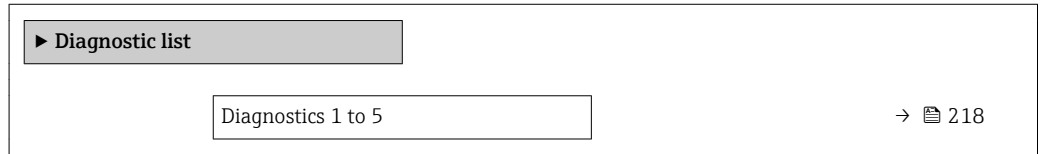
Operating time

Navigation	  Expert → Diagnostics → Operating time (0652)
Description	Indicates how long the device has been in operation.
User interface	Days (d), hours (h), minutes (m), seconds (s)
Additional information	<i>Maximum time</i> 9999 d (≈ 27 years)

3.11.4 "Diagnostic list" submenu

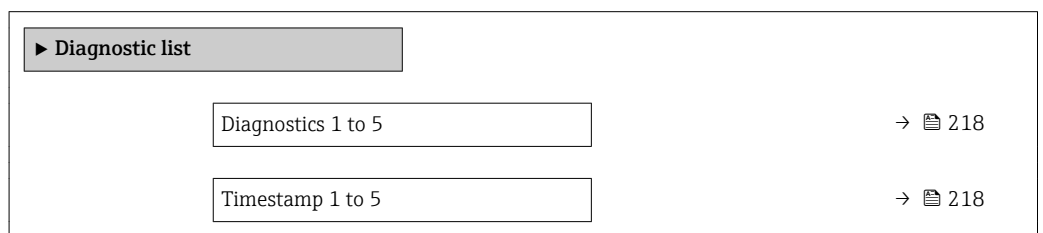
Structure of the submenu on the local display

Navigation  Expert → Diagnostics → Diagnostic list




Structure of the submenu in an operating tool


Navigation  Expert → Diagnostics → Diagnostic list



Description of parameters

Navigation  Expert → Diagnostics → Diagnostic list

Diagnostics 1 to 5

Navigation  Expert → Diagnostics → Diagnostic list → Diagnostics 1 to 5 (0692-1 to 5)


Description Display the current diagnostics messages with the highest to fifth-highest priority.

Additional information The display consists of:

- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text

Timestamp 1 to 5


Navigation  Expert → Diagnostics → Diagnostic list → Timestamp (0683)

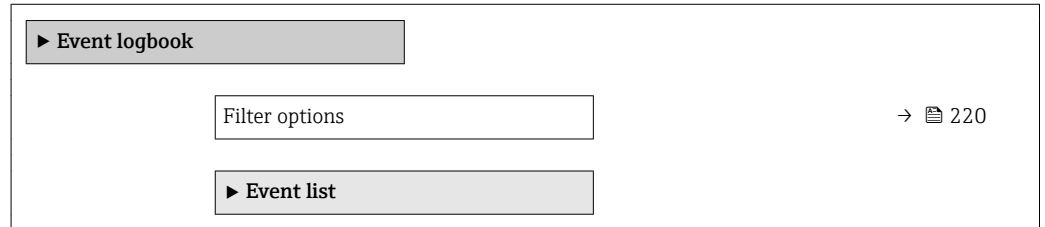
Description Displays timestamp for the **Diagnostics 1 to 5** parameter (→  218).

User interface Days (d), hours (h), minutes (m), seconds (s)


3.11.5 "Event logbook" submenu

Structure of the submenu on the local display

Navigation  Expert → Diagnostics → Event logbook



Structure of the submenu in an operating tool

Navigation  Expert → Diagnostics → Event logbook



Description of parameters

Navigation  Expert → Diagnostics → Event logbook

Filter options**Navigation**

 Expert → Diagnostics → Event logbook → Filter options (0705)

Description

Select category (status signal) whose event messages are displayed in the events list.


Selection

- All
- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
- Information (I)


Factory setting

All



Additional information



-  ▪ This parameter is only used for operation via the local display.
- The status signals are categorized according to NAMUR NE 107.

"Event list" submenu

The **Event list** submenu displays the history of past events of the category selected in the **Filter options** parameter (→  220). A maximum of 20 events are displayed in chronological order. If the advanced HistoROM functionality has been activated in the device, the event list may comprise up to 100 entries.

The following symbols indicate whether an event has occurred or has ended:

- : Event has occurred
- : Event has ended

 Information on what is causing the message, and remedy instructions, can be viewed via the -button.


Display format








- For event messages in category I: information event, event text, "recording event" symbol and time the event occurred
- For event messages in category F, M, C, S (status signal): diagnostics event, event text, "recording event" symbol and time the event occurred

3.11.6 "Device information" submenu

Structure of the submenu

Navigation


 Expert → Diagnostics → Device info

▶ Device information	
Device tag	→  223
Serial number	→  223
Firmware version	→  223
Device name	→  223
Order code	→  224
Extended order code 1 to 3	→  224
ENP version	→  224




Description of parameters

Navigation  Expert → Diagnostics → Device info



Device tag

Navigation	 Expert → Diagnostics → Device info → Device tag (0011)
Description	Enter the name for the measuring point.
Factory setting	FMR5x


Serial number

Navigation	 Expert → Diagnostics → Device info → Serial number (0009)
Description	Displays serial number of the device.
Additional information	<p> Uses of the serial number</p> <ul style="list-style-type: none"> ▪ To identify the device quickly, e.g. when contacting Endress+Hauser. ▪ To obtain specific information on the device using the Device Viewer: www.endress.com/deviceviewer <p> The serial number is also indicated on the nameplate.</p>


Firmware version

Navigation	 Expert → Diagnostics → Device info → Firmware version (0010)
Description	Indicates the installed Firmware version.
User interface	xx.yy.zz
Additional information	<p> For firmware versions differing only in the last two digits ("zz") there is no difference concerning functionality or operation.</p>


Device name

Navigation	 Expert → Diagnostics → Device info → Device name (0013)
Description	Displays device name.


Order code

Navigation	 Expert → Diagnostics → Device info → Order code (0008)
Description	Displays order code of the device.
Additional information	The order code is generated from the extended order code, which defines all device features of the product structure. In contrast, the device features can not be read directly from the order code.

Extended order code 1 to 3

Navigation	 Expert → Diagnostics → Device info → Ext. order cd. 1 to 3 (0023-1 to 3)
Description	Displays the three parts of the extended order code.
Additional information	The extended order code indicates the version of all the features of the product structure and thus uniquely identifies the device.

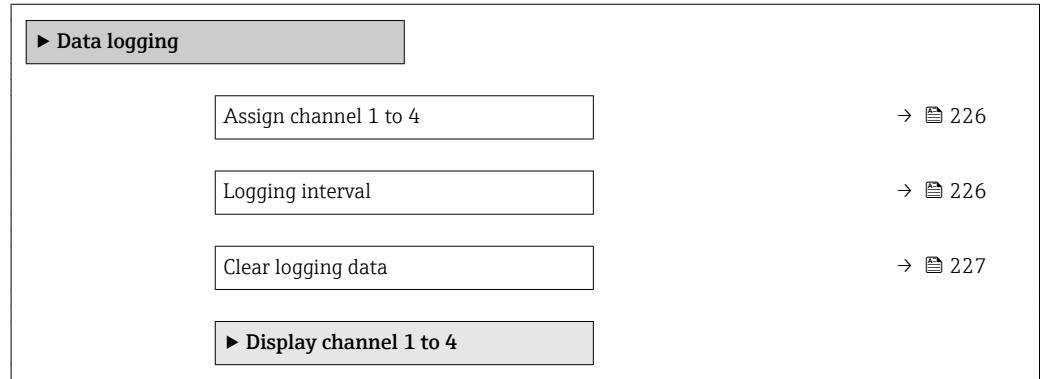
ENP version

Navigation	 Expert → Diagnostics → Device info → ENP version (0012)
Description	Displays version of the electronic nameplate (ENP).
User interface	xx.yy.zz

3.11.7 "Data logging" submenu

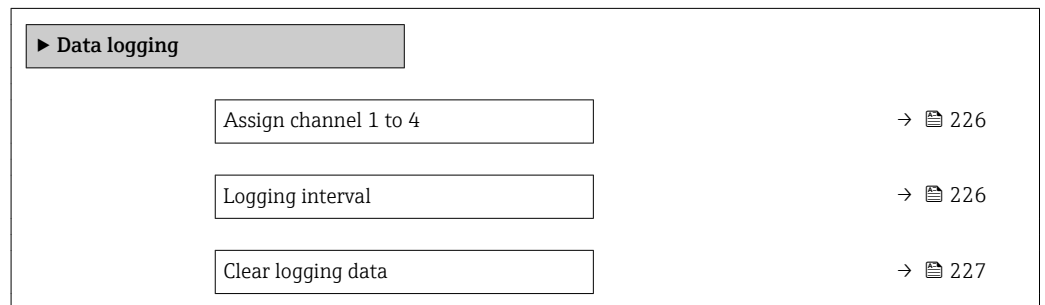
Structure of the submenu on the local display

Navigation  Expert → Diagnostics → Data logging




Structure of the submenu in an operating tool

Navigation  Expert → Diagnostics → Data logging



Description of parameters

Navigation  Expert → Diagnostics → Data logging

Assign channel 1 to 4 

Navigation  Expert → Diagnostics → Data logging → Assign chan. 1 (0851)

Description Allocate a process variable to the respective data logging channel.

Selection

- Off
- Level linearized
- Distance
- Terminal voltage
- Electronic temperature
- Absolute echo amplitude
- Relative echo amplitude
- Area of incoupling
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2


Factory setting Off


Additional information A total of 500 measured values can be logged. This means:

- 500 data points if 1 logging channel is used
- 250 data points if 2 logging channels are used
- 166 data points if 3 logging channels are used
- 125 data points if 4 logging channels are used

If the maximum number of data points is reached, the oldest data points in the data log are cyclically overwritten in such a way that the last 500, 250, 166 or 125 measured values are always in the log (ring memory principle).

 The logged data are deleted if a new option is selected in this parameter.

Logging interval 

Navigation  Expert → Diagnostics → Data logging → Logging interval (0856)

Description Define logging interval t_{\log} .

User entry 1.0 to 3 600.0 s

Factory setting 30.0 s

Additional information This parameter defines the interval between the individual data points in the data log, and thus the maximum loggable process time T_{\log} :

- If 1 logging channel is used: $T_{\log} = 500 \cdot t_{\log}$
- If 2 logging channels are used: $T_{\log} = 250 \cdot t_{\log}$
- If 3 logging channels are used: $T_{\log} = 166 \cdot t_{\log}$
- If 4 logging channels are used: $T_{\log} = 125 \cdot t_{\log}$

Once this time elapses, the oldest data points in the data log are cyclically overwritten such that a time of T_{\log} always remains in the memory (ring memory principle).



The logged data are deleted if this parameter is changed.

Example

When using 1 logging channel

- $T_{\log} = 500 \cdot 1 \text{ s} = 500 \text{ s} \approx 8.5 \text{ min}$
- $T_{\log} = 500 \cdot 10 \text{ s} = 5\,000 \text{ s} \approx 1.5 \text{ h}$
- $T_{\log} = 500 \cdot 80 \text{ s} = 40\,000 \text{ s} \approx 11 \text{ h}$
- $T_{\log} = 500 \cdot 3\,600 \text{ s} = 1\,800\,000 \text{ s} \approx 20 \text{ d}$

Clear logging data

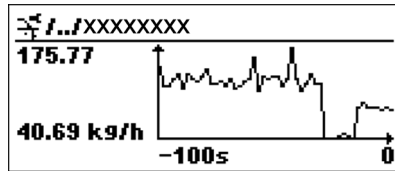


Navigation	Expert → Diagnostics → Data logging → Clear logging (0855)
Description	Initiate a deletion of the complete logging memory.
Selection	<ul style="list-style-type: none"> ▪ Cancel ▪ Clear data
Factory setting	Cancel

"Display channel 1 to 4" submenu

i The **Display channel 1 to 4** submenu is only available when operating via the local display. When operating via FieldCare, the diagram can be displayed in the "Event List / HistoROM" function.

The **Display channel 1 to 4** submenu displays the measured value trend of the respective logging channel.















- x-axis: displays 125 to 500 measured values of a process variable (the number of values depending on the number of selected channels).
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

i To quit the diagram and to return to the operating menu, press \oplus and \ominus simultaneously.

3.11.8 "Min/max values" submenu

Structure of the submenu


Navigation  Expert → Diagnostics → Min/max val.

► Min/max values	
Max. level value	→  230
Time max. level	→  230
Min. level value	→  230
Time min. level	→  230
Max. draining speed	→  230
Max. filling speed	→  231
Reset min./max.	→  231
Max. electronics temperature	→  231
Time max. electronics temperature	→  231
Min. electronics temperature	→  231
Time min. electronics temperature	→  232
Reset min./max. temp.	→  232

Description of parameters


Navigation  Expert → Diagnostics → Min/max val.

Max. level value

Navigation  Expert → Diagnostics → Min/max val. → Max. level value (2357)

Description Displays maximum level measured in the past.

Time max. level

Navigation  Expert → Diagnostics → Min/max val. → Time max. level (2385)


Description Displays operating time at which the maximum level has been obtained.

Min. level value

Navigation  Expert → Diagnostics → Min/max val. → Min. level value (2358)


Description Displays minimum level measured in the past.

Time min. level

Navigation  Expert → Diagnostics → Min/max val. → Time min. level (2386)



Description Displays operating time at which the minimum level has been obtained.

Max. draining speed

Navigation  Expert → Diagnostics → Min/max val. → Max.drain.speed (2320)



Description Displays maximum draining speed measured in the past.

Max. filling speed



Navigation	  Expert → Diagnostics → Min/max val. → Max. fill. speed (2360)
Description	Displays maximum filling speed measured in the past.

Reset min./max.





Navigation	  Expert → Diagnostics → Min/max val. → Reset min/max (2324)
Description	Select which min/max values are to be reset.
Selection	<ul style="list-style-type: none"> ■ None ■ Drain/fill speed ■ Level ■ Reset all
Factory setting	None



Max. electronics temperature

Navigation	  Expert → Diagnostics → Min/max val. → Max.electr.temp. (1031)
Description	Displays maximum electronics temperature measured in the past.


Time max. electronics temperature

Navigation	  Expert → Diagnostics → Min/max val. → Time max.el.temp (1204)
Description	Displays operating time at which the maximum electronics temperature has been obtained.


Min. electronics temperature

Navigation	  Expert → Diagnostics → Min/max val. → Min.electr.temp. (1040)
Description	Displays minimum electronics temperature measured in the past.

Time min. electronics temperature

Navigation	 Expert → Diagnostics → Min/max val. → Time min.el.temp (1205)
Description	Displays operating time at which the minimum electronics temperature has been obtained.






Reset min./max. temp.

Navigation	 Expert → Diagnostics → Min/max val. → Res.min/max temp (1173)
Description	Select which min/max values are to be reset.
User interface	<ul style="list-style-type: none">▪ None▪ Electronic temperature▪ Reset all
Factory setting	None


3.11.9 "Simulation" submenu






The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	<ul style="list-style-type: none">▪ Assign measurement variable (→  235)▪ Value process variable (→  235)
Specific state of the switch output	<ul style="list-style-type: none">▪ Switch output simulation (→  235)▪ Switch status (→  236)
Existence of an alarm	Simulation device alarm (→  236)

Structure of the submenu



Navigation  Expert → Diagnostics → Simulation

▶ Simulation	
Assign measurement variable	→  235
Value process variable	→  235
Switch output simulation	→  235
Switch status	→  236
Simulation device alarm	→  236



Description of parameters

Navigation  Expert → Diagnostics → Simulation


Assign measurement variable

Navigation	 Expert → Diagnostics → Simulation → Assign meas.var. (2328)
Description	Select process variable to be simulated.
Selection	<ul style="list-style-type: none"> ■ Off ■ Level ■ Level linearized
Factory setting	Off
Additional information	<ul style="list-style-type: none"> ■ The value of the variable to be simulated is defined in the Value process variable parameter (→  235). ■ If Assign measurement variable ≠ Off, a simulation is active. This is indicated by a diagnostic message of the <i>Function check (C)</i> category.

Value process variable

Navigation	 Expert → Diagnostics → Simulation → Value proc. var. (2329)
Prerequisite	Assign measurement variable (→  235) ≠ Off
Description	Specify value of the process value being simulated.
User entry	Signed floating-point number
Factory setting	0
Additional information	Downstream measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.

Switch output simulation

Navigation	 Expert → Diagnostics → Simulation → Switch sim. (0462)
Description	Switch the simulation of the switch output on or off.
Selection	<ul style="list-style-type: none"> ■ Off ■ On
Factory setting	Off

Switch status

**Navigation**

Expert → Diagnostics → Simulation → Switch status (0463)

Prerequisite**Switch output simulation** (→ 235) = **On****Description**

Define the switch state to be simulated.

Selection

- Open
- Closed

Factory setting

Open

Additional information

The switch status assumes the value defined in this parameter. This helps to check correct operation of connected control units.

Simulation device alarm

**Navigation**

Expert → Diagnostics → Simulation → Sim. alarm (0654)

Description

Switch alarm simulation on or off.

Selection

- Off
- On

Factory setting

Off

Additional information







When selecting the **On** option, the device generates an alarm. This helps to check the correct output behavior of the device in the case of an alarm.

An active simulation is indicated by the diagnostic message **C484 Simulation failure mode**.

3.11.10 "Device check" submenu

Structure of the submenu


Navigation  Expert → Diagnostics → Device check

► Device check	
Start device check	→  238
Result device check	→  238
Last check time	→  238
Level signal	→  239
Near distance	→  239
Area of incoupling	→  239

Description of parameters

Navigation  Expert → Diagnostics → Device check

Start device check

Navigation  Expert → Diagnostics → Device check → Start dev. check (1013)

Description Start a device check.

Selection

- No
- Yes

Factory setting No

Additional information In the case of a lost echo a device check can not be performed.

Result device check

Navigation  Expert → Diagnostics → Device check → Result dev.check (1014)

Description Displays the result of the device check.

Additional information

Meaning of the display options


- **Installation ok**
Measurement possible without restrictions.
- **Accuracy reduced**
A measurement is possible. However, the measuring accuracy may be reduced due to the signal amplitudes.
- **Measurement capability reduced**
A measurement is currently possible. However, there is the risk of an echo loss. Check the mounting position of the device and the dielectric constant of the medium.
- **Check not done**
No device check has been performed.

Last check time


Navigation  Expert → Diagnostics → Device check → Last check time (1203)

Description Displays the operating time at which the last device check has been performed.


Level signal

Navigation	 Expert → Diagnostics → Device check → Level signal (1016)
Prerequisite	Device check has been performed.
Description	Displays result of the device check for the level signal.
User interface	<ul style="list-style-type: none">■ Check not done■ Check not OK■ Check OK
Additional information	For Level signal = Check not OK : Check the mounting position of the device and the dielectric constant of the medium.

Near distance

Navigation	 Expert → Diagnostics → Device check → Near distance (1157)
Description	Displays result of the device check for the near distance.
User interface	<ul style="list-style-type: none">■ Check not done■ Check not OK■ Check OK
Factory setting	Check not done

Area of incoupling

Navigation	 Expert → Diagnostics → Device check → Area incoupling (1169)
Description	Indicates the area of ringing zone.

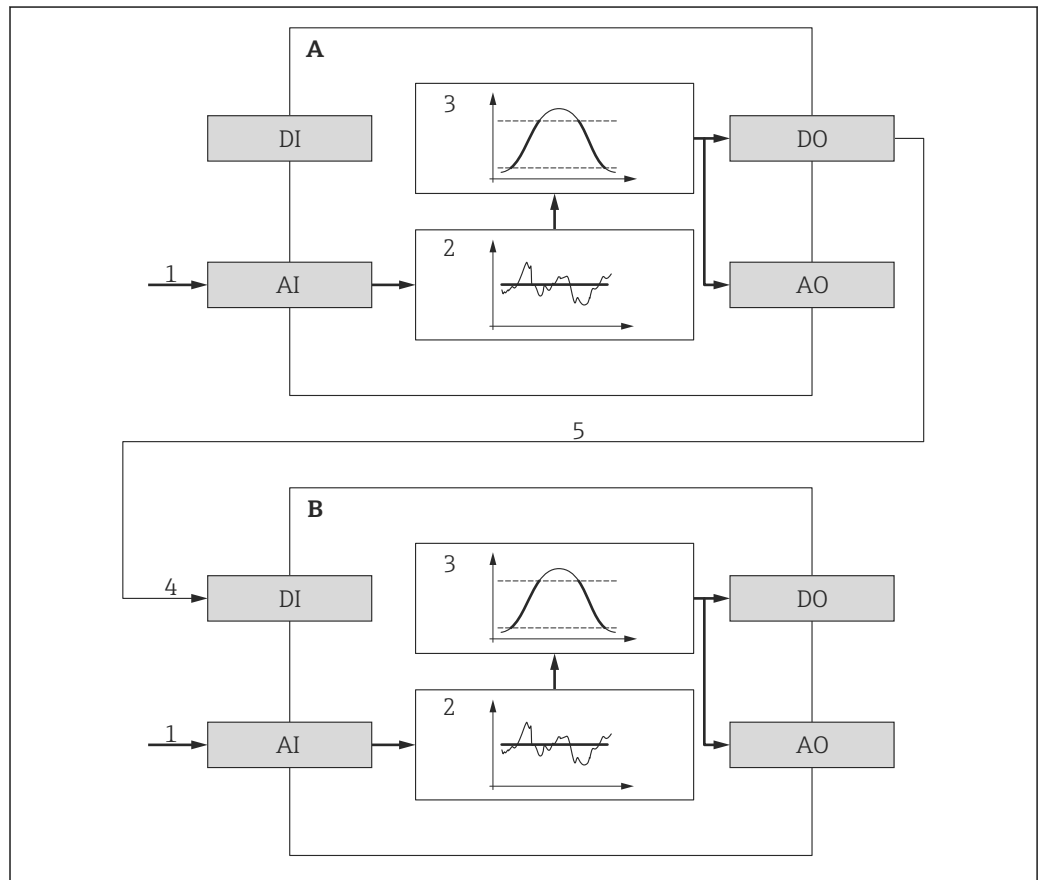
3.11.11 "Advanced diagnostics 1 to 2" submenu

Mode of operation

The Advanced Diagnostics offers additional options to monitor the process. The device contains two Advanced Diagnostic Blocks which can be used separately or in combination.

A measuring variable can be assigned to the input of each Advanced Diagnostic Block. Based on a freely configurable time interval, the variable can be submitted to a statistical function (e.g. maximum, minimum, mean, slope). Finally, a limit detection can be parametrized and its result can be transmitted to a digital output.

The result can be displayed and evaluated by a DCS or PLC. If required, it can also be linked to the second Advanced Diagnostic block and thus it is possible to combine the two results by the logical operators AND or OR.



















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

47 Combined Advanced Diagnostic blocks

- A Advanced Diagnostics 1
- B Advanced Diagnostics 2
- AI Analog input of the respective block
- DI Digital input of the respective block
- AO Analog output of the respective block
- DO Digital output of the respective block
- 1 Analog process variable
- 2 Statistical calculation (maximum, minimum, mean, slope)
- 3 Limit check
- 4 Digital input of AD2
- 5 Digital output of AD1 is linked to digital input of AD2

Overview of the Advanced Diagnostic functionalities

Task	Associated parameters
Allocation of a process variable to the analog input of the block.	Assign diagnostic signal (→  248)
Linking the digital input to the digital output of the other block.	<ul style="list-style-type: none"> ▪ Link AD to (→  248) ▪ Linking logic AD (→  248)
Calculation of one of the following quantities for a freely configurable sampling interval: <ul style="list-style-type: none"> ▪ Maximum ▪ Minimum ▪ Mean ▪ Standard deviation ▪ Difference Max. - Min. ▪ Slope 	<ul style="list-style-type: none"> ▪ Sample time (→  249) ▪ Calculation type (→  249) ▪ Calculation unit (→  251)
Drag indicator for the calculated quantity	<ul style="list-style-type: none"> ▪ Maximum value (→  253) ▪ Minimum value (→  253) ▪ Reset min./max. (→  254)
Limit check	<ul style="list-style-type: none"> ▪ Check mode (→  250) ▪ Upper limit (→  252) ▪ Lower limit (→  252) ▪ Hysteresis (→  253)
Reaction in case of a limit violation	<ul style="list-style-type: none"> ▪ Assign status signal to AD event (→  254) ▪ Assign event behaviour (→  254) ▪ Alarm delay (→  255)

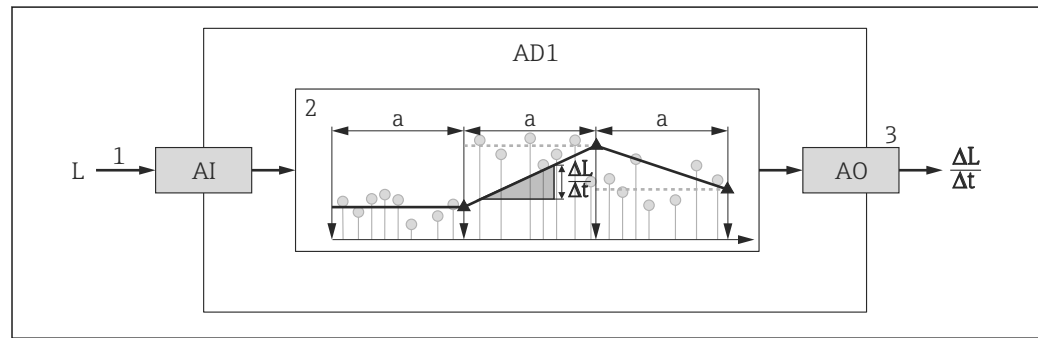
Example 1: Draining/filling speed

i Only one Advanced Diagnostic Block is needed for this application. In the example this is **Advanced diagnostics 1** (→  247). However, **Advanced diagnostics 2** (→  247) could be used just as well.

The level change rate (i.e. draining or filling speed) allows the customer to instantly realize whether or not the level is changing, and at which rate. The rate at which the level is changing must be observed as powerful pumps can create significant over and underpressure in a tank. Pressure relieve valves can only operate properly up to a certain level change rate. This is in particular valid for almost emptied tanks. The level change rate is also an intermediate result for calculating transfer estimates, such as time to fill, time to empty, time to target, etc.

Basic idea

The Advanced Diagnostics is used to calculate the draining or filling speed from the measured level. The result can be transmitted via the current output or the HART communication interface.



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i 48 Calculation of the draining or filling speed




- 1 Allocation of the (linearized) level to Advanced Diagnostic Block AD1
- 2 Calculation of the draining or filling speed $\Delta L/\Delta t$ within the sampling interval a .
- 3 $\Delta L/\Delta t$ can be transmitted via the current output or the HART communication interface.

Configuration of the calculation

The calculation of the rate of level change is configured as follows:

1. Select **Assign diagnostic signal 1 = Level linearized**.
2. Select **Link AD 1 to = None** (= factory setting)
3. Define **Sample time 1** in accordance with the expected draining or filling speed.
4. Select **Calculation type 1 = Slope**.
5. Select a suitable option in **Calculation unit 1**, e.g.: "**Level unit**" / s

i As the rate of level change is not to be checked for limit violation, the following parameters may retain their factory settings:

- **Check mode 1**
- **Assign status signal to AD event** (→  254)
- **Assign event behaviour** (→  254)
- **Alarm delay** (→  255)

i With this configuration, the **Maximum value 1** and **Minimum value 1** drag indicators display the maximum or minimum value the rate of level change has obtained. Positive values indicate filling (rising level), negative values indicate draining (falling level). If required, the drag indicators can be reset by the **Reset min./max. 1** parameter.

Allocation of the calculated rate of level change to the current output

1. Navigate to the following submenu: Expert → Output → Curr.output 1.
2. Select **Assign current output = Analog output adv. diagnostics 1**.
3. Select **Turn down = On**.
4. Enter maximum expected draining speed (negative value) in **4 mA value**.
5. Enter maximum expected filling speed (positive value) in **20 mA value**.

With this configuration, the rate of level change is transmitted via the current output. The relationship between the rate of level change and the output current is as follows:

$$\frac{\Delta L}{\Delta t} = \frac{5W_4 - W_{20}}{4} + \frac{W_{20} - W_4}{16 \text{ mA}} I$$

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Where:

- $\Delta L/\Delta t$: Rate of level change ¹⁰⁾
- W_4 : **4 mA value**
- W_{20} : **20 mA value**
- I: Output current


In the case of a constant level ($\Delta L/\Delta t = 0$) the current is:


$$I_0 = 4 \text{ mA} - \frac{W_4}{W_{20} - W_4} 16 \text{ mA}$$

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Allocation of the calculated rate of level change to the HART output

1. Navigate to the following submenu: Expert → Communication → Output
2. Select **Assign PV = Analog output adv. diagnostics 1**.

 With this configuration, the **Primary variable (PV)** parameter displays the calculated filling or draining speed. Positive values indicate filling; negative values indicate draining.

 Instead of PV, it is also possible to allocate the rate of level change to SV, TV or QV.

10) Negative values: draining speed; Positive values: filling speed

Example 2: Foam detection

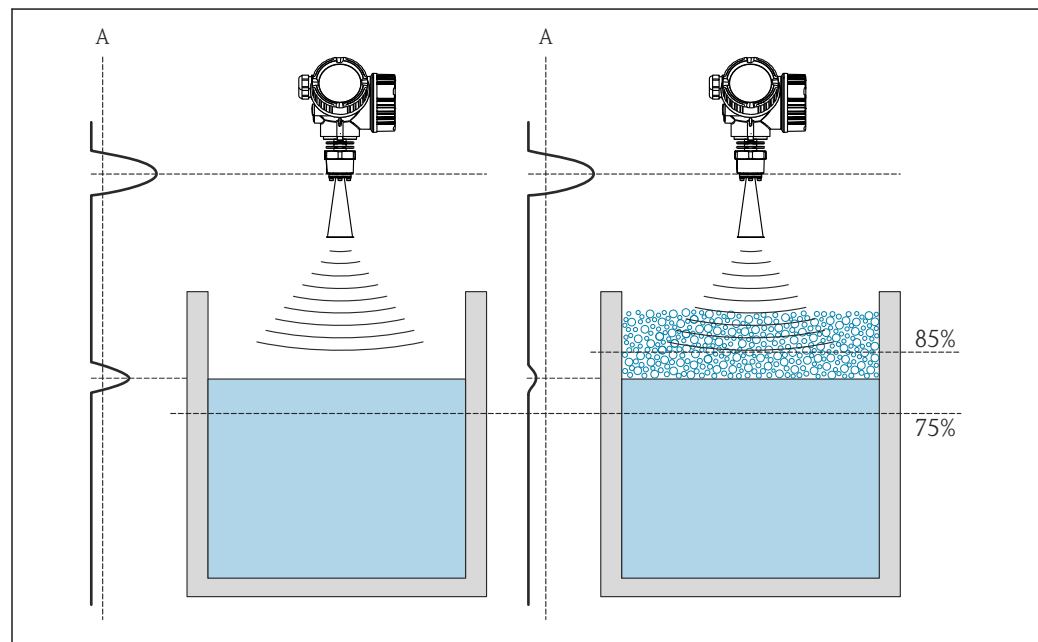
i In this example, both Advance Diagnostic Blocks are used.

Preconditions

- The process runs at a fixed level (in the example: 80 %)
- If foam occurs during the operation, the vessel should automatically be sprinkled with water from the top or an antifoam agent should be added to dissolve the foam.

Basic idea

The echo amplitude decreases in the case of foam formation. This can be used by the Advanced Diagnostics to detect the foam. The foam detection, however, should only be active as long as the level is between 75 % and 85 %.



49 Decrease of the amplitude in case of foam formation

A Amplitude threshold for foam detection

Configuration of the level monitoring

In order to ensure that the level is within the correct range, configure the **Advanced diagnostics 1** submenu (→ **247**) submenu as follows:


1. Navigate to the **Advanced diagnostics 1** submenu (→ **247**)
2. Select **Assign diagnostic signal 1 = Level linearized**.
3. Select **Check mode 1 = Out of range**
4. Set **Upper limit 1 = 85 %**.
5. Set **Lower limit 1 = 75 %**.

i **Check mode 1 = Out of range** checks whether the level is outside a defined range. As long as this is the case, the block outputs "0" (INACTIVE). If the level gets into the defined range, the block outputs "1" (ACTIVE).


Configuration of the foam detection

For the foam detection, configure the **Advanced diagnostics 2** submenu (→ **247**) as follows:


1. Select **Assign diagnostic signal 2 = Relative echo amplitude**.
2. Use the **Minimum value 2** parameter to observe the echo amplitude for the specified level (80 % in the example) for a while and determine a suitable lower limit for the amplitude (10 dB in the example).
3. Select **Calculation type 2 = Mean**.
4. Enter **Sample time 2 = "60 s"**.
5. Select **Check mode 2 = Lower limit**.
6. Enter the amplitude limit determined in step 2 into the **Lower limit 2** parameter (10 dB in the example).


-  With these settings, the Advanced Diagnostic Block behaves as follows:
- If the amplitude is above 10 dB (i.e.: no foam), the block assumes the digital value "0" (INACTIVE).
 - If the amplitude is below 10 dB (i.e.: foam present), the block assumes the digital value "1" (ACTIVE).

Configuration of the block linking

The linking logic is configured in the **Advanced diagnostics 2** submenu (→  247):

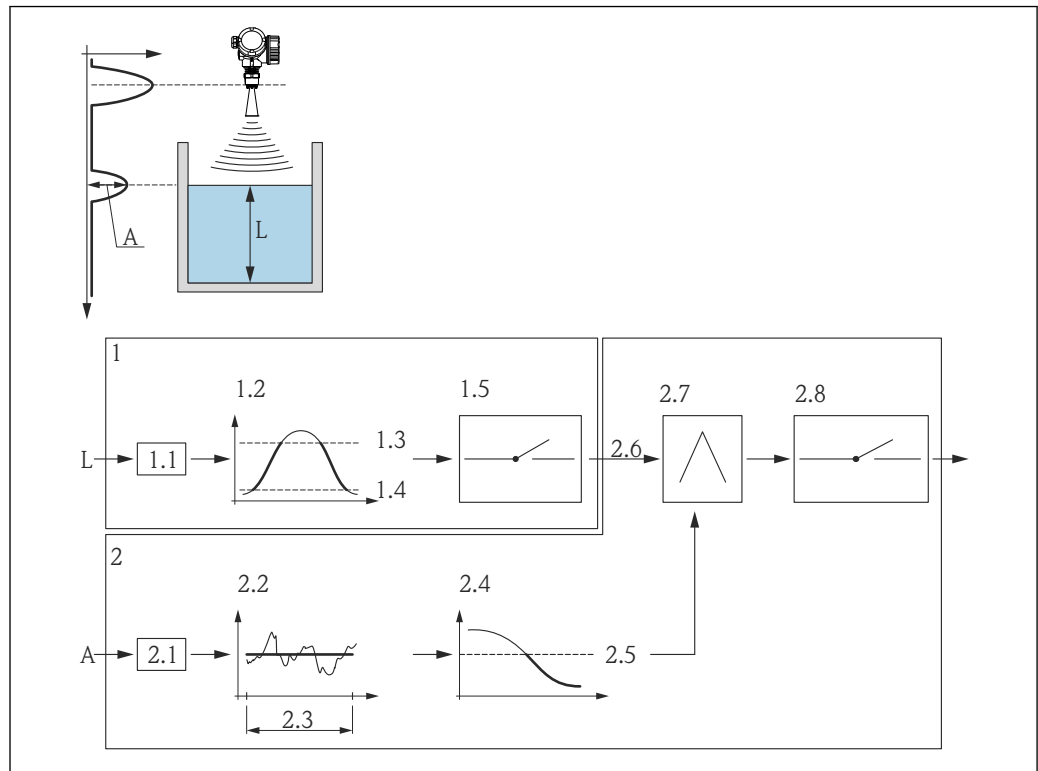
1. Select **Link AD 2 to = Digital output AD 1**.
2. **Select Linking logic AD 2 = AND**.

-  With this configuration the output of **Advanced Diagnostics 2** assumes the following value:
- 0 (INACTIVE) - if at least one of the two blocks is in the "0" (INACTIVE) status.
 - 1 (ACTIVE) - if both blocks are in the "1" (ACTIVE) status.
- For the example this means:
- A diagnostic signal is output, if the level is within the defined range and the signal amplitude is below the threshold (i.e. foam is present).
 - If, on the other hand, the level is out of the defined range or if the signal amplitude exceeds the threshold (i.e. no foam), **no** diagnostic signal is transmitted via the switch output.

-  The digital output signal of **Advanced diagnostics 2** can be linked to the switch output of the device:

Expert → Output → Switch output → Assign status (0485) = Digital output AD 2

Overview: Foam detection with the advanced diagnostics




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50 Configuration of the Advanced Diagnostics for foam detection


- L Level
- A Amplitude
- 1 Advanced diagnostics 1: Monitoring the level
 - 1.1 "Assign diagnostic signal 1" = "Relative echo amplitude"
 - 1.2 "Check mode 1" = "Out of range"
 - 1.3 "Upper limit 1" = 85 %
 - 1.4 "Lower limit 1" = 75 %
 - 1.5 Digital output of Advanced Diagnostics 1
- 2 Advanced Diagnostics 2: Monitoring the amplitude
 - 2.1 "Assign diagnostic signal 2" = "Relative echo amplitude"
 - 2.2 "Calculation type 2" = "Mean"
 - 2.3 "Sample time 2" = 60 s
 - 2.4 "Check mode 2" = "Lower limit"
 - 2.5 "Lower limit 2" = 10 dB
 - 2.6 "Link AD 2 to" = "Digital output AD 1"
 - 2.7 "Linking logic AD 2" = "AND"
 - 2.8 Digital output of Advanced Diagnostics 2

Structure of the submenu


Navigation  Expert → Diagnostics → Adv.diagn. 1 to 2

► Advanced diagnostics 1 to 2	
Assign diagnostic signal 1 to 2	→ 248
Link AD 1 to 2 to	→ 248
Linking logic AD 1 to 2	→ 248
Sample time 1 to 2	→ 249
Calculation type 1 to 2	→ 249
Check mode 1 to 2	→ 250
Calculation unit 1 to 2	→ 251
Upper limit 1 to 2	→ 252
Lower limit 1 to 2	→ 252
Hysteresis 1 to 2	→ 253
Value	→ 253
Maximum value 1 to 2	→ 253
Minimum value 1 to 2	→ 253
Reset min./max. 1 to 2	→ 254
Assign status signal to AD event 1 to 2	→ 254
Assign event behaviour 1 to 2	→ 254
Alarm delay 1 to 2	→ 255

Description of parameters

Navigation  Expert → Diagnostics → Adv.diagn. 1 to 2

Assign diagnostic signal 1 to 2

Navigation  Expert → Diagnostics → Adv.diagn. 1 to 2 → Assign signal 1 to 2 (11179-1 to 2)


Description Allocate a measuring variable to the Advanced Diagnostic Block.

Selection

- None
- Level linearized
- Unfiltered distance
- Relative echo amplitude
- Sensor debug
- Electronic temperature
- Terminal voltage
- Area of incoupling
- Analog output 1
- Analog output 2
- Analog output 3
- Analog output 4

Factory setting None

Link AD 1 to 2 to

Navigation  Expert → Diagnostics → Adv.diagn. 1 to 2 → Link AD 1 to 2 to (11180-1 to 2)


Description Link the digital input (DI) of the Advanced Diagnostic Block to the digital output (DO) of the other Advanced Diagnostic Block.


Selection

- None
- Digital output AD 1
- Digital output AD 2
- Digital output 1
- Digital output 2
- Digital output 3
- Digital output 4

Factory setting None

Linking logic AD 1 to 2

Navigation  Expert → Diagnostics → Adv.diagn. 1 to 2 → Link. logic AD 1 to 2 (11181-1 to 2)

Prerequisite **Link AD to (→  248) = Digital output AD 1 oder Digital output AD 2**



Description Select linking logic between the two Advanced Diagnostic Blocks.


Selection

- AND
- OR

Factory setting AND

Sample time 1 to 2

Navigation   Expert → Diagnostics → Adv.diagn. 1 to 2 → Sample time 1 to 2 (11187-1 to 2)


Prerequisite Assign diagnostic signal (→  248) ≠ None


Description Specify sampling interval for the calculation.

User entry 1 to 3 600 s

Factory setting 10 s

Calculation type 1 to 2

Navigation   Expert → Diagnostics → Adv.diagn. 1 to 2 → Calc. type 1 to 2 (11174-1 to 2)

Prerequisite Assign diagnostic signal (→  248) ≠ None

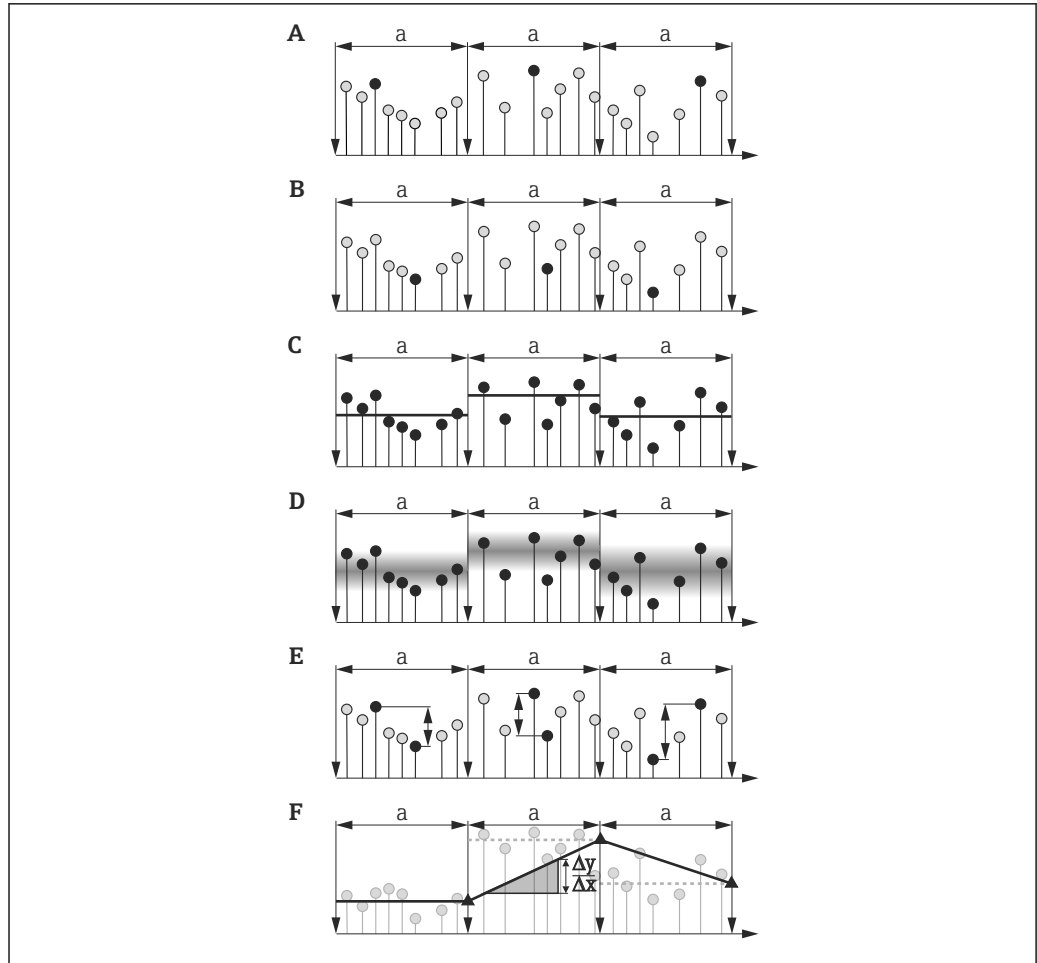
Description Select quantity to be calculated from the measured variable.

Selection

- Off
- Maximum
- Minimum
- Mean
- Standard deviation
- Difference Max. - Min.
- Slope

Factory setting Off

Additional information



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51 Options of the "Calculation type" parameter

- a* Sample time (→ 249)
- A* "Calculation type" = "Maximum"
- B* "Calculation type" = "Minimum"
- C* "Calculation type" = "Mean"
- D* "Calculation type" = "Standard deviation"
- E* "Calculation type" = "Difference Max. - Min."
- F* "Calculation type" = "Slope"

i The calculation is performed based on the sampling interval defined in the **Sample time** parameter (→ 249).

Check mode 1 to 2



Navigation

Expert → Diagnostics → Adv.diagn. 1 to 2 → Check mode 1 to 2 (11175-1 to 2)

Prerequisite

Assign diagnostic signal (→ 248) ≠ None

Description

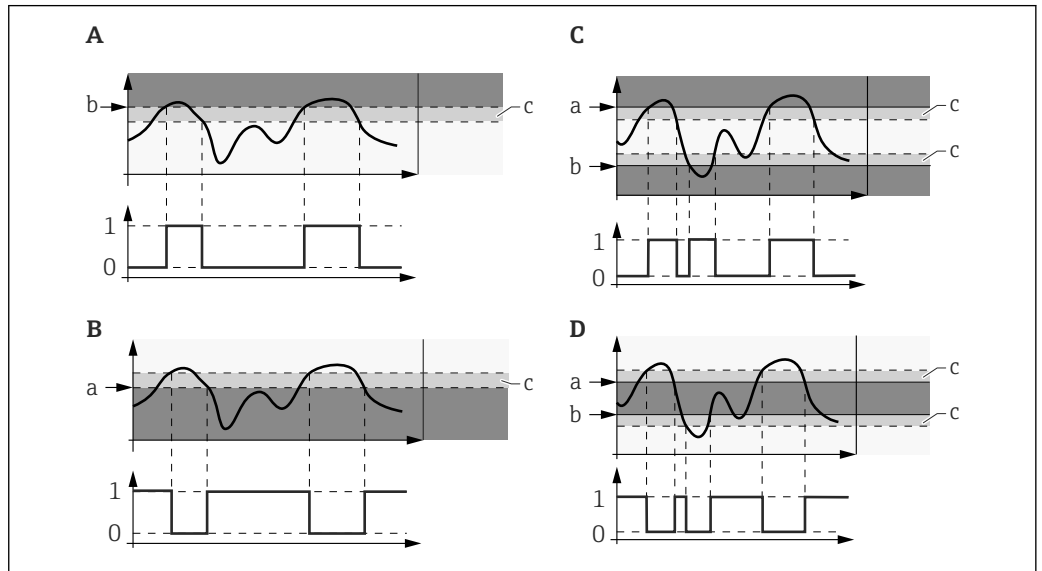
Define check mode for limit monitoring.

Selection

- Off
- Upper limit
- Lower limit
- In range
- Out of range

Factory setting Off

Additional information



52 Limit monitoring in the Advanced Diagnostic Block

- 0 Status of digital output: 0 ("INACTIVE")
- 1 Status of digital output: 1 ("ACTIVE")
- a Upper limit (→ 252)
- b Lower limit (→ 252)
- c Hysteresis (→ 253)
- A "Check mode" = "Lower limit"
- B "Check mode" = "Upper limit"
- C "Check mode" = "In range"
- D "Check mode" = "Out of range"

i If a calculation has been selected in the **Calculation type** parameter (→ 249), the check does not refer to the assigned measuring variable but to the quantity calculated from it.

Calculation unit 1 to 2

Navigation Expert → Diagnostics → Adv.diagn. 1 to 2 → Calc. unit 1 to 2 (11188-1 to 2)

Prerequisite Assign diagnostic signal (→ 248) ≠ None



Description Select unit for the calculation.

Selection Dependent on the following parameters:



- Assign diagnostic signal (→ 248)
- Calculation type (→ 249)

Factory setting


Dependent on the following parameters:

- Assign diagnostic signal (→  248)
- Calculation type (→  249)

Upper limit 1 to 2**Navigation**

  Expert → Diagnostics → Adv.diagn. 1 to 2 → Upper limit 1 to 2 (11182-1 to 2)

Prerequisite

Check mode parameter (→  250) has one of the following values:



- Upper limit
- In range
- Out of range

Description

Specify upper limit for the limit monitoring.



User entry

Dependent on the following parameters:



- Assign diagnostic signal (→  248)
- Calculation type (→  249)

Factory setting


Dependent on the following parameters:

- Assign diagnostic signal (→  248)
- Calculation type (→  249)

Lower limit 1 to 2**Navigation**

  Expert → Diagnostics → Adv.diagn. 1 to 2 → Lower limit 1 to 2 (11184-1 to 2)

Prerequisite

Check mode parameter (→  250) has one of the following values:



- Lower limit
- In range
- Out of range

Description

Define lower limit for the limit monitoring.



User entry

Dependent on the following parameters:

- Assign diagnostic signal (→  248)
- Calculation type (→  249)

Factory setting

Dependent on the following parameters:

- Assign diagnostic signal (→  248)
- Calculation type (→  249)

Hysteresis 1 to 2



Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Hysteresis 1 to 2 (11178-1 to 2)
Prerequisite	Check mode parameter (→ 250) has one of the following values: <ul style="list-style-type: none"> ■ Upper limit ■ Lower limit ■ In range ■ Out of range
Description	Select hysteresis for the limit monitoring.
User entry	Dependent on the following parameters: <ul style="list-style-type: none"> ■ Assign diagnostic signal (→ 248) ■ Calculation type (→ 249)
Factory setting	Dependent on the following parameters: <ul style="list-style-type: none"> ■ Assign diagnostic signal (→ 248) ■ Calculation type (→ 249)

Value

Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Value (11172-1 to 2)
Description	Displays the current value of the calculated process variable.

Maximum value 1 to 2

Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Maximum value 1 to 2 (11183-1 to 2)
Prerequisite	Assign diagnostic signal (→ 248) ≠ None
Description	Indicates the maximum value the assigned measuring variable has obtained in the past (drag indicator).

Minimum value 1 to 2

Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Minimum value 1 to 2 (11185-1 to 2)
Prerequisite	Assign diagnostic signal (→ 248) ≠ None
Description	Indicates minimum value the assigned measuring variable has obtained in the past (drag indicator).

Reset min./max. 1 to 2



Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Reset min/max 1 to 2 (11186-1 to 2)
Prerequisite	Assign diagnostic signal (→ 248) ≠ None
Description	Reset drag indicators (Maximum value (→ 253) and/or Minimum value (→ 253)).
Selection	<ul style="list-style-type: none"> ▪ Off ▪ Reset max. ▪ Reset min. ▪ Reset min./max.
Factory setting	Off

Assign status signal to AD event 1 to 2



Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Stat. AD event 1 to 2 (11176-1 to 2)
Prerequisite	Assign diagnostic signal (→ 248) ≠ None
Description	Assign a category according to NAMUR NE107 to the event of the Advanced Diagnostic Block.
Selection	<ul style="list-style-type: none"> ▪ Failure (F) ▪ Maintenance required (M) ▪ Function check (C) ▪ Out of specification (S)
Factory setting	Maintenance required (M)

Assign event behaviour 1 to 2



Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Evt behaviour 1 to 2 (11177-1 to 2)
Prerequisite	Assign diagnostic signal (→ 248) ≠ None
Description	Assign an event behavior to the event of the Advanced Diagnostic Block.
Selection	<ul style="list-style-type: none"> ▪ Off ▪ Alarm ▪ Warning ▪ Logbook entry only
Factory setting	Warning


Alarm delay 1 to 2



Navigation	Expert → Diagnostics → Adv.diagn. 1 to 2 → Alarm delay 1 to 2 (11171-1 to 2)
Prerequisite	Assign diagnostic signal (→ 248) ≠ None
Description	Define alarm delay for the Advanced Diagnostic Block.
User entry	0.0 to 3 600.0 s
Factory setting	10.0 s

3.11.12 "Envelope diagnostics" submenu

i In devices which have been delivered with software version 01.00.zz, this submenu is only visible for the "Service" user role.



After the configuration of the measurement it is recommended to record the current envelope curve as a reference curve. The reference curve can be used later for diagnostic purposes. To record the reference curve use the **Save reference curve** parameter (→  257).

The reference curve can only be displayed in the envelope curve diagram of FieldCare after it has been loaded from the device into FieldCare. This is performed by the "Load Reference Curve" function in FieldCare:




Structure of the submenu


Navigation   Expert → Diagnostics → Envelope diag.

▶ Envelope diagnostics	
Save reference curve	→  257
Time reference curve	→  257

Description of parameters

Navigation  Expert → Diagnostics → Envelope diag.

Save reference curve

Navigation  Expert → Diagnostics → Envelope diag. → Save ref. curve (1218)

Description Save current envelope curve as reference curve.


Selection No
 Yes

Factory setting No

Additional information **Meaning of the options**

- No
No action
- Yes
The current envelope curve is saved as reference curve.

Time reference curve

Navigation  Expert → Diagnostics → Envelope diag. → Time ref. curve (1232)

Description Indicates at which time the existing reference curve has been recorded.

4 Overview of information events

Info number	Info name
I1000	----- (Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Trend data deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1185	Display backup done
I1186	Restore via display done
I1187	Settings downloaded with display
I1188	Display data cleared
I1189	Backup compared
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished

5 Overview of diagnostic events

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of electronic				
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change I/O or main electronic module	F	Alarm
261	Electronic modules	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
262	Module connection	1. Check module connections 2. Change electronic modules	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	1. Emergency operation via display 2. Change main electronics	F	Alarm
275	I/O module failure	Change I/O module	F	Alarm
276	I/O module failure	1. Restart device 2. Change I/O module	F	Alarm
282	Data storage	1. Restart device 2. Contact service	F	Alarm
283	Memory content	1. Transfer data or reset device 2. Contact service	F	Alarm
311	Electronic failure	1. Transfer data or reset device 2. Contact service	F	Alarm
311	Electronic failure	Maintenance required! 1. Do not perform reset 2. Contact service	M	Warning
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
411	Up-/download active	Up-/download active, please wait	C	Warning
412	Processing Download	Download active, please wait	C	Warning
435	Linearization	Check linearization table	F	Alarm
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
482	Block in OOS	Set Block in AUTO mode	F	Alarm
484	Simulation failure mode	Deactivate simulation	C	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
485	Simulation measured value	Deactivate simulation	C	Warning
494	Switch output simulation	Deactivate simulation switch output	C	Warning
495	Simulation diagnostic event	Deactivate simulation	C	Warning
497	Simulation block output	Deactivate simulation	C	Warning
585	Simulation distance	Deactivate simulation	C	Warning
586	Record map	Recording of mapping please wait	C	Warning
Diagnostic of process				
801	Energy too low	Increase supply voltage	S	Warning
825	Operating temperature	1. Check ambient temperature 2. Check process temperature	S	Warning
825	Operating temperature	1. Check ambient temperature 2. Check process temperature	F	Alarm
921	Change of reference	1. Check reference configuration 2. Check pressure 3. Check sensor	S	Warning
941	Echo lost	Check parameter 'DC value'	F	Alarm ¹⁾
942	In safety distance	1. Check level 2. Check safety distance 3. Reset self holding	S	Alarm ¹⁾
943	In blocking distance	Reduced accuracy Check level	S	Warning
950	Advanced diagnostic 1 to 2 occurred	Maintain your diagnostic event	M	Warning ¹⁾

1) Diagnostic status is changeable.

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