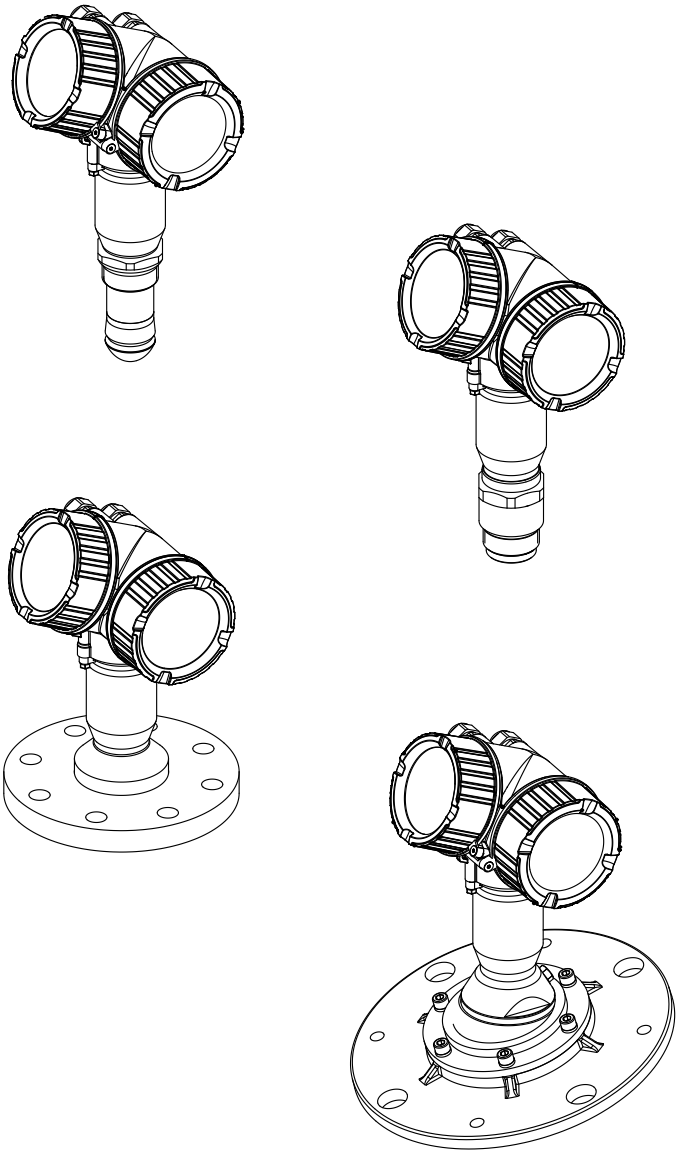
GP01101F/00/EN/01.17
71347970
01.00.zz (Device firmware)

Description of Device Parameters
Micropilot FMR6x
HART

Free-space radar



Endress+Hauser
People for Process Automation

Table of contents

1 Important document information 4
1.1 Document function 4
1.2 Symbols 4
1.2.1 Safety symbols 4
1.2.2 Electrical symbols 4
1.2.3 Tool symbols 4
1.2.4 Symbols for certain types of information 5
1.2.5 Symbols in graphics 5
1.2.6 Symbols at the device 5
1.3 Terms and abbreviations 6
1.4 Registered trademarks 7

2 Overview of the operating menu 8

3 "Expert" menu 19
3.1 Description of parameters 20
3.2 "System" submenu 23
3.2.1 Structure of the submenu 23
3.2.2 "Display" submenu 24
3.2.3 "Conf.backup disp" submenu 33
3.2.4 "Administration" submenu 38
3.3 "Sensor" submenu 42
3.3.1 Structure of the submenu 42
3.3.2 Description of parameters 43
3.3.3 "Medium" submenu 48
3.3.4 "Level" submenu 51
3.3.5 "Linearization" submenu 64
3.3.6 "Information" submenu 74
3.3.7 "Distance" submenu 77
3.3.8 "Sensor diag." submenu 83
3.3.9 "Safety sett." submenu 85
3.3.10 "Mapping" submenu 94
3.3.11 "Tank bottom eval" submenu 104
3.3.12 "Echo tracking" submenu 105
3.4 "Output" submenu 108
3.4.1 Structure of the submenu 108
3.4.2 "Curr.output 1 to 2" submenu 109
3.4.3 "Switch output" submenu 118
3.5 "Communication" submenu 125
3.5.1 Structure of the submenu 125
3.5.2 "Diagnostic configuration" submenu . 126
3.5.3 "Configuration" submenu 127
3.5.4 "Information" submenu 130
3.5.5 "Burst config. 1 to 3" submenu 134
3.5.6 "Output" submenu 138
3.6 "Diagnostics" submenu 142
3.6.1 Structure of the submenu on the local display 142
3.6.2 Structure of the submenu in an operating tool 143
3.6.3 Description of parameters 144
3.6.4 "Diagnostic list" submenu 146
3.6.5 "Event logbook" submenu 148
3.6.6 "Device info" submenu 151
3.6.7 "Data logging" submenu 155
3.6.8 "Min/max val." submenu 159
3.6.9 "Simulation" submenu 164
3.6.10 "Device check" submenu 170
3.6.11 "Adv.diagn. 1 to 4" submenu 173
3.6.12 "Envelope diag." submenu 190

4 Overview of information events . . . 192

5 Overview of diagnostic events 193

Index 195

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 Safety symbols

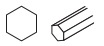
Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⊜	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Tool symbols

Symbol	Meaning
 A0013442	Torx screwdriver
 A0011220	Flat blade screwdriver

Symbol	Meaning
 A0011219	Cross-head screwdriver
 A0011221	Allen key
 A0011222	Hexagon wrench

1.2.4 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

1.2.5 Symbols in graphics

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

1.2.6 Symbols at the device

Symbol	Meaning
	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
	**Temperature resistance of the connection cables** Specifies the minimum value of the temperature resistance of the connection cables.

1.3 Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
FieldCare	Scalable software tool for device configuration and integrated plant asset management solutions
DeviceCare	Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices
DTM	Device Type Manager
DD	Device Description for HART communication protocol
DC	Relative dielectric constant ε_r
Operating tool	The term "operating tool" is used in place of the following operating software: FieldCare / DeviceCare, for operation via HART communication and PC
BD	Blocking Distance; no signals are analyzed within the BD.

1.4 Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

KALREZ®, VITON®
Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

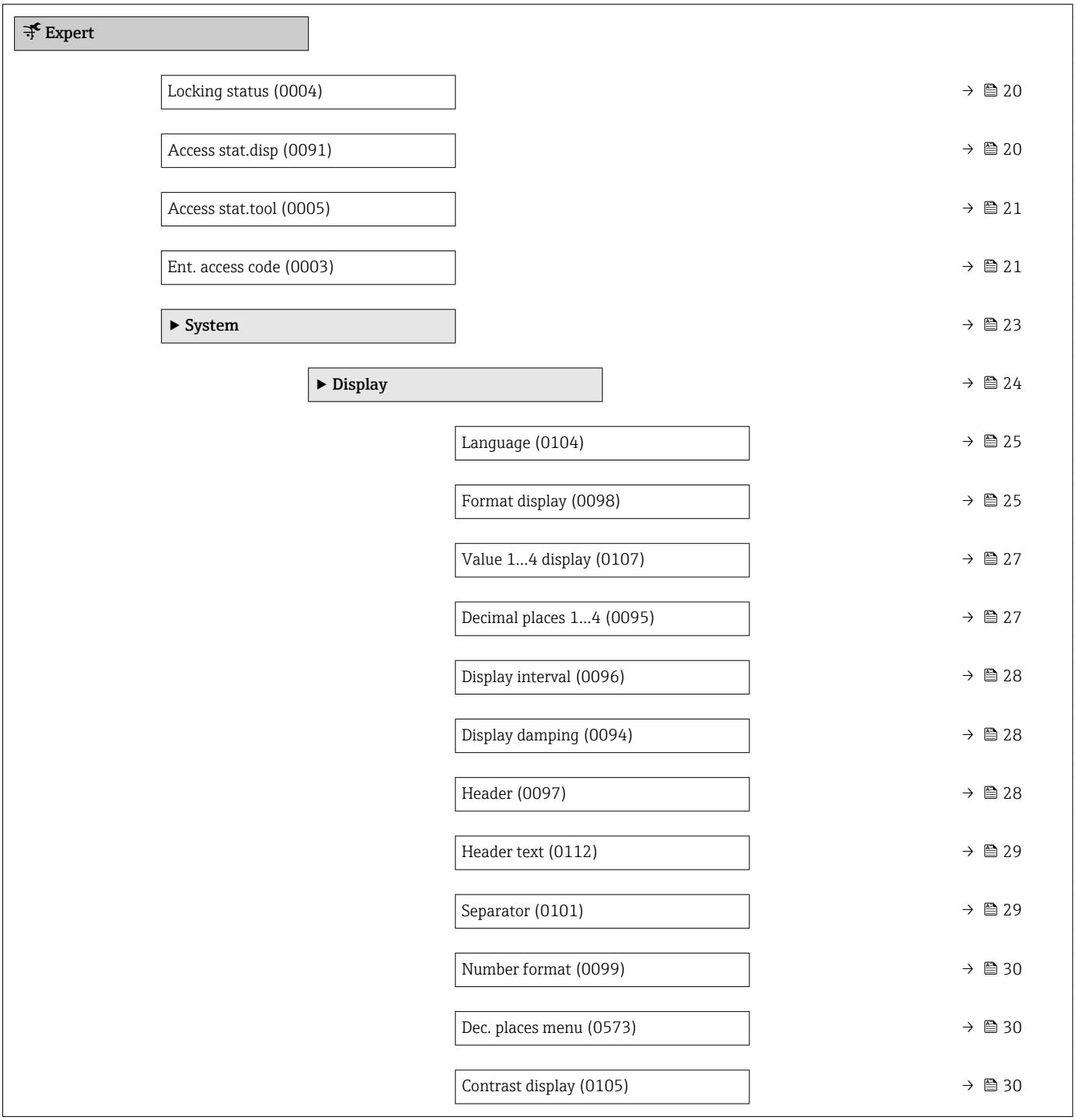
TEFLON®
Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

TRI CLAMP®
Registered trademark of Ladish Co. Inc., Kenosha, USA

2 Overview of the operating menu

- 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



- Backlight (0111) → 31
- Access stat.disp (0091) → 31
- ▶ **Conf.backup disp** → 34
  - Operating time (0652) → 35
  - Last backup (0102) → 35
  - Config. managem. (0100) → 35
  - Backup state (0121) → 36
  - Compar. result (0103) → 37
- ▶ **Administration** → 38
  - Def. access code (0093) → 39
  - Activate SW opt. (0029) → 39
  - Device reset (0000) → 40
- ▶ **Sensor** → 42
  - Distance unit (0551) → 43
  - Temperature unit (0557) → 43
  - Tank type (12519) → 43
  - Bin type (12535) → 44
  - Max drain liquid (12531) → 44
  - Max. fill liquid (12532) → 45
  - Max.drain solid (12533) → 46
  - Max. fill. solid (12534) → 46
  - ▶ **Medium** → 48
    - Medium type (12527) → 49
    - Medium group (12528) → 49
    - Medium property (12529) → 50

- ▶ **Level** → 52
  - Empty calibr. (2343) → 53
  - Full calibr. (2308) → 54
  - Tank/silo height (12403) → 55
  - Level unit (0576) → 56
  - Output mode (2317) → 57
  - Distance offset (2309) → 57
  - Distance (2231) → 58
  - Level limit mode (2314) → 59
  - High limit (2312) → 60
  - Low limit (2313) → 61
  - Level correction (2325) → 61
  - Level (2319) → 61
  - Level linearized (2318) → 62
- ▶ **Linearization** → 65
  - Lineariz. type (2339) → 66
  - Unit lineariz. (2340) → 68
  - Free text (2341) → 68
  - Level linearized (2318) → 69
  - Maximum value (2315) → 69
  - Diameter (2342) → 69
  - Intermed. height (2310) → 70
  - Table mode (2303) → 70
  - Table number (2370) → 71
  - Level (2383) → 72

Level (2389) → 72

Customer value (2384) → 72

Activate table (2304) → 73

▶ **Information** → 74

Signal quality (12477) → 75

Abs. echo ampl. (12457) → 75

Relat.echo ampl. (12468) → 75

Tank bottom ampl (12467) → 75

Found echoes (12492) → 76

Used calculation (12488) → 76

Actual IF gain (12540) → 76

Sensor temp. (12499) → 76

▶ **Distance** → 78

Distance (12401) → 79

Dead time (12521) → 80

Integration time (12489) → 80

Blocking dist. (12424) → 81

▶ **Sensor diag.** → 83

Start self check (12496) → 84

Result selfcheck (12497) → 84

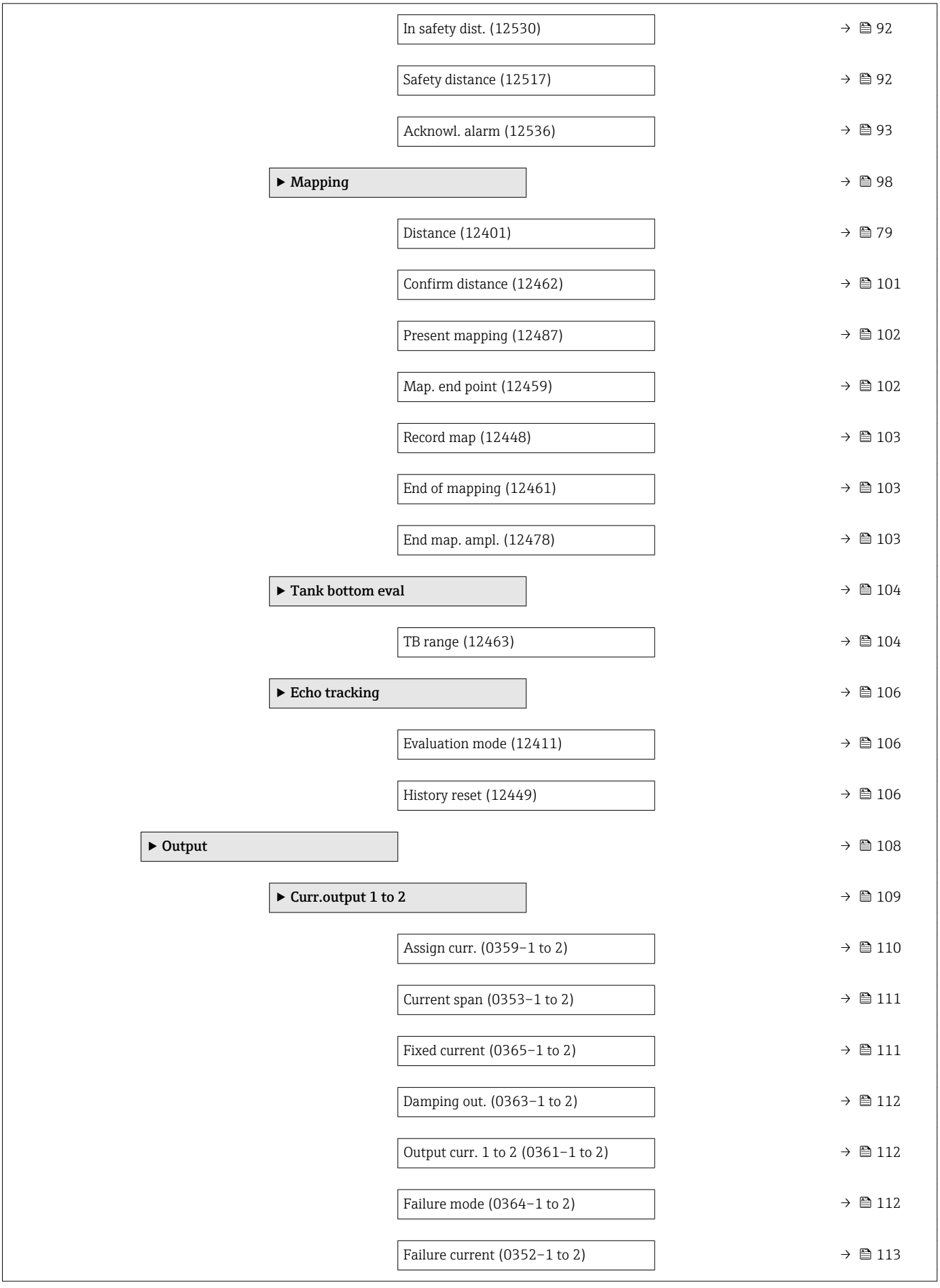
▶ **Safety sett.** → 89

Output echo lost (2307) → 90

Value echo lost (2316) → 90

Ramp echo lost (2323) → 91

Delay echo lost (12456) → 92


In safety dist. (12530) → 92
Safety distance (12517) → 92
Acknowl. alarm (12536) → 93
▶ Mapping → 98
Distance (12401) → 79
Confirm distance (12462) → 101
Present mapping (12487) → 102
Map. end point (12459) → 102
Record map (12448) → 103
End of mapping (12461) → 103
End map. ampl. (12478) → 103
▶ Tank bottom eval → 104
TB range (12463) → 104
▶ Echo tracking → 106
Evaluation mode (12411) → 106
History reset (12449) → 106
▶ Output → 108
▶ Curr.output 1 to 2 → 109
Assign curr. (0359–1 to 2) → 110
Current span (0353–1 to 2) → 111
Fixed current (0365–1 to 2) → 111
Damping out. (0363–1 to 2) → 112
Output curr. 1 to 2 (0361–1 to 2) → 112
Failure mode (0364–1 to 2) → 112
Failure current (0352–1 to 2) → 113

- Turn down (0358–1 to 2) → 113
- 4 mA value (0367–1 to 2) → 114
- 20 mA value (0372–1 to 2) → 114
- Measuring mode (0351–1 to 2) → 115
- Start-up mode (0368–1 to 2) → 115
- Start-up current (0369–1 to 2) → 116
- Measur. curr. 1 to 2 (0366–1 to 2) → 116
- Terminal volt. 1 (0662) → 117

▶ Switch output → 118

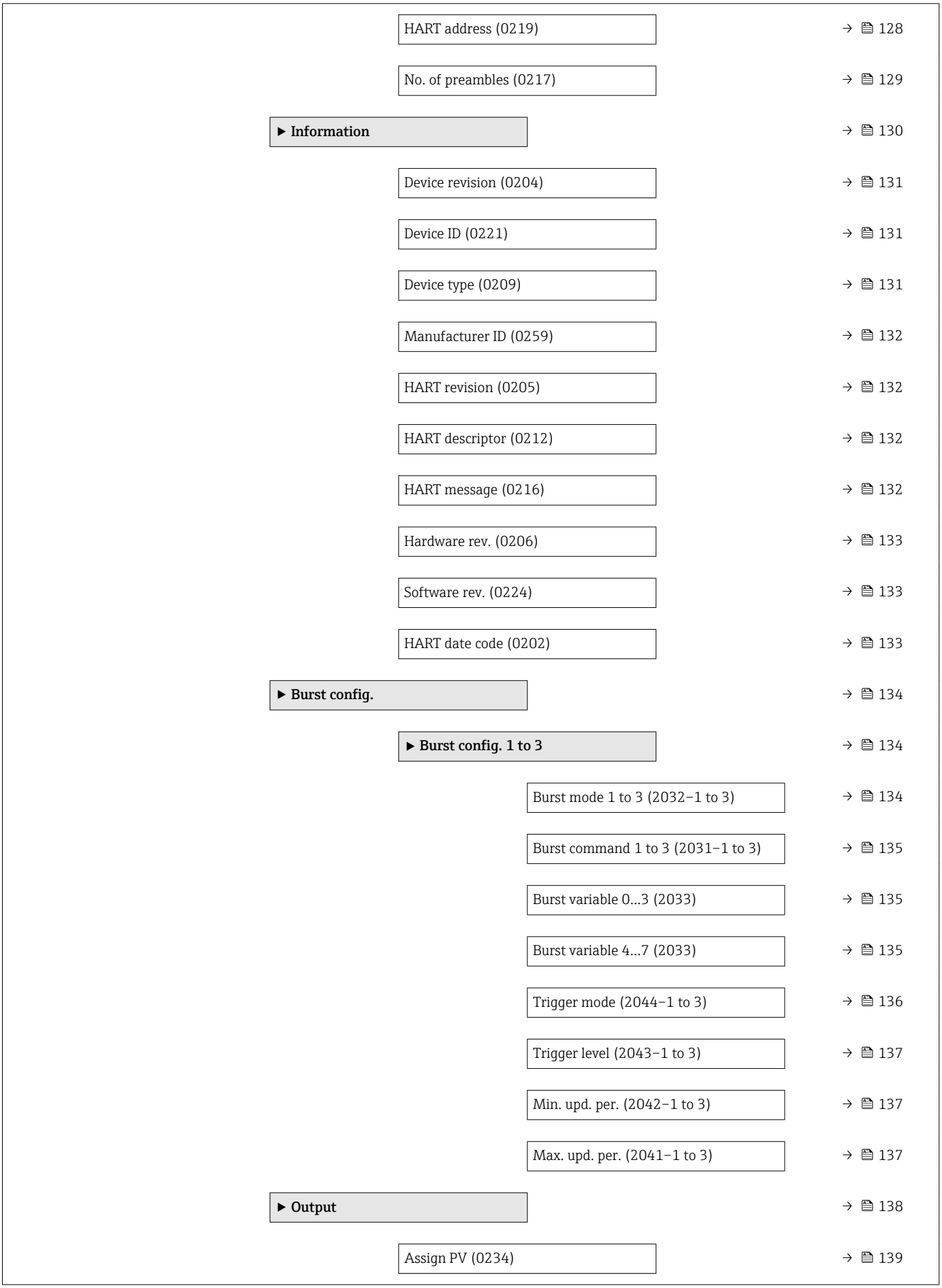
- Switch out funct (0481) → 119
- Assign diag. beh (0482) → 120
- Assign limit (0483) → 120
- Switch-on value (0466) → 120
- Switch-off value (0464) → 122
- Assign status (0485) → 122
- Switch-on delay (0467) → 122
- Switch-off delay (0465) → 123
- Failure mode (0486) → 123
- Switch status (0461) → 124
- Invert outp.sig. (0470) → 124

▶ Communication → 125

▶ Diag. config. → 126

▶ Configuration → 127

- HART short tag (0220) → 128
- Device tag (0215) → 128


HART address (0219) → 128
No. of preambles (0217) → 129
▶ Information → 130
Device revision (0204) → 131
Device ID (0221) → 131
Device type (0209) → 131
Manufacturer ID (0259) → 132
HART revision (0205) → 132
HART descriptor (0212) → 132
HART message (0216) → 132
Hardware rev. (0206) → 133
Software rev. (0224) → 133
HART date code (0202) → 133
▶ Burst config. → 134
▶ Burst config. 1 to 3 → 134
Burst mode 1 to 3 (2032–1 to 3) → 134
Burst command 1 to 3 (2031–1 to 3) → 135
Burst variable 0...3 (2033) → 135
Burst variable 4...7 (2033) → 135
Trigger mode (2044–1 to 3) → 136
Trigger level (2043–1 to 3) → 137
Min. upd. per. (2042–1 to 3) → 137
Max. upd. per. (2041–1 to 3) → 137
▶ Output → 138
Assign PV (0234) → 139

- Primary var (PV) (0201) → 139
- Assign SV (0235) → 139
- Second.var(SV) (0226) → 140
- Assign TV (0236) → 140
- Tertiary var(TV) (0228) → 141
- Assign QV (0237) → 141
- Quaterna.var(QV) (0203) → 141

▶ Diagnostics → 142

- Actual diagnos. (0691) → 144
- Timestamp (0667) → 144
- Prev.diagnostics (0690) → 144
- Timestamp (0672) → 145
- Time fr. restart (0653) → 145
- Operating time (0652) → 145

▶ Diagnostic list → 146

- Diagnostics 1…5 (0692) → 147
- Timestamp 1…5 (0683) → 147

▶ Event logbook → 148

▶ Device info → 151

- Device tag (0011) → 152
- Serial number (0009) → 152
- Firmware version (0010) → 152
- Device name (0013) → 153
- Order code (0008) → 153
- Ext. order cd. 1 to 3 (0023–1 to 3) → 153

ENP version (0012) → 153

Config. counter (0233) → 154

▶ **Data logging** → 155

Assign chan. 1 to 4 (0851–1 to 4) → 156

Logging interval (0856) → 156

Clear logging (0855) → 157

▶ **Min/max val.** → 159

Max. level value (2357) → 160

Time max. level (2385) → 160

Min. level value (2358) → 160

Time min. level (2386) → 160

Max.drain.speed (2320) → 161

Max. fill. speed (2360) → 161

Reset min/max (2324) → 161

Max.electr.temp. (12506) → 161

Time max.el.temp (12507) → 162

Min.electr.temp. (12508) → 162

Time min.el.temp (12509) → 162

Res.min/max temp (12510) → 162

▶ **Simulation** → 165

Assign meas.var. (2328) → 166

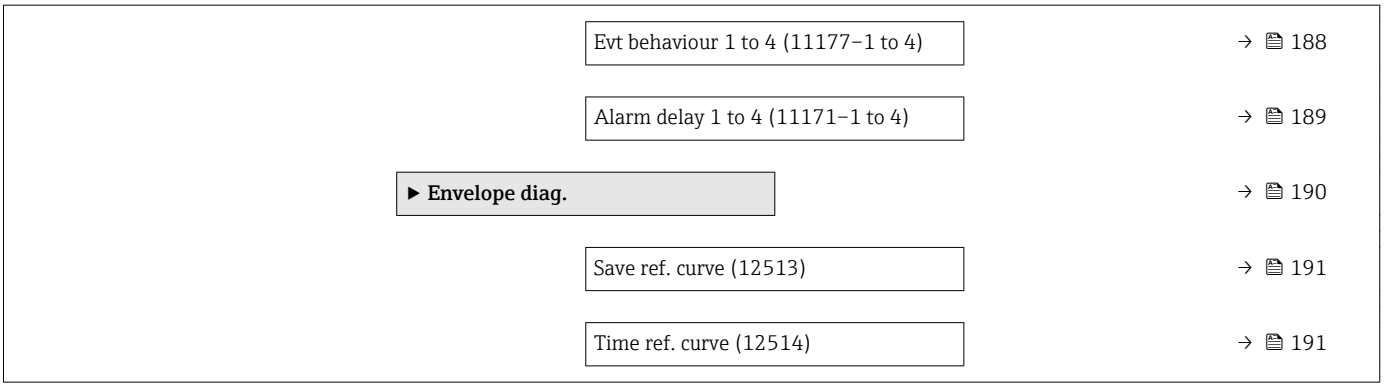
Proc. var. value (2329) → 166

Curr.out. 1 to 2 sim. (0354–1 to 2) → 166

Value curr.out 1 to 2 (0355–1 to 2) → 167

Switch sim. (0462) → 167

- Switch status (0463) → 168
- Dev. alarm sim. (0654) → 168
- Diag. event sim. (0737) → 168
- ▶ **Device check** → 170
  - Start dev. check (12481) → 171
  - Result dev.check (12482) → 171
  - Level signal (12483) → 171
  - Area incoupling (12525) → 171
- ▶ **Adv.diagn. 1 to 4** → 180
  - Assign signal 1 to 4 (11179–1 to 4) → 181
  - Link AD 1 to 4 to (11180–1 to 4) → 181
  - Link. logic AD 1 to 4 (11181–1 to 4) → 182
  - Sample time 1 to 4 (11187–1 to 4) → 182
  - Calc. type 1 to 4 (11174–1 to 4) → 182
  - Check mode 1 to 4 (11175–1 to 4) → 183
  - Calc. unit 1 to 4 (11188–1 to 4) → 184
  - Upper limit 1 to 4 (11182–1 to 4) → 185
  - Lower limit 1 to 4 (11184–1 to 4) → 185
  - Hysteresis 1 to 4 (11178–1 to 4) → 186
  - Value (11172–1 to 4) → 186
  - Maximum value 1 to 4 (11183–1 to 4) → 186
  - Minimum value 1 to 4 (11185–1 to 4) → 187
  - Reset min/max 1 to 4 (11186–1 to 4) → 187
  - Application (11173–1 to 4) → 187
  - Stat. AD event 1 to 4 (11176–1 to 4) → 188


Evt behaviour 1 to 4 (11177–1 to 4)
→ 188
Alarm delay 1 to 4 (11171–1 to 4)
→ 189
▶ Envelope diag.
→ 190
Save ref. curve (12513)
→ 191
Time ref. curve (12514)
→ 191

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 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 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
- 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)
- 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)

In this document, the direct access code is added in brackets after the parameter name in the *Navigation* category.

Read access	Operator
Write access	Maintenance

Locking status

Navigation Expert → Locking status (0004)

Description Indicates curr. write protec. with highest prio.

Additional information

Read access	Operator
Write access	-

Access stat.disp

Navigation Expert → Access stat.disp (0091)

Prerequisite The device has a local display.

Description Indicates access authorization to parameter.

Additional information

The access authorization can be changed via the **Ent. access code** parameter (→ 21).

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 (→ 20).

Read access	Operator
Write access	-

Access stat.tool

Navigation Expert → Access stat.tool (0005)

Description Acc.authorization to parameters via operating tool.

Additional information

Read access	Operator
Write access	-

The access authorization can be changed via the **Ent. access code** parameter (→ 21).

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 (→ 20).

Ent. access code

Navigation Expert → Ent. access code (0003)

Description Enter access code to disable write protec.

User entry 0 to 9 999

Additional information

- For local operation, the customer-specific access code, which has been defined in the **Def. access code** parameter (→ 39), 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.

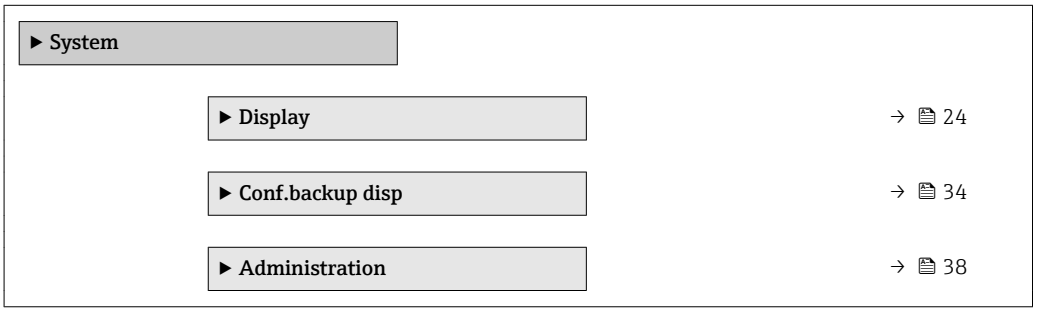
Read access	Operator
Write access	Maintenance

3.2 "System" submenu

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

3.2.1 Structure of the submenu

Navigation Expert → System



3.2.2 "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	→ 25
Format display	→ 25
Value 1 to 4 display	→ 27
Decimal places 1 to 4	→ 27
Display interval	→ 28
Display damping	→ 28
Header	→ 28
Header text	→ 29
Separator	→ 29
Number format	→ 30
Dec. places menu	→ 30
Contrast display	→ 30
Backlight	→ 31
Access stat.disp	→ 31

Description of parameters

Navigation Expert → System → Display

Language

Navigation Expert → System → Display → Language (0104)

Description Set display language.

Selection
- English
- Deutsch *
- Français *
- Español *
- Italiano *
- Nederlands *
- Portuguesa *
- Polski *
- русский язык(Ru) *
- Svenska *
- Türkçe *
- 中文 (Chinese) *
- 日本語 (Japanese) *
- 한국어 (Korean) *
- Bahasa Indonesia *
- tiếng Việt (Vit) *
- čeština (Czech) *

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

Additional information

Read access	Operator
Write access	Operator

Format display

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

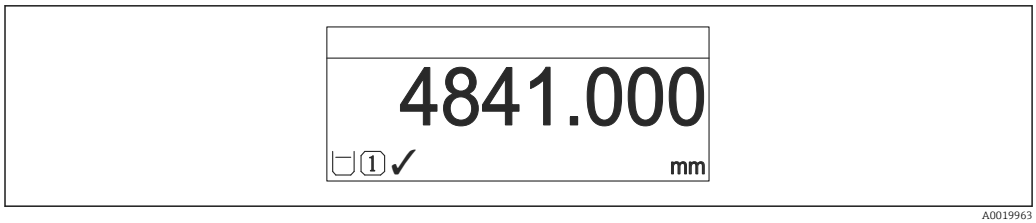
Description Select how measured val. are shown on the display.

Selection
- 1 value, max.
- Bargr. + 1 value
- 2 values
- Val. large+2val.
- 4 values

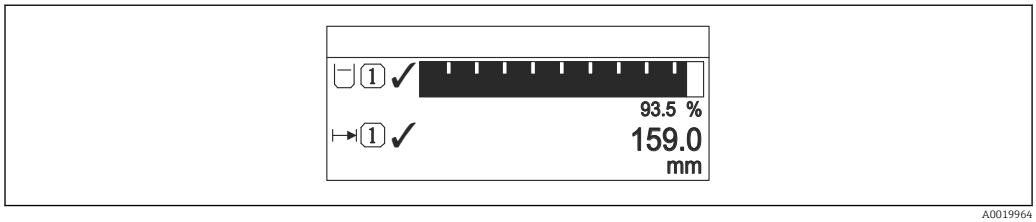
Factory setting 1 value, max.

* Visibility depends on order options or device settings

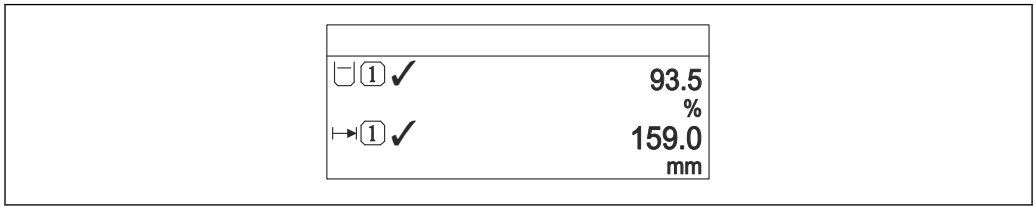
Additional information



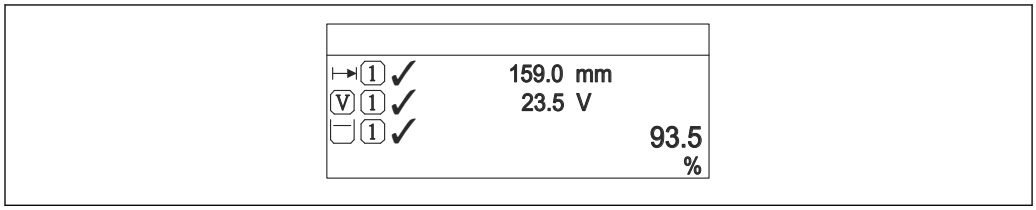
1 *"Format display" = "1 value, max."*



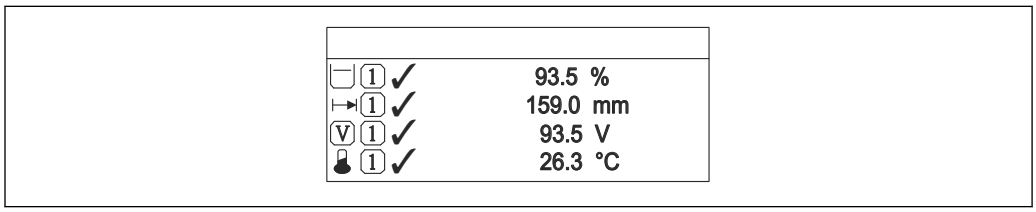
2 *"Format display" = "Bargr. + 1 value"*



3 *"Format display" = "2 values"*



4 *"Format display" = "Val. large+2val."*



5 *"Format display" = "4 values"*

- The **Value 1 to 4 display** → 27 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 (→ 28).

Read access	Operator
Write access	Operator

Value 1 to 4 display

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

Description Select measured value that is shown on the display.

Selection
- Level linearized
- Distance
- Abs. echo ampl.
- Relat.echo ampl.
- Area incoupling
- Curr.output 1
- Measur. curr.
- Curr.output 2 *
- Terminal volt.
- Electronic temp.
- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4

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

Additional information

Read access	Operator
Write access	Maintenance

Decimal places 1 to 4

Navigation Expert → System → Display → Decimal places 1 (0095)

Description This selection does not affect the measurement and calculation accuracy of the device.

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.

Read access	Operator
Write access	Maintenance

* Visibility depends on order options or device settings

Display interval

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

Description Time meas. val. are shown if displ. alternates.

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.

Read access	Operator
Write access	Operator

Display damping

Navigation Expert → System → Display → Display damping (0094)

Description Display reaction time to fluctuations of meas.val.

User entry 0.0 to 999.9 s

Factory setting 0.0 s

Additional information

Read access	Operator
Write access	Maintenance

Header

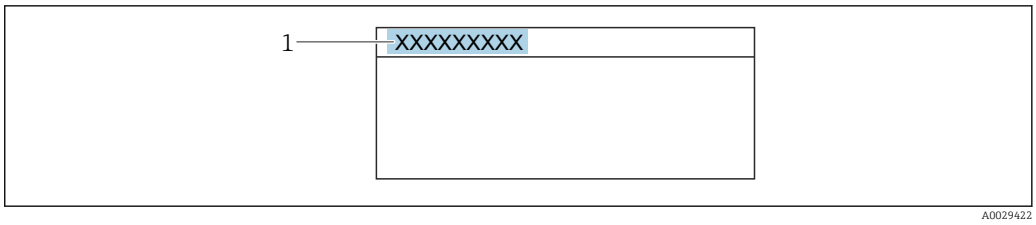
Navigation Expert → System → Display → Header (0097)

Description Select display header contents.

Selection
- Device tag
- Free text

Factory setting Device tag

Additional information



1 Position of the header text on the display

Meaning of the options

- **Device tag**
  Is defined in the **Device tag** parameter (→ 128)
- **Free text**
  Is defined in the **Header text** parameter (→ 29)

Read access	Operator
Write access	Maintenance

Header text

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

Prerequisite **Header (→ 28) = Free text**

Description Enter display header text.

Factory setting ----------

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

Read access	Operator
Write access	Maintenance

Separator

Navigation Expert → System → Display → Separator (0101)

Description Select separator for displaying numerical values.

Selection
- .
- ,

Factory setting .

Additional information

Read access	Operator
Write access	Maintenance

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.

Read access	Operator
Write access	Maintenance

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

Factory setting x.xxx

Additional information
- Is only valid for numbers in the operating menu (e.g. **Empty calibr.**, **Full calibr.**), 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** → 27 parameters.
- The setting does not affect the accuracy of the measurement or the calculations.

Read access	Operator
Write access	Maintenance

Contrast display

Navigation Expert → System → Display → Contrast display (0105)

Description Adjust display contrast setting to ambient cond.

User entry 20 to 80 %

Factory setting Dependent on the display.

Additional information

Setting the contrast via push-buttons:
- Darker: press the ⊖ E buttons simultaneously.
- Brighter: press the ⊕ E buttons simultaneously.

Read access	Operator
Write access	Operator

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
- Disable
- Enable

Factory setting Disable

Additional information

Meaning of the options
- **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.

Read access	Operator
Write access	Operator

Access stat.disp

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

Prerequisite The device has a local display.

Description Indicates access authorization to parameter.

Additional information

The access authorization can be changed via the **Ent. access code** parameter (→ 21).

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 (→ 20).

Read access	Operator
Write access	-

3.2.3 "Conf.backup disp" 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 **Config. managem.** parameter (→ 35). It provides the following options:

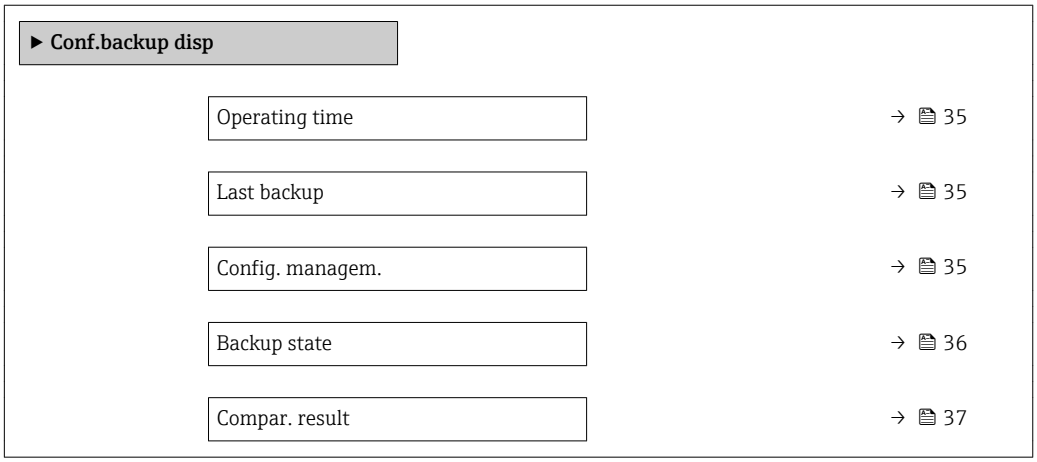
- **Execute backup**
  Saves the current device configuration in the display module.
- **Restore**
  This option can be used to restore a configuration back into the device which has previously been saved in the display module.
- **Duplicate**
  If the configuration has been saved into the display module, 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



Description of parameters

Navigation Expert → System → Conf.backup disp

Operating time

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

Description Indicates how long device has been in operation.

Additional information *Maximum time*

9 999 d (≈ 27 years)

Read access	Operator
Write access	-

Last backup

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

Description Indicates when last backup was saved to display.

Additional information

Read access	Operator
Write access	-

Config. managem.

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

Description Select action for managing the device data.

Selection

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

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:
  – HART date code
  – HART short tag
  – HART message
  – HART descriptor
  – HART address
  – Device tag
  – 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 **Compar. result** parameter (→ 37).
- **Clear backup**
  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.

Read access	Operator
Write access	Maintenance

Backup state

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

Description Displays which backup action is currently in progress.

Additional information

Read access	Operator
Write access	-

Compar. result

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

Description Comp. between present device data and disp. backup.

Additional information

Meaning of the display options

- **Set. identical**
  The current device configuration of the HistoROM is identical to the backup copy in the display module.
- **Set. not ident.**
  The current device configuration of the HistoROM is not identical to the backup copy in the display module.
- **No backup**
  There is no backup copy of the device configuration of the HistoROM in the display module.
- **Backup 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 incomp.**
  The data sets are incompatible and can not be compared.

To start the comparison, set **Config. managem. (→ 35)** = **Compare**.

If the transmitter configuration has been duplicated from a different device by **Config. managem. (→ 35)** = **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 **Set. not ident.**.

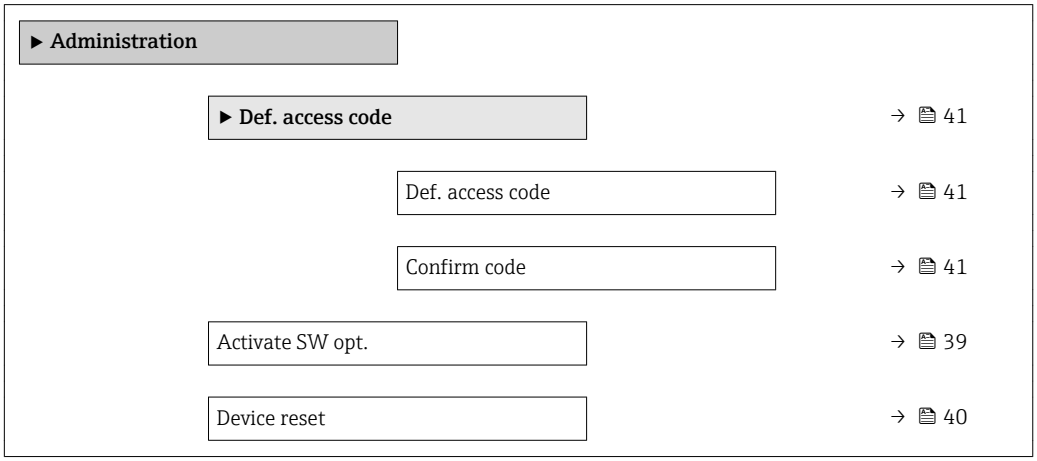
Read access	Operator
Write access	-

3.2.4 "Administration" submenu

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

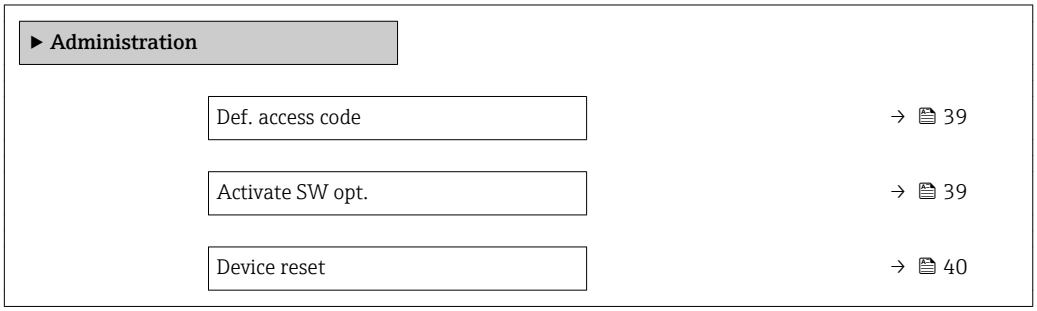
Structure of the submenu on the local display

Navigation Expert → System → Administration



Structure of the submenu in an operating tool

Navigation Expert → System → Administration



Description of parameters

Navigation Expert → System → Administration

Def. access code

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

Description Define release code for write access to parameters.

User entry 0 to 9 999

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 **Ent. access code** parameter (→ 21).

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 code** parameter (→ 41).

Read access	Operator
Write access	Maintenance

Activate SW opt.

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

Description Enter code to unlock specific software options.

User entry Positive integer

Factory setting 0

Additional information

Read access	Operator
Write access	Maintenance

Device reset

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

Description Reset device configuration to a defined state.

Selection
- Cancel
- To fact.defaults
- To delivery set.
- Of customer set.
- To transd.def.
- Restart device

Factory setting Cancel

Additional information

Meaning of the options
- **Cancel**
  No action
- **To fact.defaults**
  All parameters are reset to the order-code specific factory setting.
- **To delivery set.**
  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 set.**
  All customer parameters are reset to their factory setting. Service parameters, however, remain unchanged.
- **To transd.def.**
  Every measurment-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.

Read access	Operator
Write access	Maintenance

"Def. access code" wizard

Navigation Expert → System → Administration → Def. access code

Def. access code

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

Description → 39

Confirm code

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

Description Confirm the entered access code.

User entry 0 to 9 999

Factory setting 0

Additional information

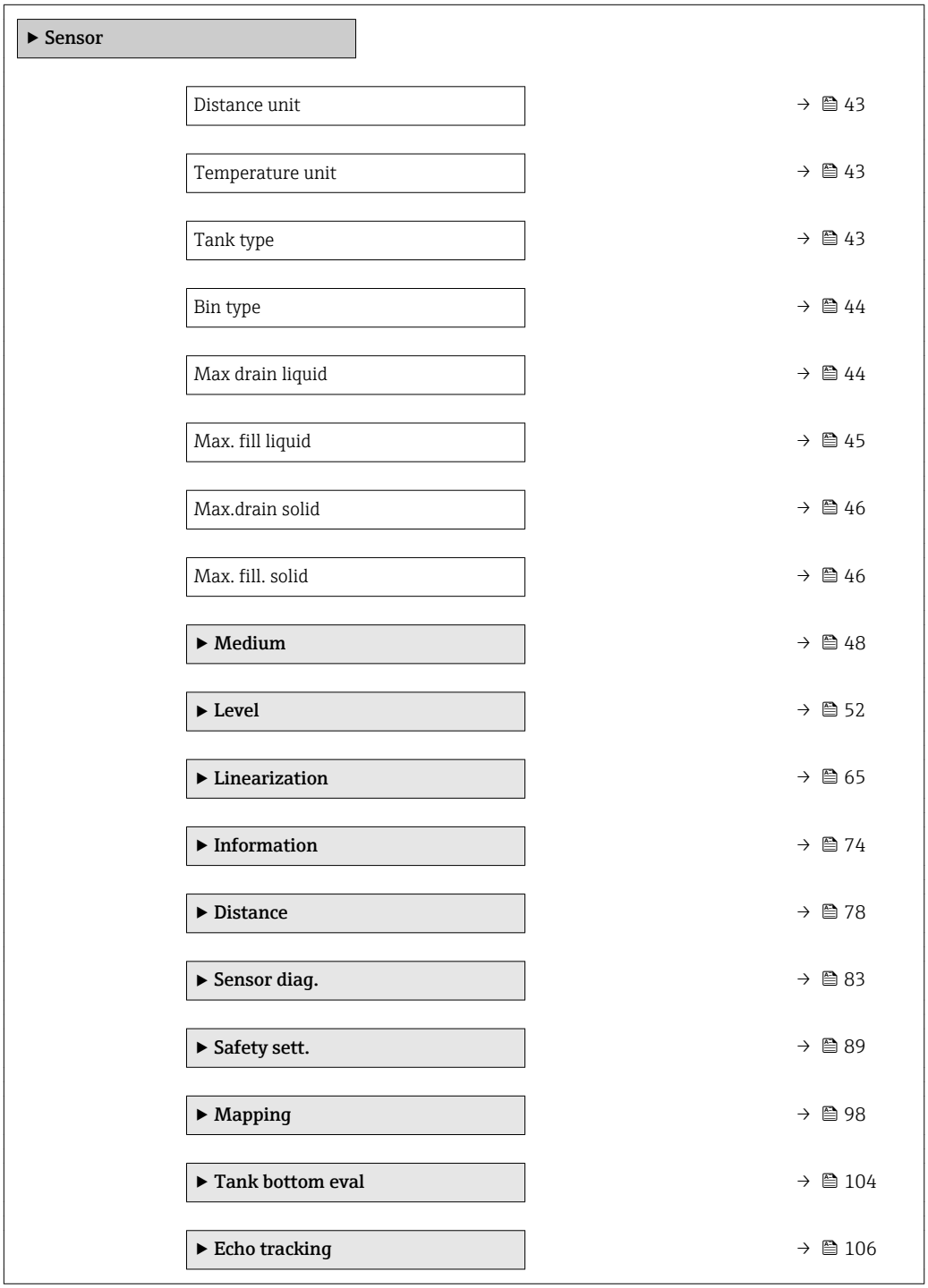
Read access	Operator
Write access	Maintenance

3.3 "Sensor" submenu

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

3.3.1 Structure of the submenu

Navigation Expert → Sensor



3.3.2 Description of parameters

Navigation Expert → Sensor

Distance unit

Navigation Expert → Sensor → Distance unit (0551)

Description Used for the basic calibration (Empty / Full).

Selection

SI units	*US units*
▪ mm	▪ ft
▪ m	▪ in

Factory setting m

Additional information

Read access	Operator
Write access	Maintenance

Temperature unit

Navigation Expert → Sensor → Temperature unit (0557)

Description Used to display the electronics temperature.

Selection

SI units	*US units*
▪ °C	▪ °F
▪ K	▪ °R

Factory setting °C

Additional information

Read access	Operator
Write access	Maintenance

Tank type

Navigation Expert → Sensor → Tank type (12519)

Prerequisite **Medium type (→ 49) = Liquid**

Description Optimizes the signal filters for the respective tank type. Note: 'Workbench test' deactivates all filters. This option should exclusively be used for tests.

Selection
- Open channel
- Sphere
- Storage vessel
- Vessel standard
- Vessel w. agitat
- Workbench test

Factory setting
Vessel standard

Additional information
Workbench test deactivates all filters. This option is intended for tests only.

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

Read access	Operator
Write access	Maintenance

Bin type

Navigation
Expert → Sensor → Bin type (12535)

Prerequisite
Medium type (→ 49) = Solid

Description
Optimizes the signal filters for the respective bin type. Note: 'Workbench test' deactivates all filters. This option should exclusively be used for tests.

Selection
- Buffer silo fast
- Bin/ Pile
- Crusher / belt
- Silo
- Workbench test

Factory setting
Silo

Additional information
Workbench test deactivates all filters. This option is intended for tests only.

Read access	Operator
Write access	Maintenance

Max drain liquid

Navigation
Expert → Sensor → Max drain liquid (12531)

Prerequisite
Tank type (→ 43) = Liquid

Description
Select expected maximum draining speed.

Selection
- Slow < 1cm /min
- Medium <10cm/min
- Standard <1m/min
- Fast < 2m /min
- Very fast > 2m/m
- No filter / test

Factory setting
Depending on the **Tank type** parameter (→ 43)

Additional information
By selecting the maximum expected filling and draining speed the signal evaluation is automatically optimized for the process.

The filling and draining speeds can be set separately as the filling and draining procedures may be different.

With the **No filter / test** option all signal evaluation filters are deactivated. This option should exclusively be used for tests.

Max drain liquid is preset by **Tank type**. It can, however, be adjusted to the process in the vessel at any time. If **Tank type** is changed again, it may be necessary to repeat the fine adjustment.

Read access	Operator
Write access	Maintenance

Max. fill liquid

Navigation
Expert → Sensor → Max. fill liquid (12532)

Prerequisite
Medium type (→ 49) = Liquid

Description
Select expected maximum filling speed.

Selection
- Slow < 1cm /min
- Medium <10cm/min
- Standard <1m/min
- Fast < 2m /min
- Very fast > 2m/m
- No filter / test

Factory setting
Depending on the **Tank type** parameter (→ 43)

Additional information
By selecting the maximum expected filling and draining speed the signal evaluation is automatically optimized for the process.

The filling and draining speeds can be set separately as the filling and draining procedures may be different.

With the **No filter / test** option all signal evaluation filters are deactivated. This option should exclusively be used for tests.

Max. fill liquid is preset by **Tank type**. It can, however, be adjusted to the process in the vessel at any time. If **Tank type** is changed again, it may be necessary to repeat the fine adjustment.

Read access	Operator
Write access	Maintenance

Max.drain solid

Navigation Expert → Sensor → Max.drain solid (12533)

Prerequisite **Medium type (→ 49) = Solid**

Description Select maximum expecte draining speed.

Selection
- Very slow<0.5m/h
- Slow < 1m /h
- Standard < 2m /h
- Medium < 4m /h
- Fast < 8m /h
- Very fast >8m/h
- No filter / test

Factory setting No filter / test

Additional information By specifying the maximum filling and draining speed the signal evaluation is automatically optimized for the process.

The filling and draining speed can be set separately as filling and draining may may be different processes.

When selecting the **No filter / test** option all filters of the signal evaluation are deactivated. This option is intended for tests only.

Read access	Operator
Write access	Maintenance

Max. fill. solid

Navigation Expert → Sensor → Max. fill. solid (12534)

Prerequisite **Medium type (→ 49) = Solid**

Description Select expected maximum filling speed.

Selection
- Very slow<0.5m/h
- Slow < 1m /h
- Standard < 2m /h
- Medium < 4m /h
- Fast < 8m /h
- Very fast >8m/h
- No filter / test

Factory setting No filter / test

Additional information

By specifying the maximum filling and draining speed the signal evaluation is automatically optimized for the process.

The filling and draining speed can be set separately as filling and draining may may be different processes.

When selecting the **No filter / test** option all filters of the signal evaluation are deactivated. This option is intended for tests only.

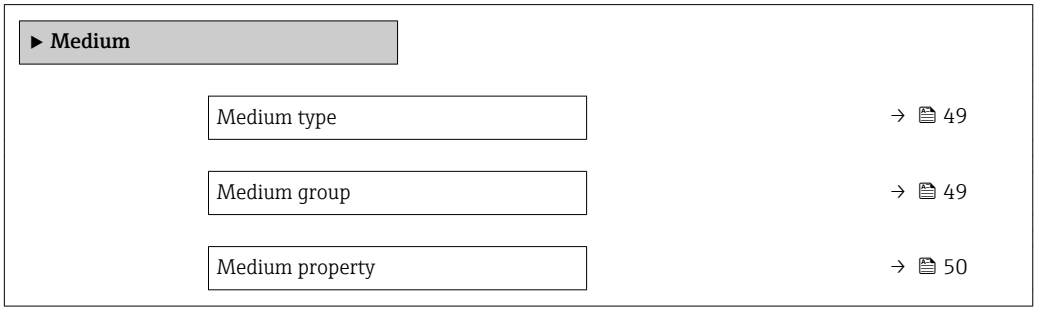
Read access	Operator
Write access	Maintenance

3.3.3 "Medium" submenu

The **Medium** submenu is used to specify the relevant properties of the measured medium.

Structure of the submenu

Navigation Expert → Sensor → Medium



Description of parameters

Navigation Expert → Sensor → Medium

Medium type

Navigation Expert → Sensor → Medium → Medium type (12527)

Description Specify medium type.

User interface
- Liquid
- Solid

Factory setting
- Liquid
- Liquid
- 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.

Read access	Operator
Write access	Service

Medium group

Navigation Expert → Sensor → Medium → Medium group (12528)

Prerequisite **Medium type (→ 49) = Liquid**

Description Select medium group.

Selection
- Others
- Water based DC>4

Factory setting Others

Additional information This parameter roughly specifies the dielectric constant (DC) of the medium. For a more detailed definition of the DC use the **Medium property** parameter (→ 50).

The **Medium group** parameter (→ 49) presets the **Medium property** parameter (→ 50) as follows:

Medium group (→ 49)	Medium property (→ 50)
Others	Unknown
Water based DC>4	DC 4 … 7

The **Medium property** parameter (→ 50) can be changed subsequently. However, when doing so, the **Medium group** parameter (→ 49) retains its value. Only the **Medium property**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.

Read access	Operator
Write access	Maintenance

Medium property

Navigation Expert → Sensor → Medium → Medium property (12529)

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 Depending on the **Medium type (→ 49)** and **Medium group (→ 49)** parameters.

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

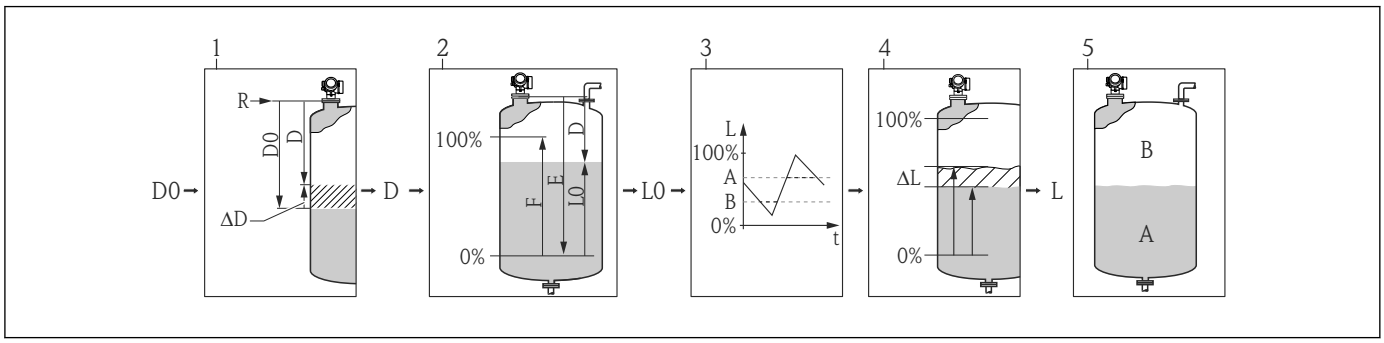
Medium type (→ 49)	Medium group (→ 49)	Medium property (→ 50)
Solid		Unknown
Liquid	Water based DC>4	DC 4 … 7
	Others	Unknown

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)

Read access	Operator
Write access	Maintenance

3.3.4 "Level" submenu

The **Level** submenu (→ 52) is used to configure the calculation of the level from the measured distance.

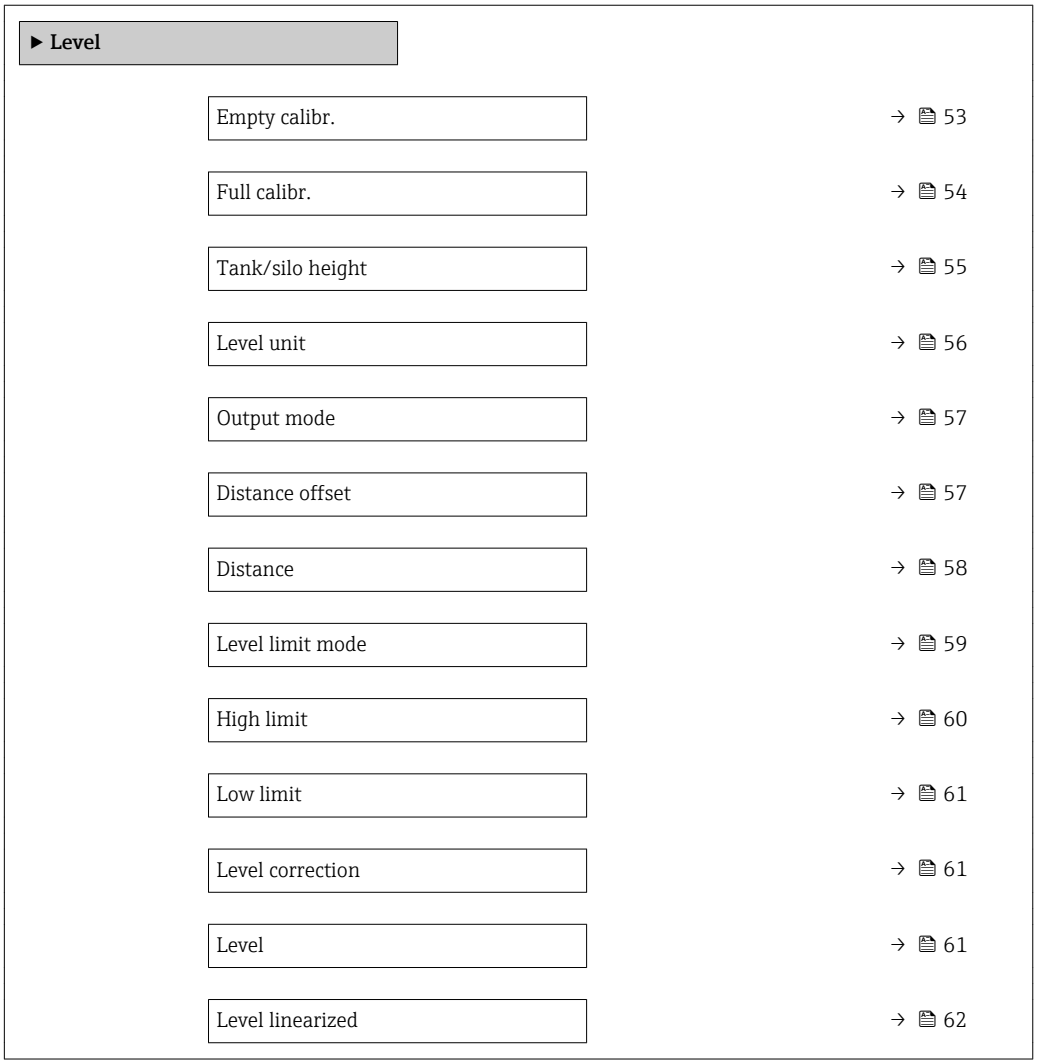


6 *Calculation of the level from the measured distance*

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



Description of parameters

Navigation Expert → Sensor → Level

Empty calibr.

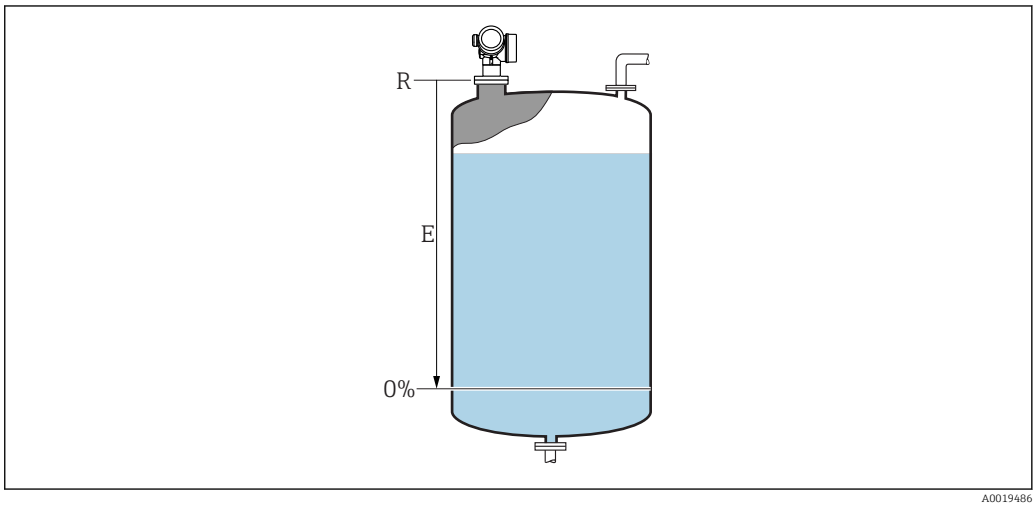
Navigation Expert → Sensor → Level → Empty calibr. (2343)

Description Distance between process connection and minimum level (0%).

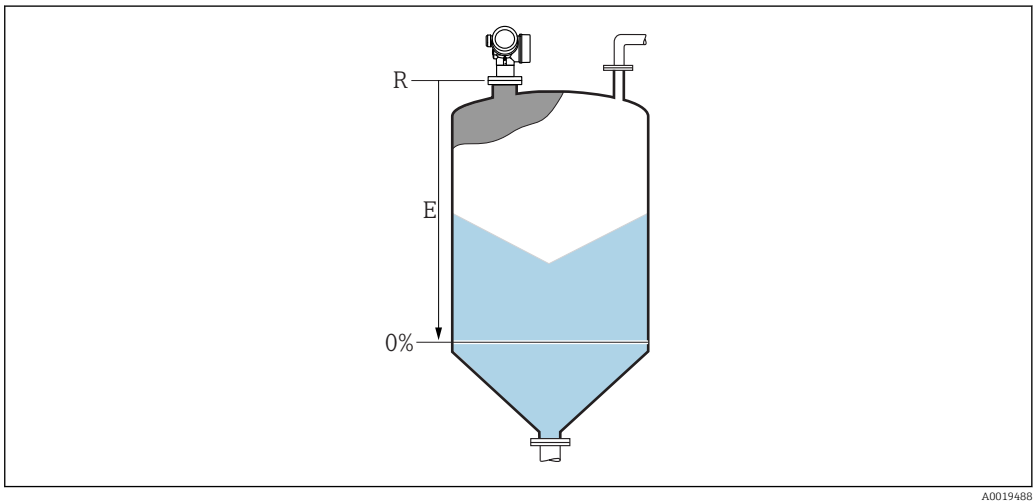
User entry Depending on the antenna

Factory setting Depending on the antenna

Additional information



7 *Empty calibr. (E) for level measurements in liquids*



8 *Empty calibr. (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.

Read access	Operator
Write access	Maintenance

Full calibr.

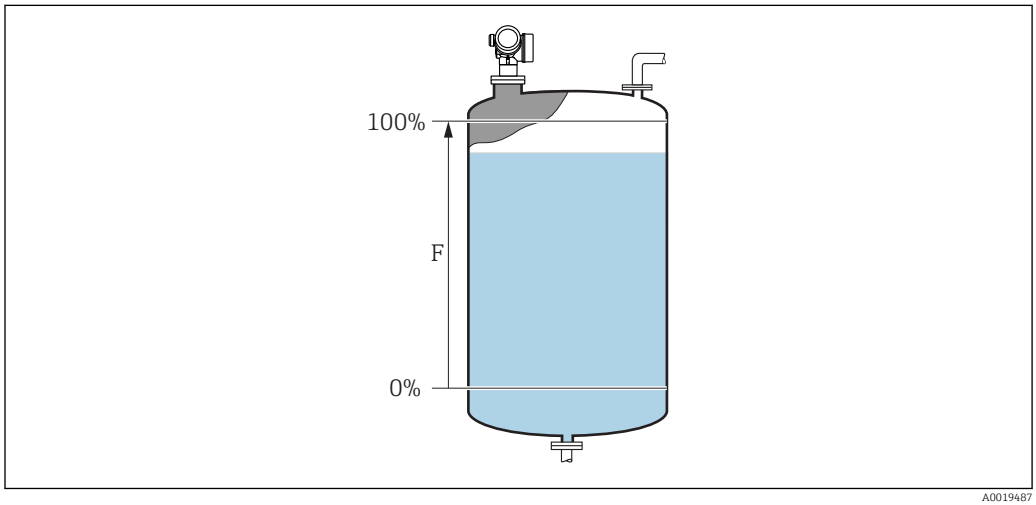
Navigation Expert → Sensor → Level → Full calibr. (2308)

Description Distance between minimum level (0%) and maximum level (100%).

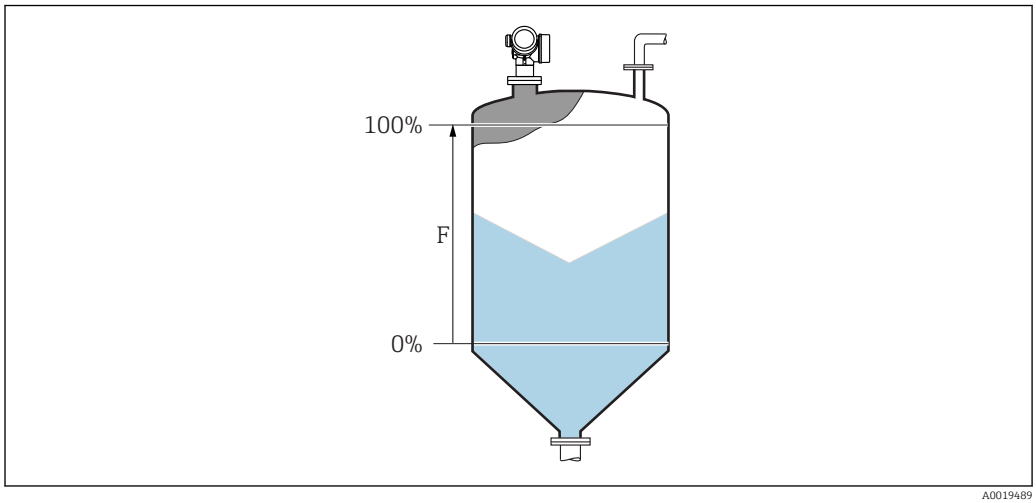
User entry Depending on the antenna

Factory setting Depending on the antenna

Additional information



9 Full calibr. (F) for level measurements in liquids



10 Full calibr. (F) for level measurements in bulk solids

Read access	Operator
Write access	Maintenance

Tank/silo height

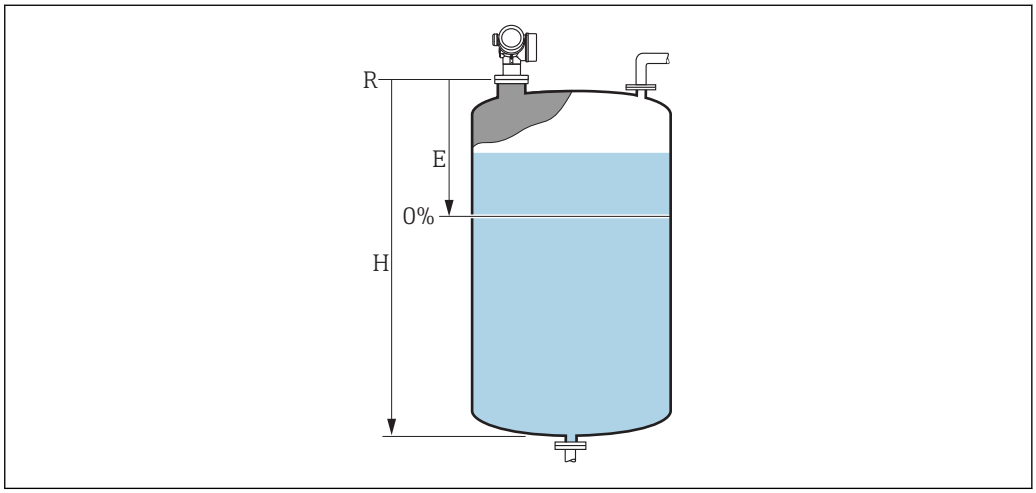
Navigation Expert → Sensor → Level → Tank/silo height (12403)

Description Total height of the tank or silo (measured from the process connection)

User entry –999.9999 to 999.9999 m

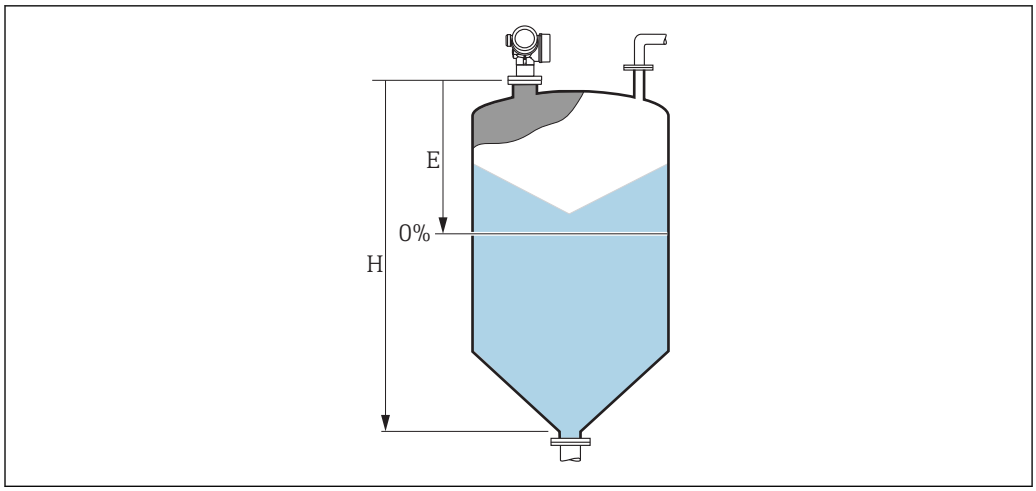
Factory setting **Empty calibration (→ 53)**

Additional information If the parametrized measuring range 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.



11 "Tank/silo height" parameter' for measurements in liquids

E Empty calibr. (→ 53)
H Tank/silo height (→ 55)



12 *"Tank/silo height" parameter' for measurements in bulk solids*

E Empty calibr. (→ 53)
H Tank/silo height (→ 55)

For tanks with conical outlet, **Tank/silo height** should not be changed as in this type of applications **Empty calibr. (→ 53)** is usually **not** much less-than the tank or silo height.

Read access	Operator
Write access	Maintenance

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 (→ 43):

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibr. (→ 53)** and **Full calibr. (→ 54)**).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

Read access	Operator
Write access	Maintenance

Output mode

Navigation Expert → Sensor → Level → Output mode (2317)

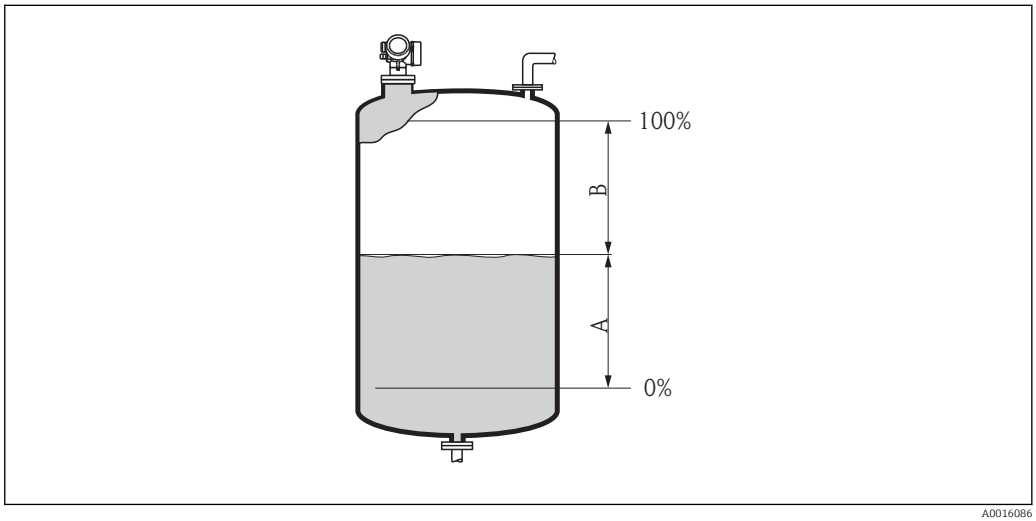
Description Select output mode.

Selection
- 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

13 Definition of the "Output mode (→ 57)" parameter

A Level linearized
B Ullage

The **Ullage** option is not available for **Linearizing type (→ 66)** = **Table**.

Read access	Operator
Write access	Maintenance

Distance offset

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

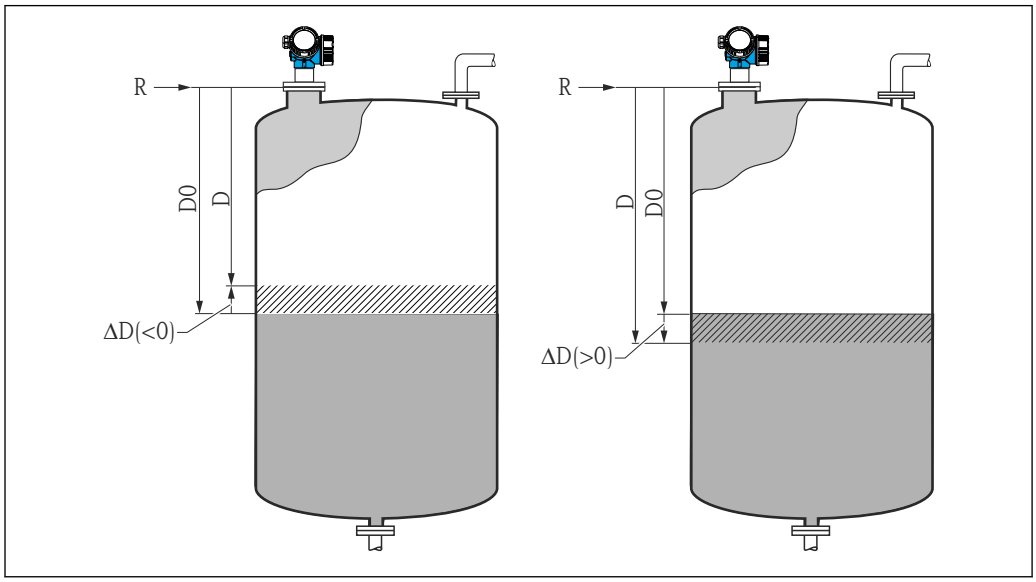
Description Specify distance offset.

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.



14 *Effect of "Distance offset (→ 57)"*

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)

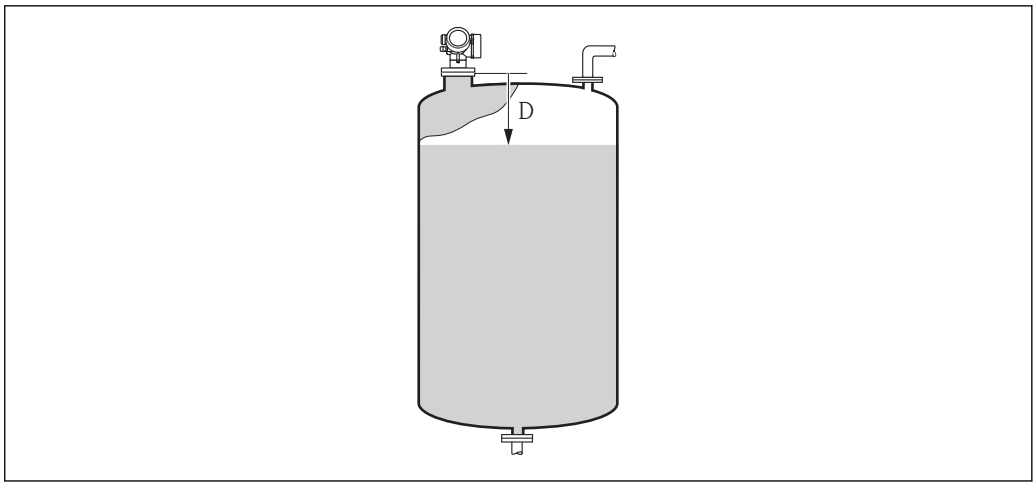
Read access	Operator
Write access	Maintenance

Distance

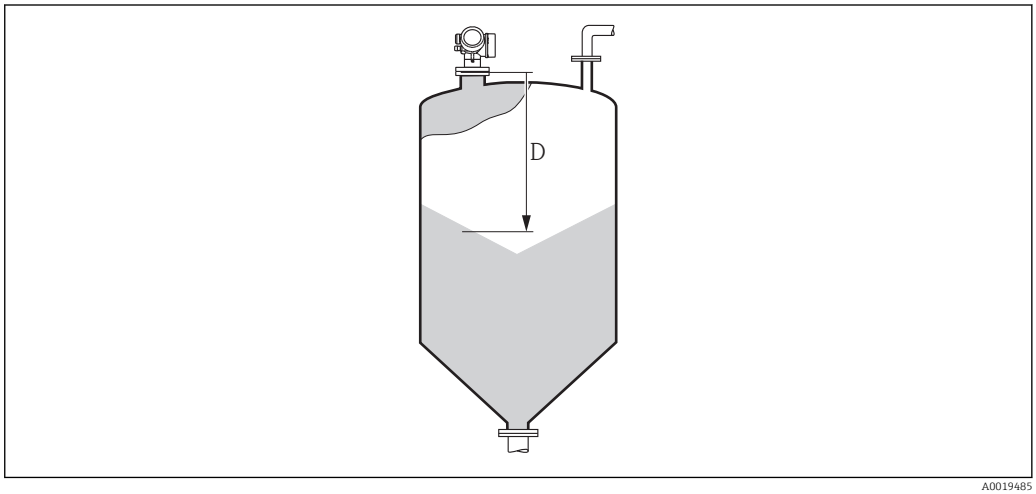
Navigation Expert → Sensor → Level → Distance (2231)

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 (→ 57) is included in the displayed value.

Additional information



15 *Distance for level measurements*



16 *Distance for bulk solid measurements*

The unit is defined by the **Distance unit** parameter (→ 43).

Read access	Operator
Write access	-

Level limit mode

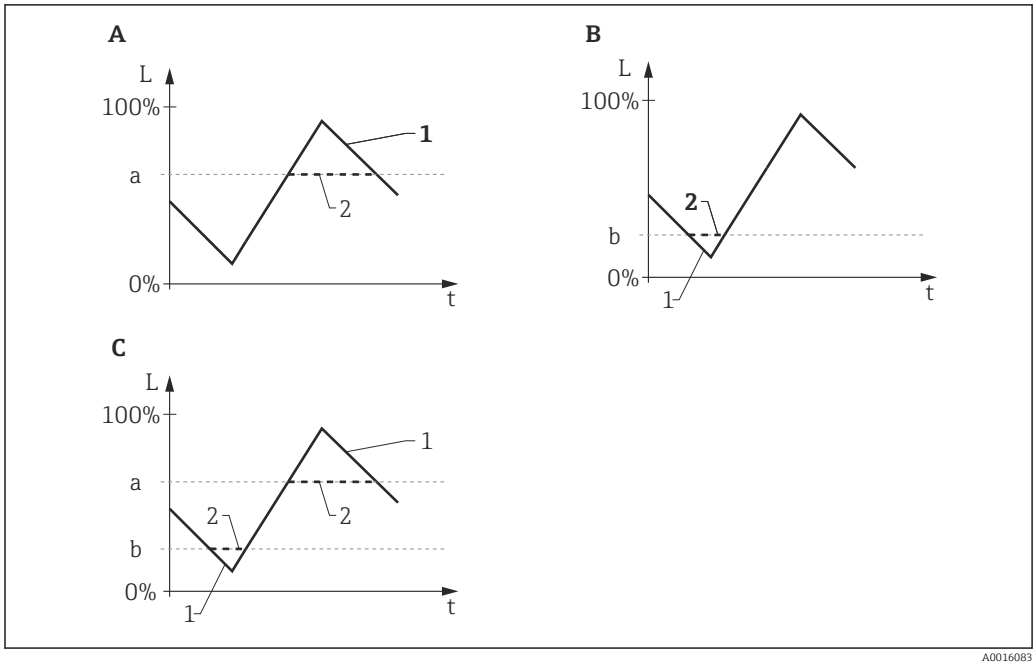
Navigation Expert → Sensor → Level → Level limit mode (2314)

Description Select the type of level limitation.

Selection
- Off
- Low limit
- High limit
- Low + 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.



17 *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 + High Limit"
a "High limit"
b "Low limit"
1 Level before limitation
2 Level after limitation

Read access	Operator
Write access	Maintenance

High limit

Navigation Expert → Sensor → Level → High limit (2312)

Prerequisite **Level limit mode (→ 59)** = **High limit** oder **Low + 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).

Read access	Operator
Write access	Maintenance

Low limit

Navigation Expert → Sensor → Level → Low limit (2313)

Prerequisite **Level limit mode (→ 59)** = **Low limit** oder **Low + 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).

Read access	Operator
Write access	Maintenance

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).

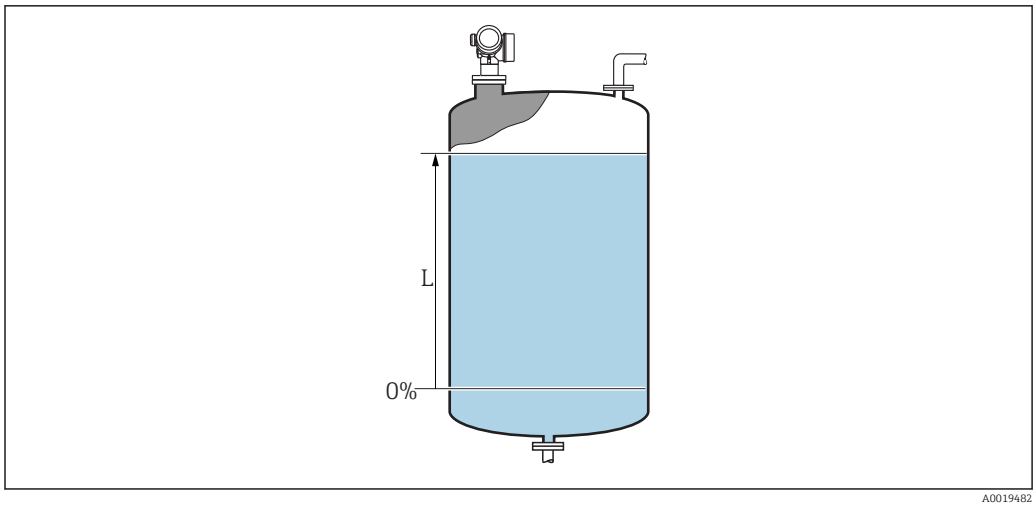
Read access	Operator
Write access	Maintenance

Level

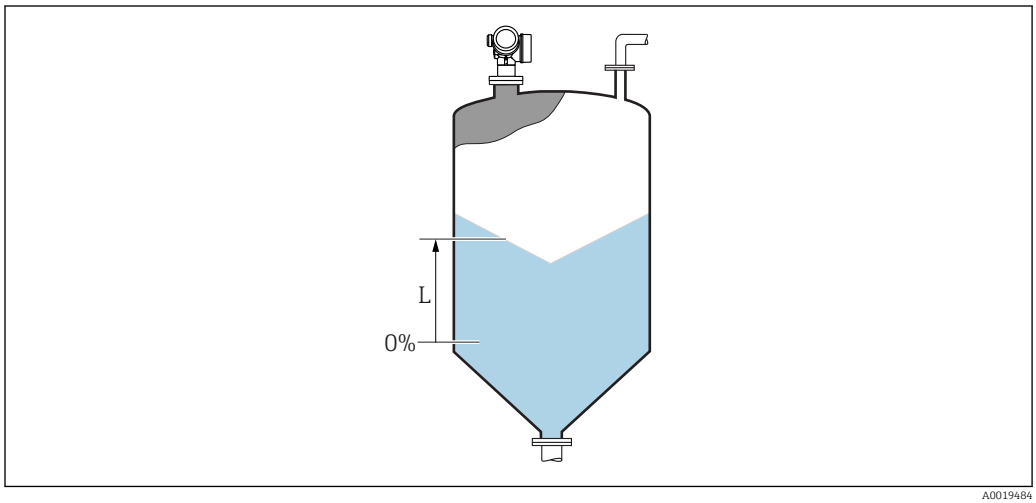
Navigation Expert → Sensor → Level → Level (2319)

Description Displays measured level L (before linearization).

Additional information



18 *Level in case of liquid measurements*



19 *Level in case of bulk solid measurements*

The unit is defined in the **Level unit** parameter (→ 56).

Read access	Operator
Write access	-

Level linearized

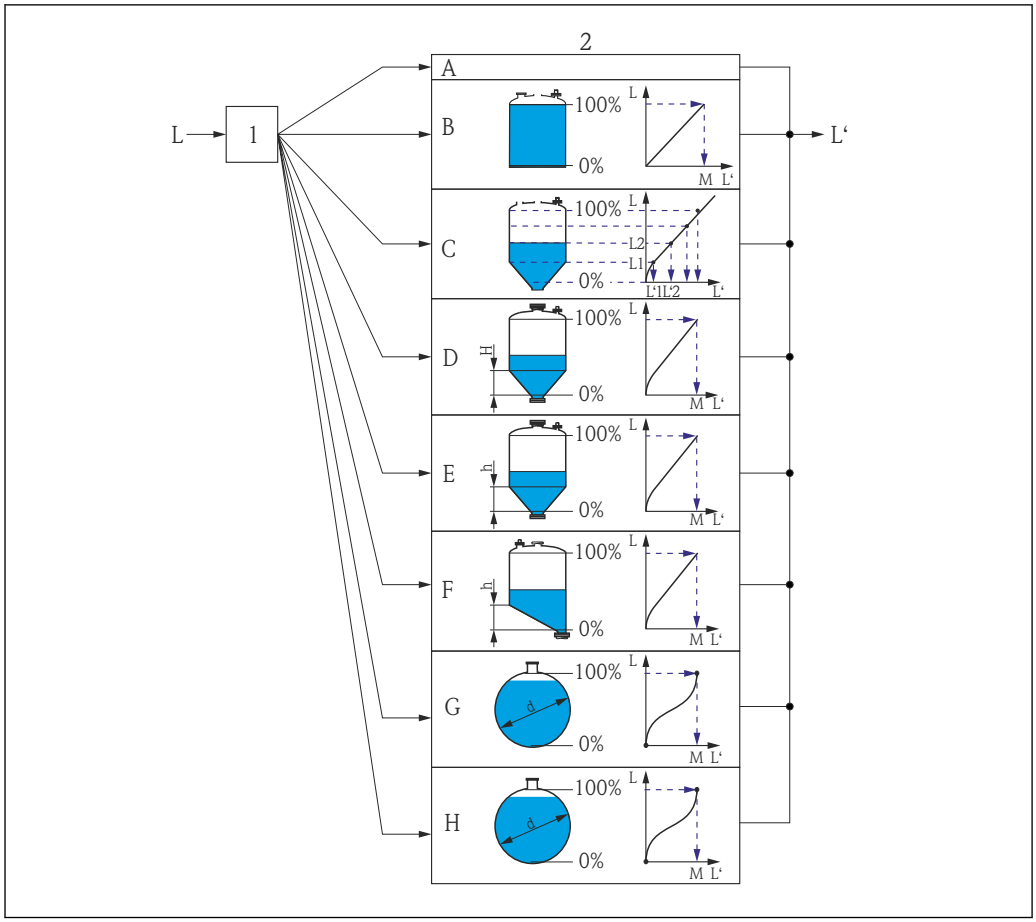
Navigation Expert → Sensor → Level → Level linearized (2318)

Description Displays linearized level.

Additional information The unit is defined by the **Unit lineariz.** parameter → 68.

Read access	Operator
Write access	-

3.3.5 "Linearization" submenu

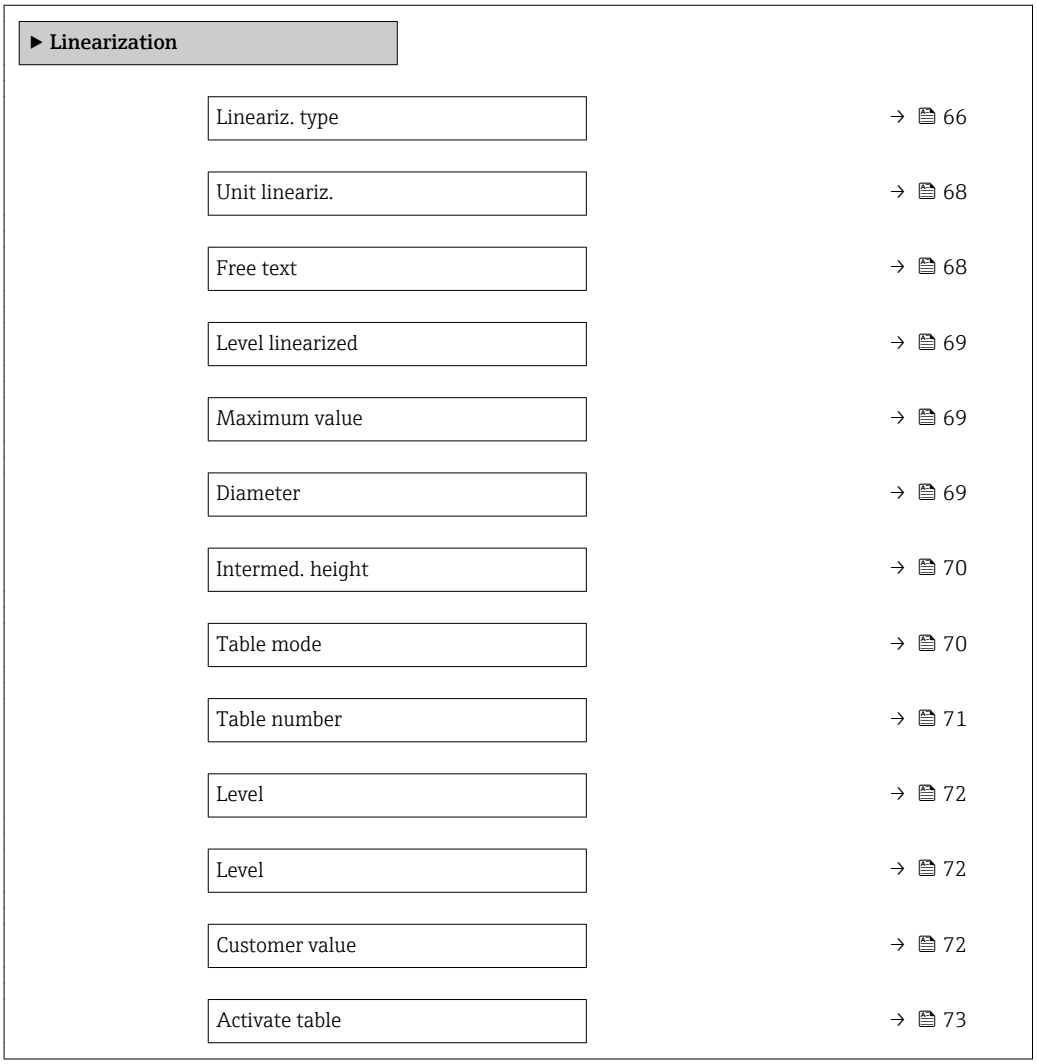


20 *Linearization: Transformation of the level into a volume or weight; the transformation is dependent on the shape of the vessel.*

1 Selection of linearization type and unit
2 Configuration of the linearization
A Lineariz. type (→ 66) = None
B Lineariz. type (→ 66) = Linear
C Lineariz. type (→ 66) = Table
D Lineariz. type (→ 66) = Pyramid bottom
E Lineariz. type (→ 66) = Conical bottom
F Lineariz. type (→ 66) = Angled bottom
G Lineariz. type (→ 66) = Horizontal cyl.
H Lineariz. type (→ 66) = Sphere
L Level before linearization (measured in distance units)
L' Level linearized (→ 62) (corresponds to volume or weight)
M Maximum value (→ 69)
d Diameter (→ 69)
h Intermed. height (→ 70)

Structure of the submenu

Navigation Expert → Sensor → Linearization



Description of parameters

Navigation Expert → Sensor → Linearization

Lineariz. type

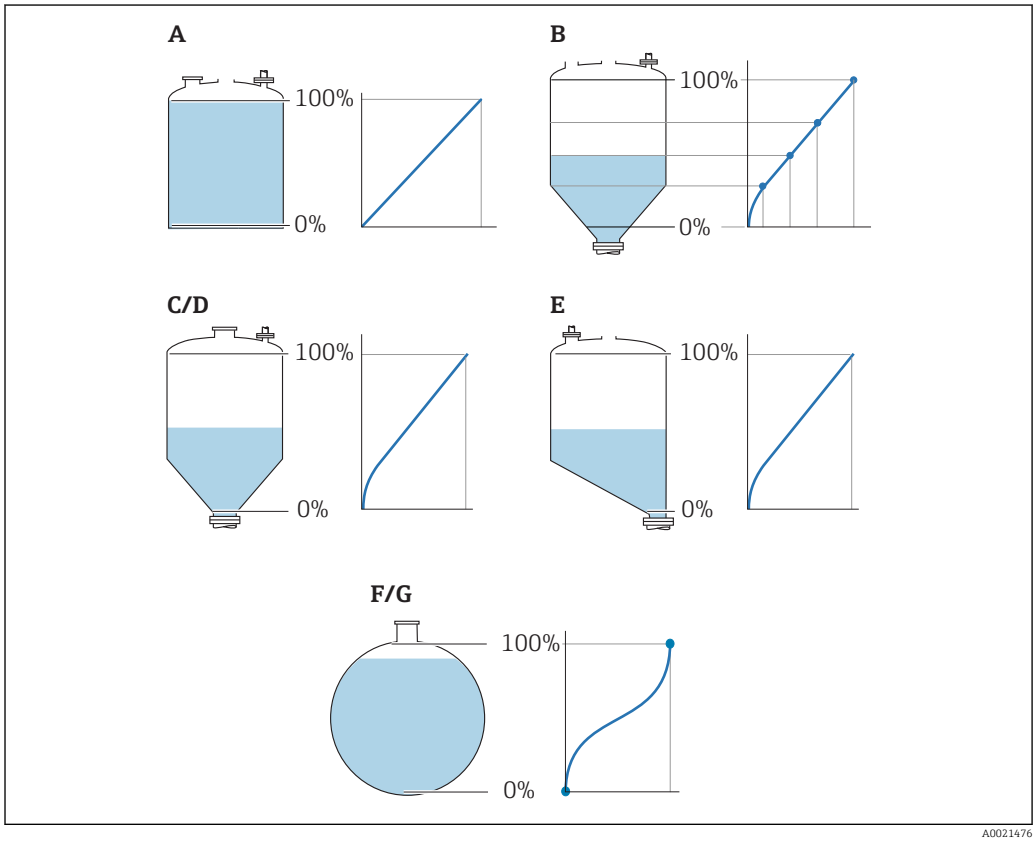
Navigation Expert → Sensor → Linearization → Lineariz. type (2339)

Description Select linearization type.

Selection
- None
- Linear
- Table
- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cyl.
- Sphere

Factory setting None

Additional information



21 Linearization types

A None
B Table
C Pyramid bottom
D Conical bottom
E Angled bottom
F Sphere
G Horizontal cyl.

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 lineariz. (→ 68)**
  – **Maximum value (→ 69)**: 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 lineariz. (→ 68)**
  – **Table mode (→ 70)**
  – For each table point: **Level (→ 72)**
  – For each table point: **Customer value (→ 72)**
  – **Activate table (→ 73)**
- **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 lineariz. (→ 68)**
  – **Maximum value (→ 69)**: Maximum volume or weight
  – **Intermed. height (→ 70)**: 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 lineariz. (→ 68)**
  – **Maximum value (→ 69)**: Maximum volume or weight
  – **Intermed. height (→ 70)**: 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 lineariz. (→ 68)**
  – **Maximum value (→ 69)**: Maximum volume or weight
  – **Intermed. height (→ 70)**: Height of the angled bottom
- **Horizontal cyl.**
  The output value corresponds to the volume or weight in a horizontal cylinder. The following additional parameters have to be specified:
  – **Unit lineariz. (→ 68)**
  – **Maximum value (→ 69)**: Maximum volume or weight
  – **Diameter (→ 69)**
- **Sphere**
  The output value corresponds to the volume or weight in a spherical tank. The following additional parameters have to be specified:
  – **Unit lineariz. (→ 68)**
  – **Maximum value (→ 69)**: Maximum volume or weight
  – **Diameter (→ 69)**

Read access	Operator
Write access	Maintenance

Unit lineariz.

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

Prerequisite **Lineariz. type (→ 66)** ≠ None

Description Select unit of the lineaized value.

Selection

SI units
- STon
- t
- kg
- cm^3
- dm^3
- m^3
- hl
- l
- %
- mm
- m

US units
- lb
- UsGal
- ft^3
- ft
- in

Imperial units
impGal

Custom-specific units
Free text

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 lineariz.** parameter and enter the required unit into the **Free text** parameter (→ 68).

Read access	Operator
Write access	Maintenance

Free text

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

Prerequisite **Unit lineariz. (→ 68)** = **Free text**

Description Enter unit symbol.

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

Factory setting Free text

Additional information

Read access	Operator
Write access	Maintenance

Level linearized

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

Description Displays linearized level.

Additional information The unit is defined by the **Unit linearize.** parameter → 68.

Read access	Operator
Write access	-

Maximum value

Navigation Expert → Sensor → Linearization → Maximum value (2315)

Prerequisite **Linearize. type (→ 66)** has one of the following values:
- Linear
- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cyl.
- Sphere

Description Linearized value corresponding to a level of 100%.

User entry −50 000.0 to 50 000.0 %

Factory setting 100.0 %

Additional information

Read access	Operator
Write access	Maintenance

Diameter

Navigation Expert → Sensor → Linearization → Diameter (2342)

Prerequisite **Linearize. type (→ 66)** has one of the following values:
- Horizontal cyl.
- Sphere

Description Diameter of the cylindrical or spherical tank.

User entry 0 to 9 999.999 m

Factory setting 2 m

Additional information The unit is defined in the **Distance unit** parameter (→ 43).

Read access	Operator
Write access	Maintenance

Intermed. height

Navigation Expert → Sensor → Linearization → Intermed. height (2310)

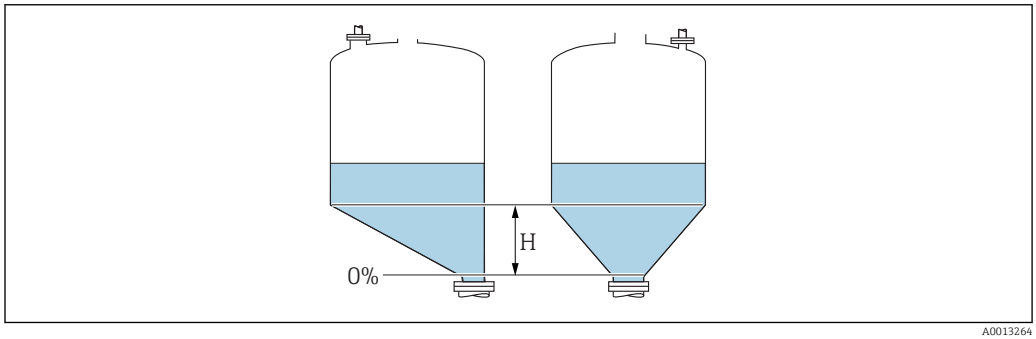
Prerequisite **Lineariz. type (→ 66)** has one of the following values:
- Pyramid bottom
- Conical bottom
- Angled bottom

Description Height of the pyramid, conical or angled bottom.

User entry 0 to 200 m

Factory setting 0 m

Additional information



H Intermediate height

The unit is defined in the **Distance unit** parameter (→ 43).

Read access	Operator
Write access	Maintenance

Table mode

Navigation Expert → Sensor → Linearization → Table mode (2303)

Prerequisite **Lineariz. type (→ 66)** = **Table**

Description Select editing mode of the linearization table.

Selection
- Manual
- Semiautomatic
- 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 linerization points into an ascending order.

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 calibr. (→ 53)** and **Full calibr. (→ 54)** 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 (→ 70)** = **Clear table**). Then enter a new table.

How to enter the table
- Via FieldCare
  The table points can be entered via the **Table number (→ 71)**, **Level (→ 72)** and **Customer value (→ 72)** 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 (→ 56) beforehand.

If a decreasing table is entered, the values for 20 mA and 4 mA of the current output are interchanged. That means: 20 mA refers to the lowest level, whereas 4 mA refers to the highest level. If required, the current output can be inverted in the **Measuring mode** parameter (→ 115).

Read access	Operator
Write access	Maintenance

Table number

Navigation Expert → Sensor → Linearization → Table number (2370)

Prerequisite **Lineariz. type (→ 66)** = **Table**

Description Select table point you are going to enter or change.

User entry 1 to 32

Factory setting 1

Additional information

Read access	Operator
Write access	Maintenance

Level (Manual)

Navigation Expert → Sensor → Linearization → Level (2383)

Prerequisite
- **Lineariz. type (→ 66)** = Table
- **Table mode (→ 70)** = Manual

Description Enter level value of the table point (value before linearization).

User entry Signed floating-point number

Factory setting 0 %

Additional information

Read access	Operator
Write access	Maintenance

Level (Semiautomatic)

Navigation Expert → Sensor → Linearization → Level (2389)

Prerequisite
- **Lineariz. type (→ 66)** = **Table**
- **Table mode (→ 70)** = **Semiautomatic**

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

Additional information

Read access	Operator
Write access	Maintenance

Customer value

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

Prerequisite **Lineariz. type (→ 66)** = **Table**

Description Enter linearized value for the table point.

User entry Signed floating-point number

Factory setting 0 %

Additional information

Read access	Operator
Write access	Maintenance

Activate table

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

Prerequisite **Lineariz. type (→ 66)** = **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 **Lineariz. type (→ 66)** = **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.

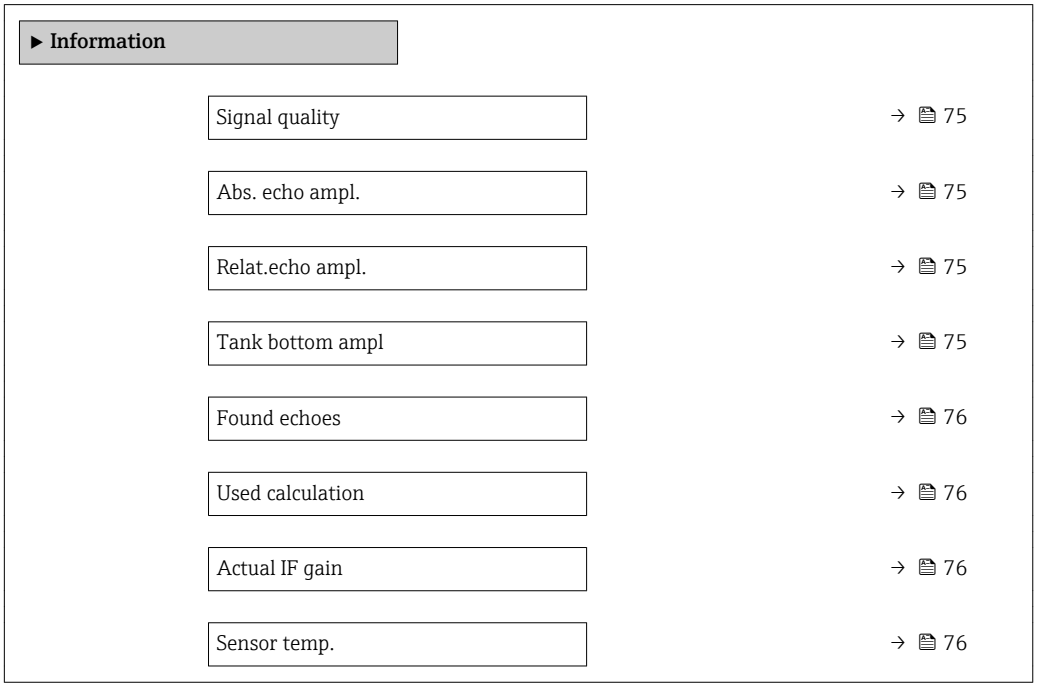
Read access	Operator
Write access	Maintenance

3.3.6 "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



Description of parameters

Navigation Expert → Sensor → Information

Signal quality

Navigation Expert → Sensor → Information → Signal quality (12477)

Description Shows the quality of the evaluated level signal.

Abs. echo ampl.

Navigation Expert → Sensor → Information → Abs. echo ampl. (12457)

Description Absolute amplitude of the evaluated level signal.

Additional information

Read access	Operator
Write access	-

Relat.echo ampl.

Navigation Expert → Sensor → Information → Relat.echo ampl. (12468)

Description Relative amplitude of the evaluated level signal.

Additional information In the envelope curve display of FieldCare, the absolute echo amplitude is indicated instead of the relative amplitude.

Read access	Operator
Write access	-

Tank bottom ampl

Navigation Expert → Sensor → Information → Tank bottom ampl (12467)

Description Displays the absolute amplitude of the end-of-probe signal in the subtracted curve.

Additional information The tank bottom echo is only evaluated for media with a small dielectric contant (DC).

Read access	Operator
Write access	-

Found echoes

Navigation Expert → Sensor → Information → Found echoes (12492)

Description Indicates which echoes have been found.

Additional information

Read access	Operator
Write access	-

Used calculation

Navigation Expert → Sensor → Information → Used calculation (12488)

Description Indicates which signal is used for the level calculation.

Additional information

Read access	Operator
Write access	

Actual IF gain

Navigation Expert → Sensor → Information → Actual IF gain (12540)

Description Indicates the current gain of the intermediate frequency.

Additional information

Read access	Operator
Write access	-

Sensor temp.

Navigation Expert → Sensor → Information → Sensor temp. (12499)

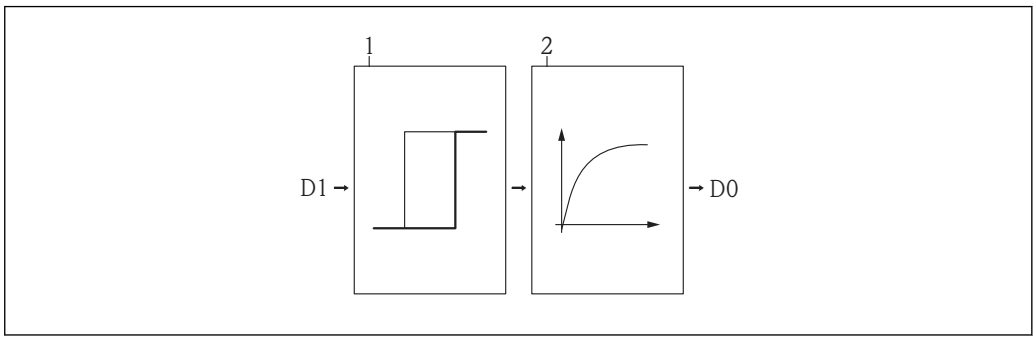
Description Indicates the current sensor temperature.

Additional information

Read access	Operator
Write access	-

3.3.7 "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.

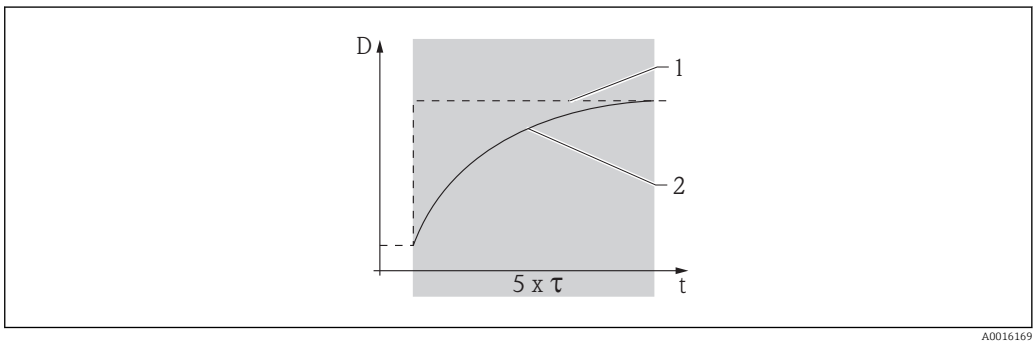


22 *The configurable distance filters*

1 Dead time
2 Integration time (low pass filter)

Low pass filter

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

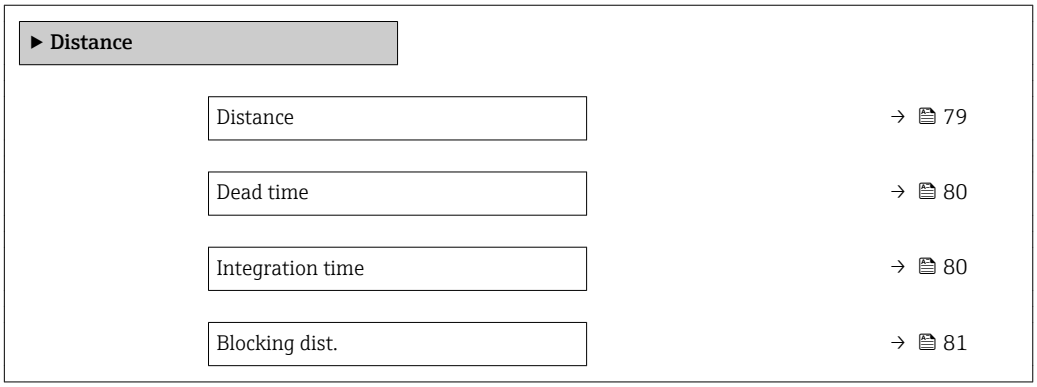


23 *Low pass filter*

1 Signal before the low pass filter
2 Signal after the low pass filter
τ Integration time

Structure of the submenu

Navigation Expert → Sensor → Distance



Description of parameters

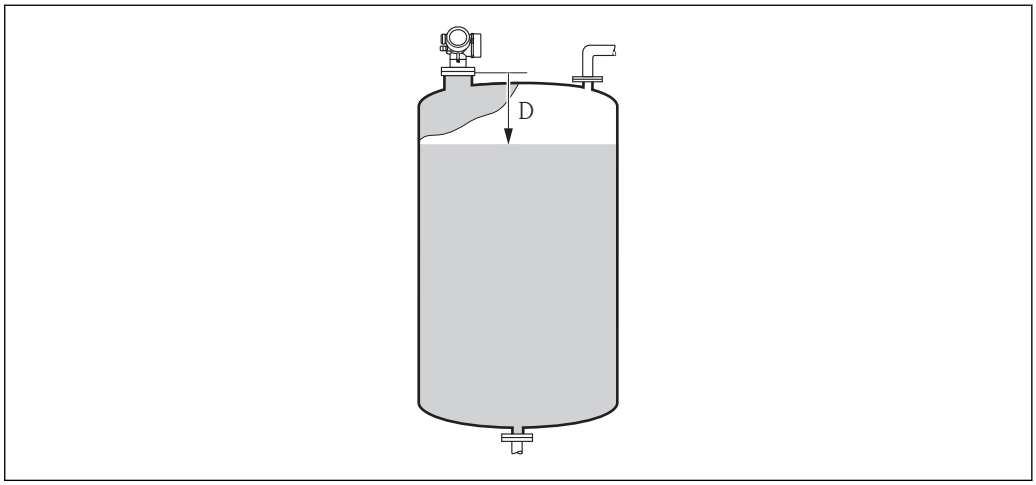
Navigation Expert → Sensor → Distance

Distance

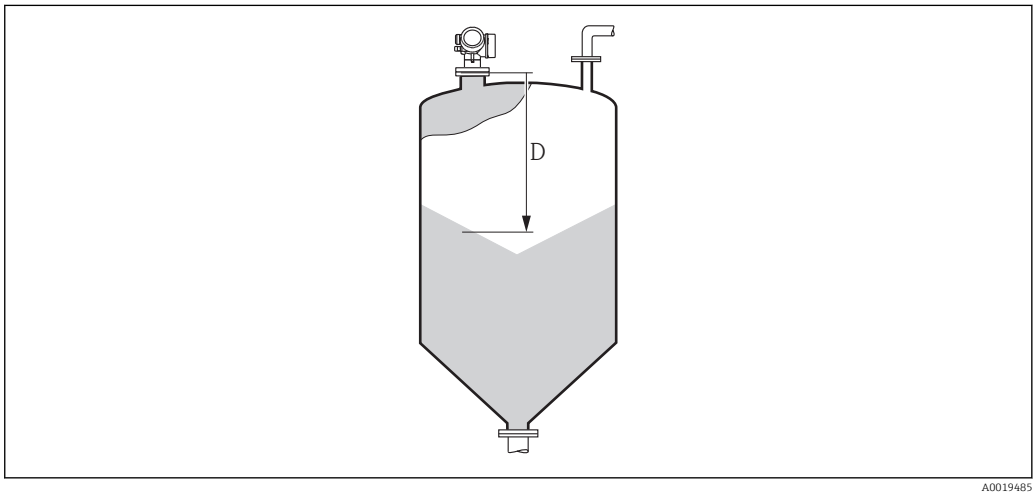
Navigation Expert → Sensor → Distance → Distance (12401)

Description Distance between lower edge of flange or thread and medium surface.

Additional information



24 *Distance for liquid measurements*



25 *Distance for bulk solid measurements*

Read access	Operator
Write access	-

Dead time

Navigation Expert → Sensor → Distance → Dead time (12521)

Description Dead time in seconds

Additional information

Read access	Maintenance
Write access	Service

Integration time

Navigation Expert → Sensor → Distance → Integration time (12489)

Description Integration time for the low pass filter

User entry 0.0 to 200 000.0 s

Factory setting **Dependent on the following parameters:**
- **Medium type**
- **Max. filling speed liquid** or **Max. filling speed solid**
- **Max. draining speed liquid** or **Max. draining speed solid**

Additional information *Factory settings for "Medium type" = "Liquid"*

Max. fill liquid	Max drain liquid					
	Slow < 1cm /min	Medium <10cm/min	Standard <1m/min	Fast < 2m /min	Very fast > 2m/m	No filter / test
Slow < 1cm /min	30 s	15 s	5 s	1 s	0 s	0 s
Medium <10cm/min	15 s	15 s	5 s	1 s	0 s	0 s
Standard <1m/min	5 s	5 s	5 s	1 s	0 s	0 s
Fast < 2m /min	1 s	1 s	1 s	1 s	0 s	0 s
Very fast > 2m/m	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 settings for "Medium type" = "Solid"

Max. fill. solid	Max.drain solid						
	Very slow<0.5m/h	Slow < 1m /h	Standard < 2m /h	Medium < 4m /h	Fast < 8m /h	Very fast >8m/h	No filter / test
Very slow<0.5m/h	250 s	200 s	200 s	100 s	50 s	1 s	0 s
Slow < 1m /h	200 s	200 s	200 s	100 s	50 s	1 s	0 s
Standard < 2m /h	200 s	200 s	100 s	100 s	50 s	1 s	0 s
Medium < 4m /h	100 s	100 s	100 s	50 s	50 s	1 s	0 s
Fast < 8m /h	50 s	50 s	50 s	50 s	20 s	1 s	0 s
Very fast >8m/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

Read access	Operator
Write access	Maintenance

Blocking dist.

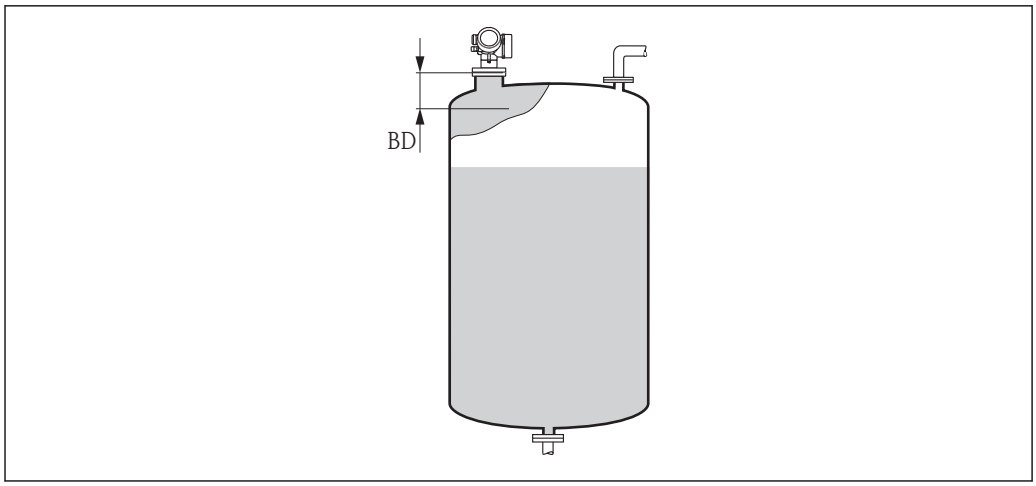
Navigation Expert → Sensor → Distance → Blocking dist. (12424)

Description Dead band in front of the process connection.

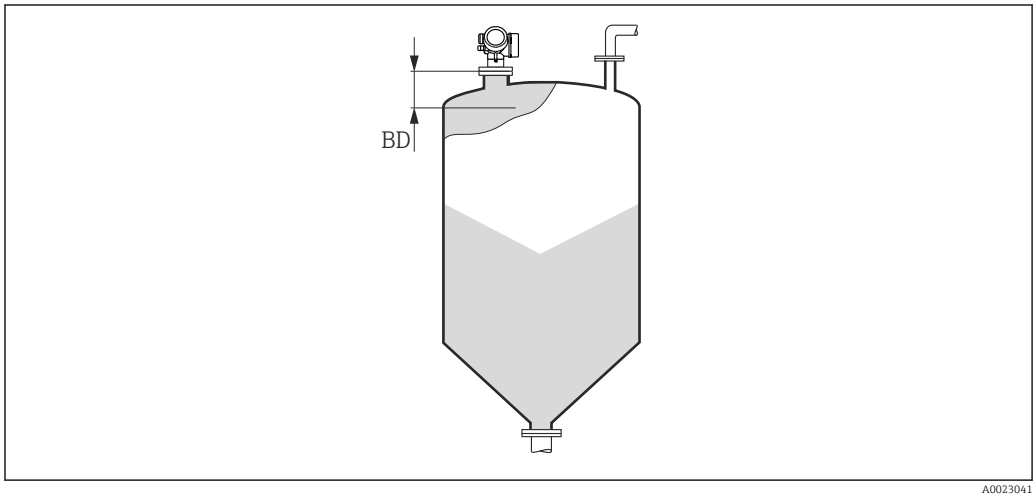
User entry 0 to 200 m

Factory setting
- **Empty calibration** - **Full calibration** - 200 mm (8 in)
- Minimum value: 150 mm (6 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.



26 Blocking distance (BD) for liquid measurements



27 Blocking distance (BD) for bulk solid measurements

Read access	Operator
Write access	Maintenance

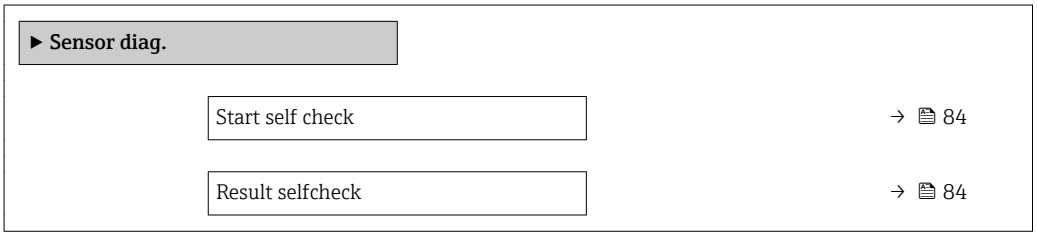
3.3.8 "Sensor diag." submenu

The **Sensor diag.** submenu is used for the proof-test which is required for SIL applications in regular intervals. For details refer to the Functional Safety Manual of the respective device.

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 selfcheck** parameter.

Structure of the submenu

Navigation Expert → Sensor → Sensor diag.



Description of parameters

Navigation Expert → Sensor → Sensor diag.

Start self check

Navigation Expert → Sensor → Sensor diag. → Start self check (12496)

Description The **Yes** option starts a self check.

Selection
- No
- Yes

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

Result selfcheck

Navigation Expert → Sensor → Sensor diag. → Result selfcheck (12497)

Description Shows the result of the self check.

Additional information

Read access	Operator
Write access	-

3.3.9 "Safety sett." submenu

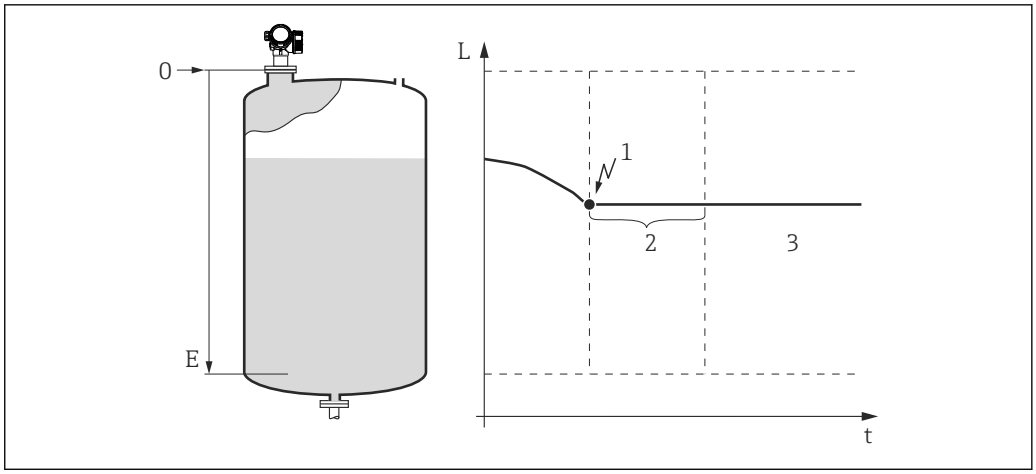
The **Safety sett.** submenu contains all parameters which determnine the behavior of the device in critical situations such as an echo loss or an undershooting of a user defined safety distance.

Behavior in the case of an echo loss

The bahavior in case of an echo loss is defined in the **Output echo lost** parameter (→ 🖹 90). Depending on the selected option, suitable values must be selected in a number of additional parameters:

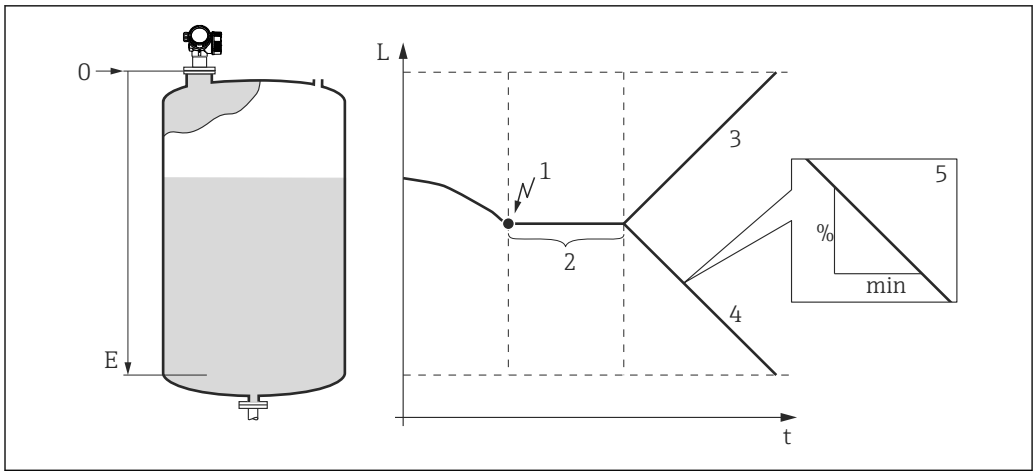
Option selected in "Output echo lost (→ 🖹 90)"	Required additional parameters
Last valid value	Delay echo lost (→ 🖹 92)
Ramp echo lost	▪ Ramp echo lost (→ 🖹 91) ▪ Delay echo lost (→ 🖹 92)
Value echo lost	▪ Value echo lost (→ 🖹 90) ▪ Delay echo lost (→ 🖹 92)
Alarm	1)

1) The alarm bahavior ist defined in the submenus "Curr.output" (HART) or "Analog input" (PROFIBUS PA, FOUNDATION Fieldbus).



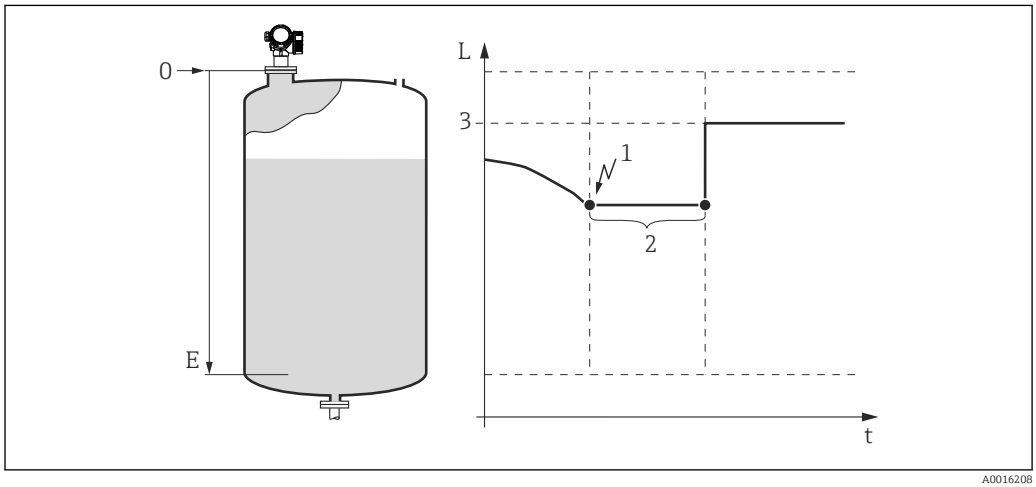
28 "Output echo lost (→ 🖹 90)" = "Last valid value"

1 Echo loss
2 Delay echo lost (→ 🖹 92)
3 The last valid measured value is held.



29 "Output echo lost (→ 90)" = "Ramp echo lost"

1 *Echo loss*
2 *"Delay echo lost (→ 92)"*
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".*

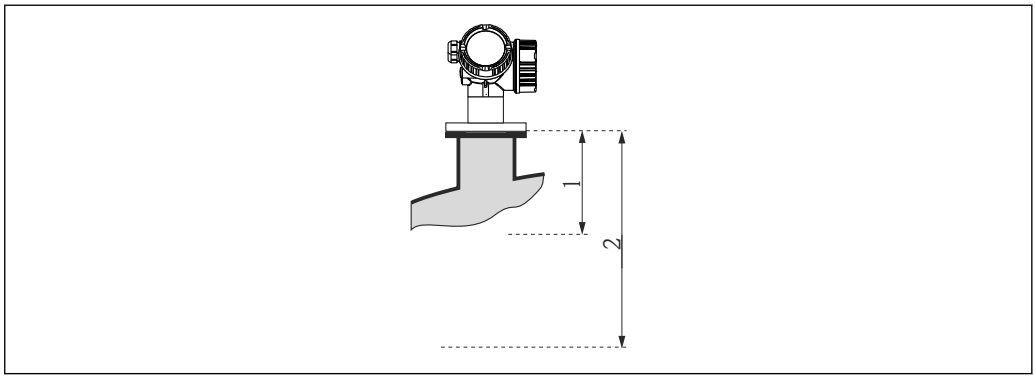


30 "Output echo lost (→ 90)" = "Value echo lost"

1 *Echo loss*
2 *Delay echo lost (→ 92)*
3 *Value echo lost (→ 90)*

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 (→ 92).



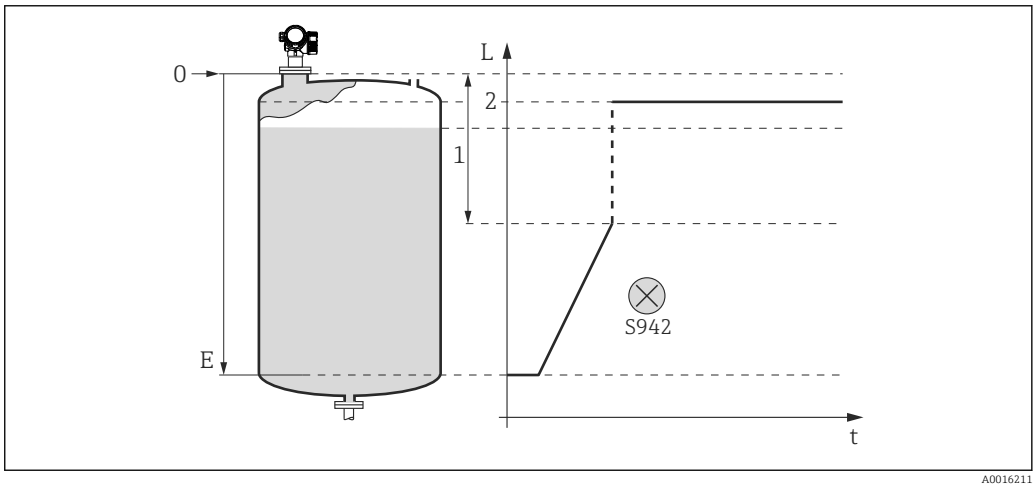
A0016210

31 *Definition of the safety distance*

1 *Blocking dist. (→ 81)*
2 *Safety distance (→ 92)*

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

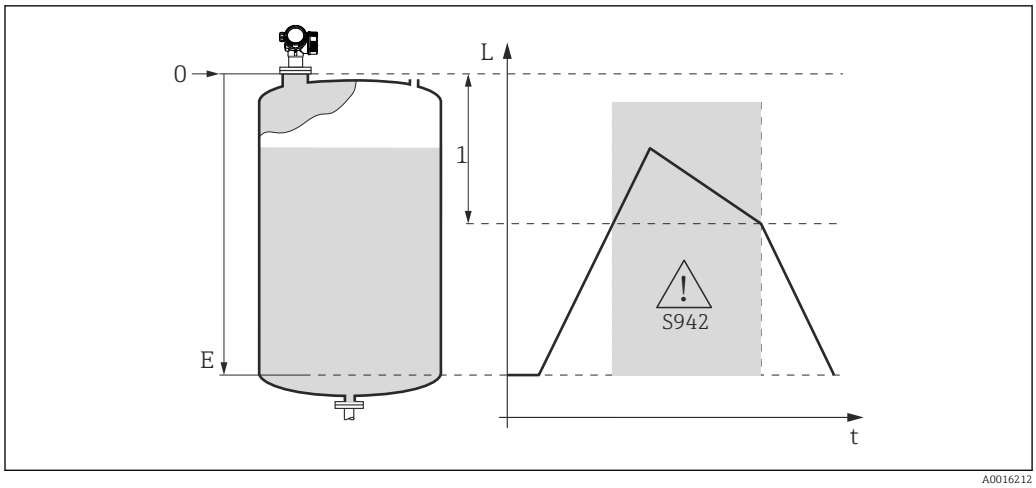
- **In safety dist. (→ 92)**
- **Acknowl. alarm (→ 93)**



A0016211

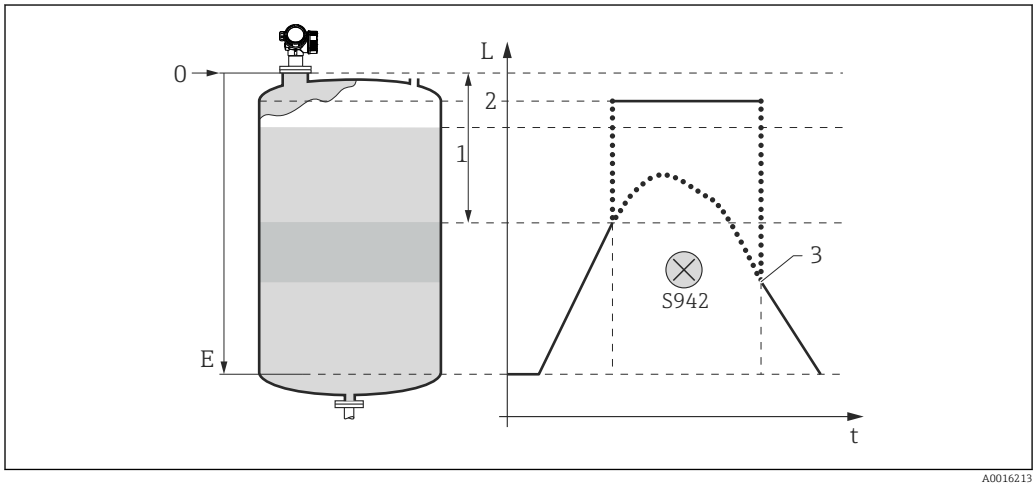
32 *"In safety dist." = "Alarm": If the safety distance is undershot, the device generates an alarm.*

1 *Safety distance (→ 92)*
2 *Value defined in "Failure mode (→ 112)"*



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

1 Safety distance (→ 92)

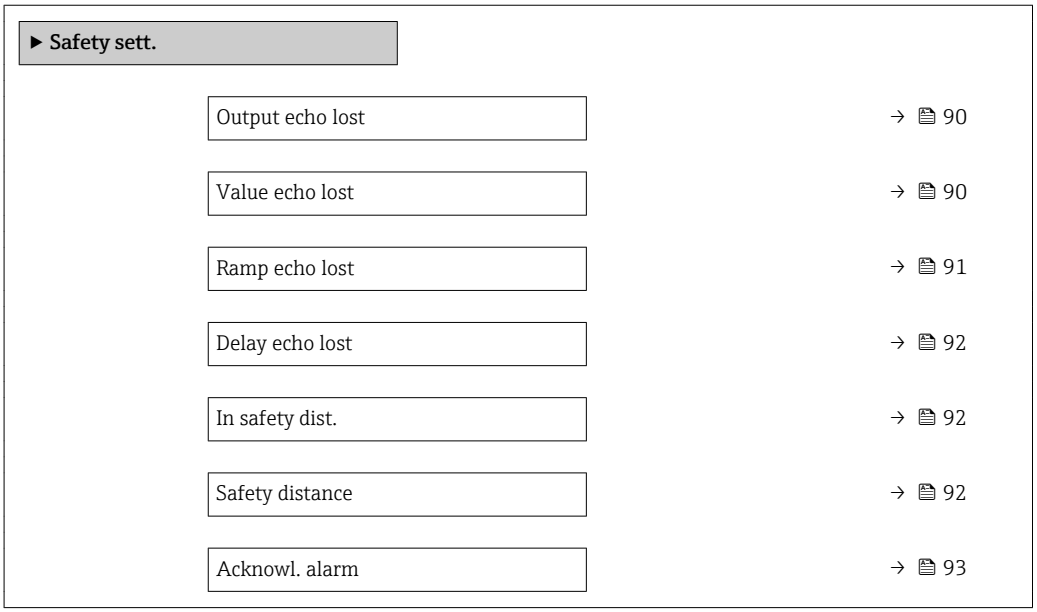


34 *"In safety dist." = "Self holding": If the safety distance is undershot, the device generates an alarm. The measurement is not resumed until this alarm has been acknowledged by the user.*

1 Safety distance (→ 92)
2 Value defined in "Failure mode (→ 112)"
3 Acknowl. alarm (→ 93)

Structure of the submenu

Navigation Expert → Sensor → Safety sett.



Description of parameters

Navigation Expert → Sensor → Safety sett.

Output echo lost

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

Description Output signal in case of a lost echo.

Selection
- Last valid value
- Ramp 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 echo lost** [1)]
  In the case of a lost echo the output value is continously shifted towards 0% or 100%. The slope of the ramp is defined in the **Ramp echo lost** parameter (→ 🖹 91).
- **Value echo lost** [1)]
  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→ 🖹 90).
- **Alarm**
  In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter (→ 🖹 112)

Read access	Operator
Write access	Maintenance

Value echo lost

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

Prerequisite **Output echo lost (→ 🖹 90)** = **Value echo lost**

Description Output value in case of a lost echo

User entry 0 to 200 000.0 %

Factory setting 0.0 %

1) Only visible if "Lineariz. type (→ 🖹 66)" = "None"

Additional information

Use the unit which has been defined for the measured value output:
- without linearization: **Level unit** (→ 56)
- with linearization: **Unit linearize.** (→ 68)

Read access	Operator
Write access	Maintenance

Ramp echo lost

Navigation

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

Prerequisite

Output echo lost (→ 90) = **Ramp echo lost**

Description

Slope of the ramp in the case of a lost echo

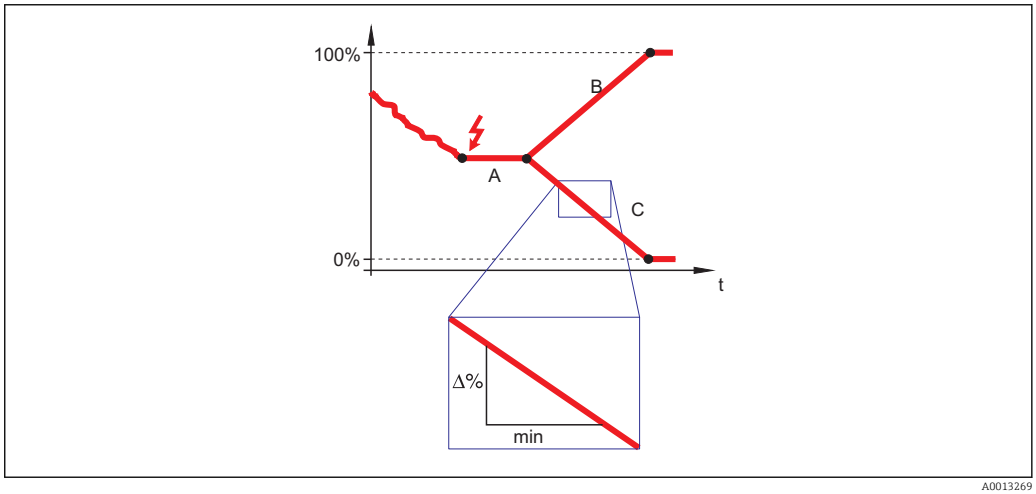
User entry

Signed floating-point number

Factory setting

0.0 %/min

Additional information



A Delay echo lost
B Ramp echo lost (→ 91) (positive value)
C Ramp echo lost (→ 91) (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 continuosly increased until it reaches 100%.

Read access	Operator
Write access	Maintenance

Delay echo lost

Navigation Expert → Sensor → Safety sett. → Delay echo lost (12456)

Description Time between the echo loss and the reaction defined for the output.

User entry 0 to 99 999.9 s

Factory setting 60.0 s

Additional information

Read access	Operator
Write access	Maintenance

In safety dist.

Navigation Expert → Sensor → Safety sett. → In safety dist. (12530)

Description Defines the reaction if the level rises into the safety distance.

Selection
- Off
- Alarm
- Warning
- Self holding

Factory setting Warning

Additional information

Read access	Operator
Write access	Maintenance

Safety distance

Navigation Expert → Sensor → Safety sett. → Safety distance (12517)

Description Safety distance, measured from the reference point of the measurement (lower edge of the flange or threaded connection)

User entry −200 to 200 m

Factory setting 0 m

Additional information The safety distance can be used to generate a warning before the level rises into the blocking distance. The **In safety dist.** parameter defines the reaction of the device if the level rises into the safety distance.

Read access	Operator
Write access	Maintenance

Acknowl. alarm

Navigation Expert → Sensor → Safety sett. → Acknowl. alarm (12536)

Prerequisite **In safety dist. (→ 92)** = **Self holding**

Description **Yes** option resets an active alarm.

Selection
- No
- Yes

Factory setting No

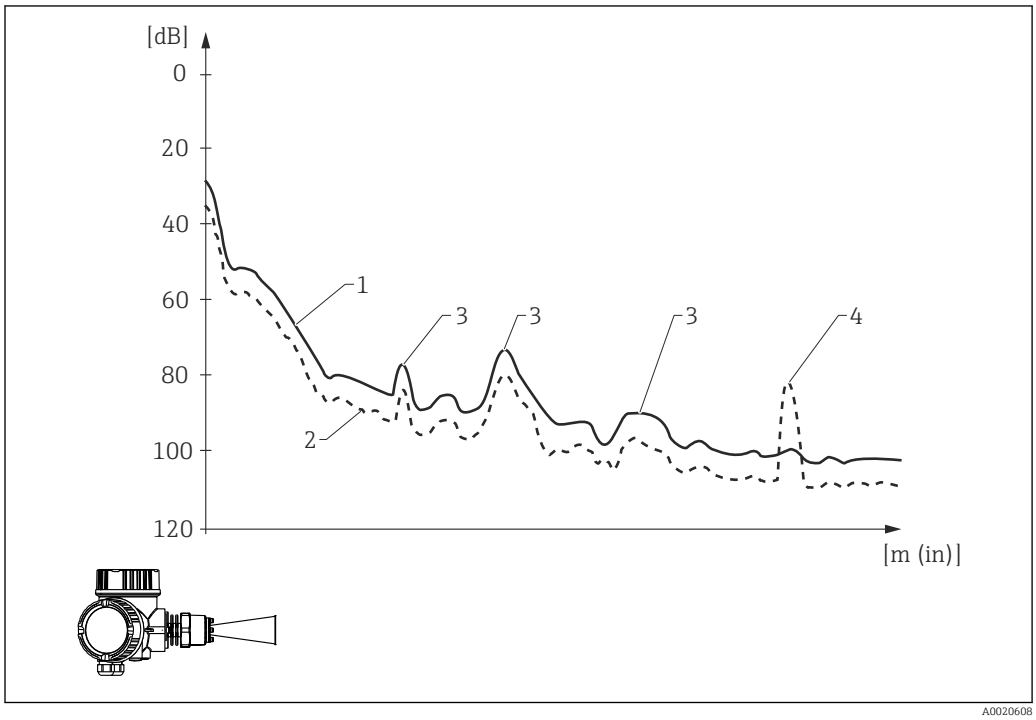
Additional information

Read access	Operator
Write access	Maintenance

3.3.10 "Mapping" submenu

The mapping is used to suppress static interference signals which may be generatet 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** [2] 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** [2] 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.

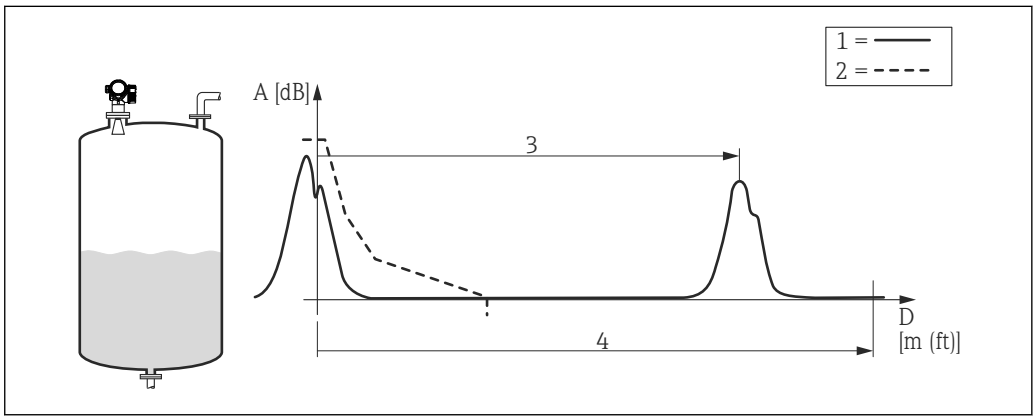
2) For the difference between static and dynamic envelope curve evaluation refer to the "Expert → Sensor → Echo tracking" submenu.

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).



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 (→ 101).

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 **Map 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 **Map 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.

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 (→ 101) and select the **Manual map** option.
2. Go to the **Record map** parameter (→ 103) 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 **Map. end point** parameter (→ 🖹 102).

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:

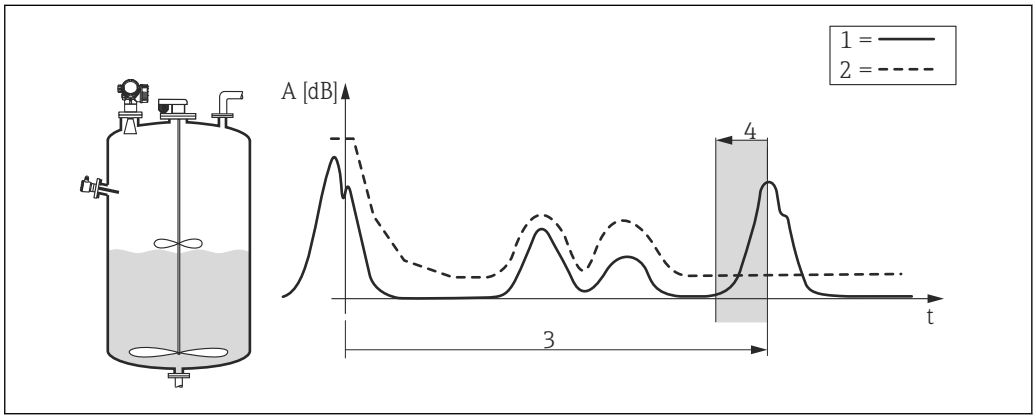
1. Enter the end point of the area to be deleted into the **Map. end point** parameter (→ 🖹 102).
2. Go to the **Record map** parameter (→ 🖹 103) and select the **Delete part. map** option.

Mapping in the tank bottom area

Irrespective of the definded mapping range, no mapping is recorded near the end of the measuring range (defined in the **Tank/silo height** parameter (→ 🖹 55)). In this gap the map assumes a constant value as defined by the **End of mapping (→ 🖹 103)** and **End map. ampl. (→ 🖹 103)** parameters.

"End of mapping" = "Last map value"

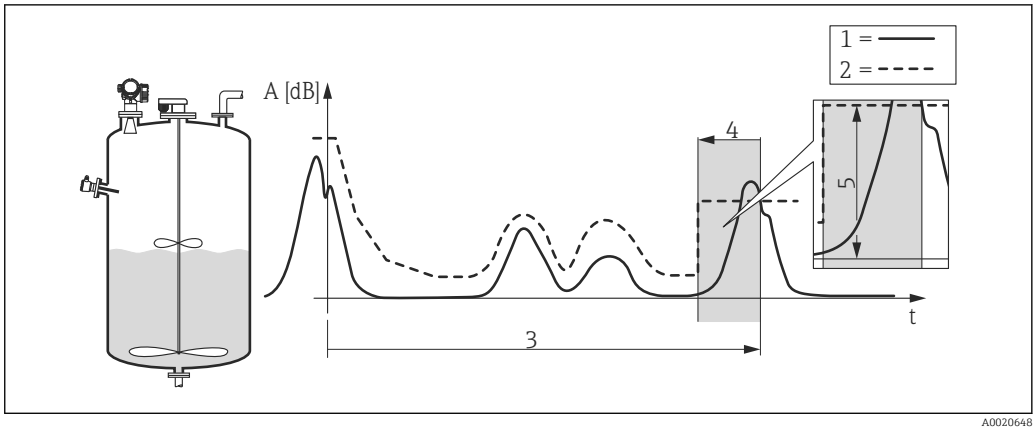
With this setting the last value of the map remains valid within the tank bottom area.



1 Envelope curve
2 Map
3 Tank/silo height (→ 🖹 55)
4 Tank bottom area

"End of mapping" = "Adjustable"

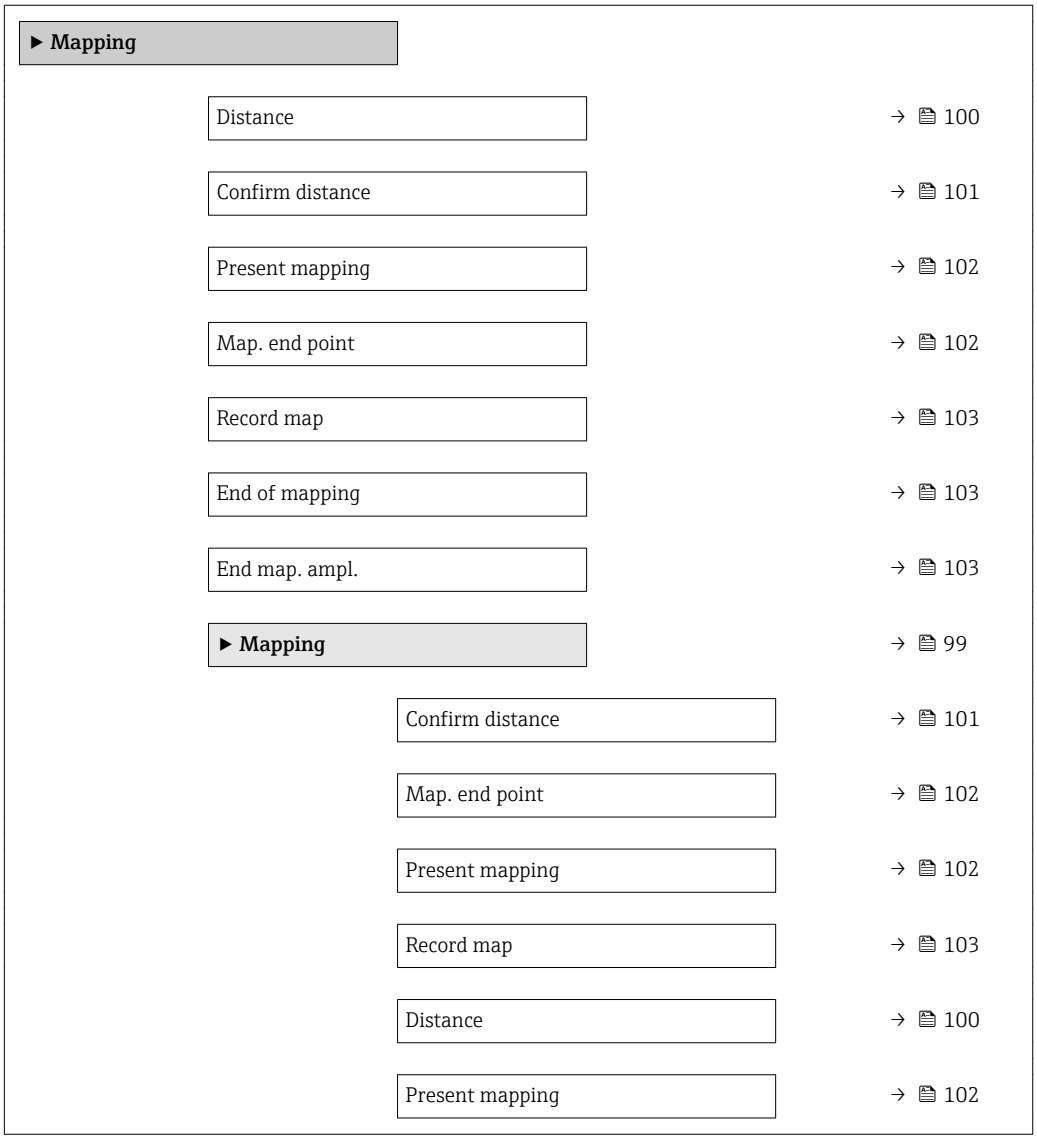
With this setting the value of the mapping curve within the tank bottom area is defined in the **End map. ampl.** parameter (→ 🖹 103).



1 Envelope curve
2 Map
3 Tank/silo height (→ 🖹 55)
4 Tank bottom area
5 End map. ampl. (→ 🖹 103)

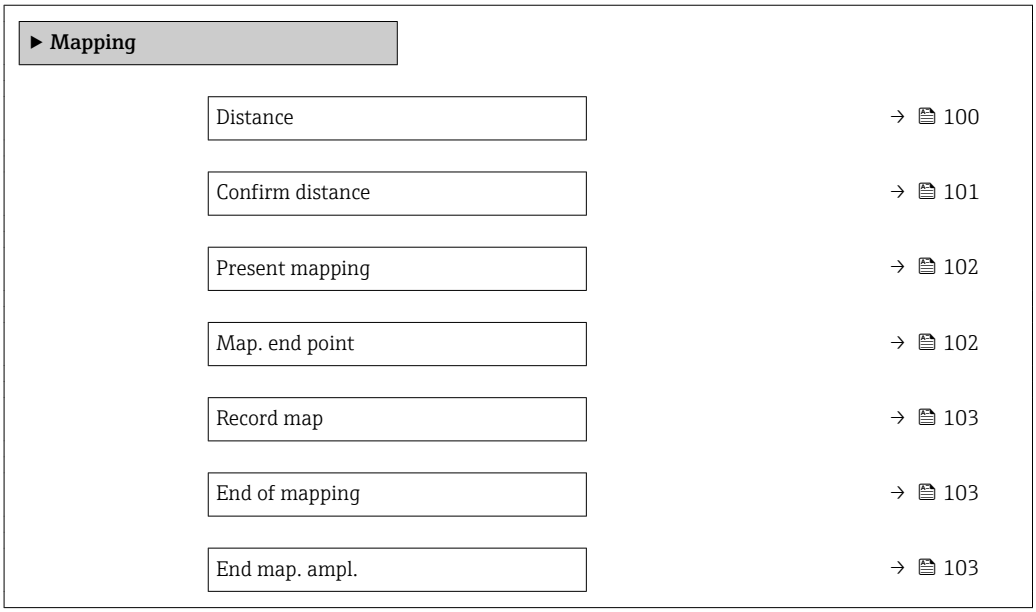
Structure of the submenu on the local display

Navigation Expert → Sensor → Mapping



Structure of the submenu in an operating tool

Navigation Expert → Sensor → Mapping



Description of parameters

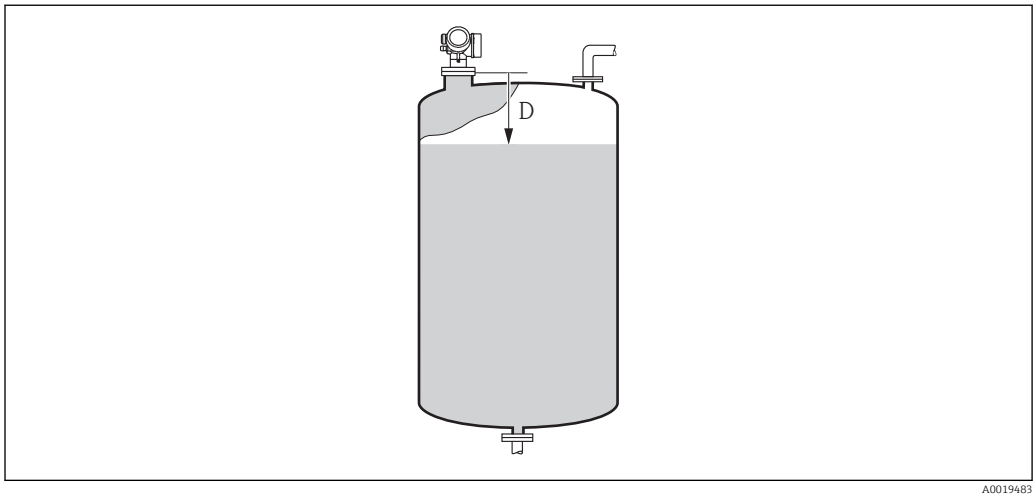
Navigation Expert → Sensor → Mapping

Distance

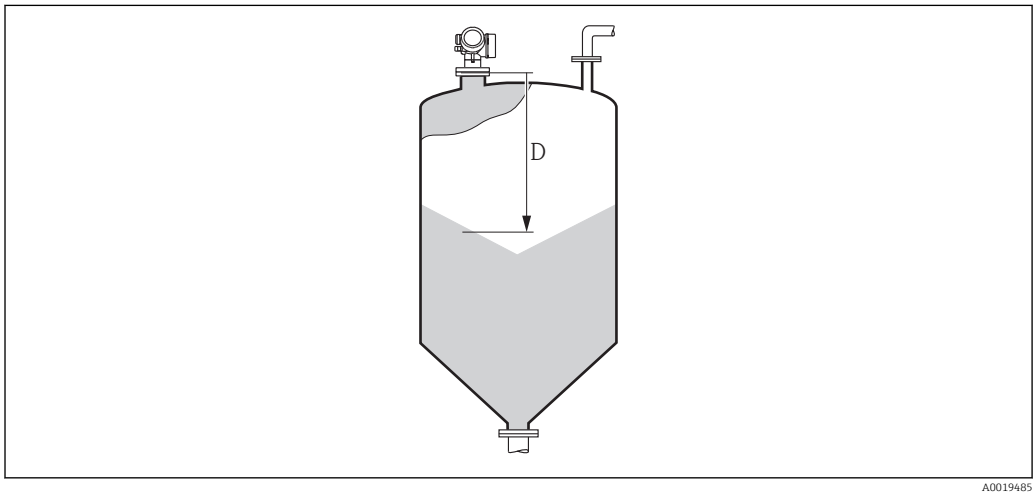
Navigation Expert → Sensor → Mapping → Distance (12401)

Description Distance between lower edge of flange or thread and medium surface.

Additional information



35 *Distance for liquid measurements*



36 *Distance for bulk solid measurements*

Read access	Operator
Write access	-

Confirm distance

Navigation Expert → Sensor → Mapping → Confirm distance (12462)

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
- Dist. too small *
- Distance too big *
- 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 **Map. end point** parameter. 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.
- **Dist. too small** 3)
  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**.

* Visibility depends on order options or device settings
3) Only available for "Expert → Sensor → Echo tracking → **Evaluation mode** parameter " ≠ " **History off** option"

- **Distance too big**
  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. By default, **Tank/silo height** = **Empty calibr.**.
  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 calibr. (→ 53)** and **Tank/silo height** may not reach below this point as otherwise the empty signal is suppressed.
- **Factory map**
  The factory map permanently stored in the device is used.

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

If the teaching procedure with the **Dist. too small** option or **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.

Read access	Operator
Write access	Maintenance

Present mapping

Navigation Expert → Sensor → Mapping → Present mapping (12487)

Description Present end of mapping.

Additional information

Read access	Operator
Write access	-

Map. end point

Navigation Expert → Sensor → Mapping → Map. end point (12459)

Prerequisite **Confirm distance (→ 101)** = **Manual map** or **Dist. too small**

Description New end point of mapping.

User entry 0.0001 to 999 999.9 m

Factory setting 0.1 m

Additional information

Read access	Operator
Write access	Maintenance

Record map

Navigation Expert → Sensor → Mapping → Record map (12448)

Prerequisite **Confirm distance** = **Manual map** or **Dist. too small**

Selection
- No
- Record map
- Overlay map
- Factory map
- Delete part. map

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

End of mapping

Navigation Expert → Sensor → Mapping → End of mapping (12461)

Description Behavior of the mapping curve in the tank bottom area

Selection
- Adjustable
- Last map value

Factory setting Adjustable

Additional information

Read access	Operator
Write access	Maintenance

End map. ampl.

Navigation Expert → Sensor → Mapping → End map. ampl. (12478)

Description Amplitude of the mapping curve in the tank bottom area

User entry −99 999.0 to 99 999.0 dB

Factory setting −90 dB

Additional information

Read access	Operator
Write access	Operator

3.3.11 "Tank bottom eval" submenu

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

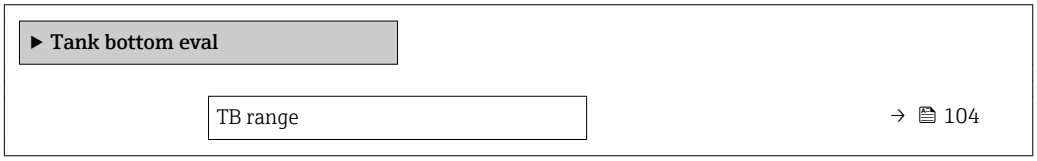
If no echo is found within the defined tank height (**Tank/silo height (→ 55)**) the tank bottom searches beyond this distance in the **TB range**, to see whether an echo from the tank bottom exists.

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 measruing 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 submenu

Navigation Expert → Sensor → Tank bottom eval



Description of parameters

Navigation Expert → Sensor → Tank bottom eval

TB range

Navigation Expert → Sensor → Tank bottom eval → TB range (12463)

Description Range in which the tank bottom echo is searched for

User entry 0 to 99.999 m

Factory setting 15 m

Additional information

Read access	Operator
Write access	Maintenance

3.3.12 "Echo tracking" submenu

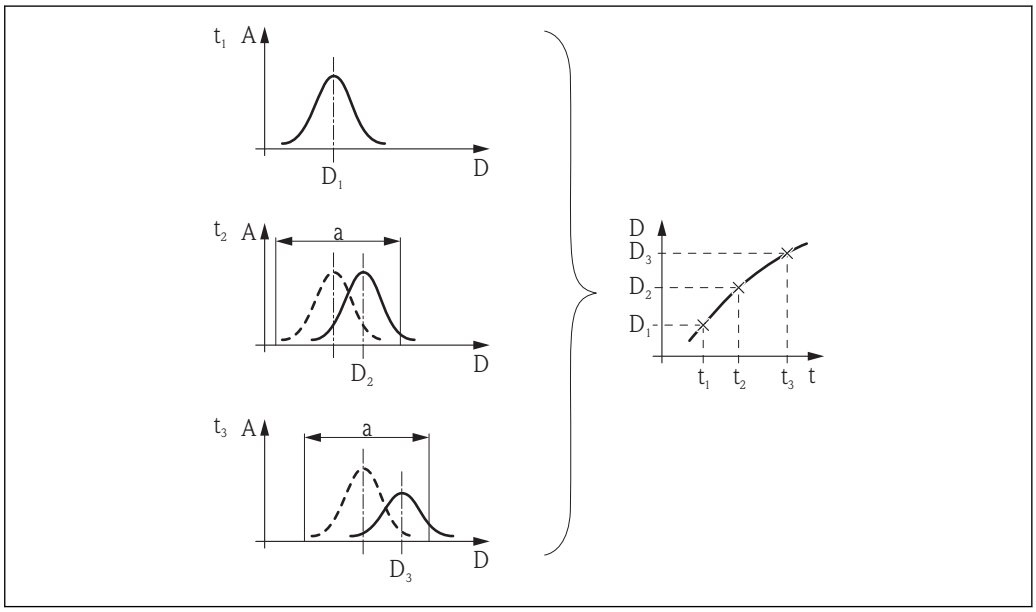
The echo tracking algorithm takes into account temporal changes of the level echo when evaluating the envelope curve. This improves the allocation of the echoes to the level signal.

The following types of echo tracking can be selected in the **Evaluation mode** parameter (→ 106):

- **History off**
  Static envelope curve evaluation taking into account the mapping.
- **Short time hist.**
  Echo tracking (see below) without consideration of the mapping.
- **Echo track.**
  Echo tracking (see below) taking into account the mapping.

Echo tracking

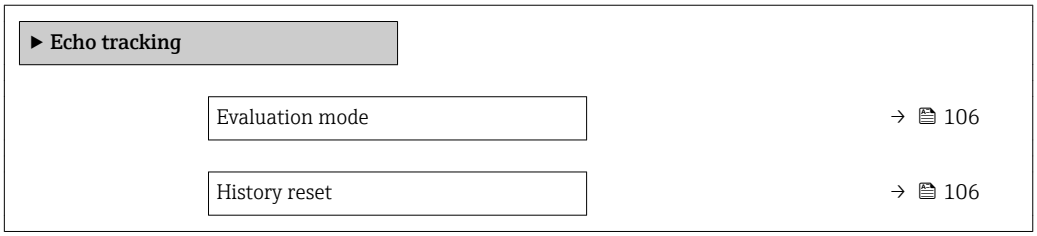
The position of the individual echoes is tracked. The track contains the position, the velocity, the relative and the absolute echo amplitude. Normally the strongest echo within a search window is selected and allocated to the track.



37 *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.*

Structure of the submenu

Navigation Expert → Sensor → Echo tracking



Description of parameters

Navigation Expert → Sensor → Echo tracking

Evaluation mode

Navigation Expert → Sensor → Echo tracking → Evaluation mode (12411)

Description Defines the evaluation mode for the echo tracking.

Selection
- History off
- Short time hist.
- Echo track.

Factory setting Echo track.

Additional information

Read access	Operator
Write access	Maintenance

History reset

Navigation Expert → Sensor → Echo tracking → History reset (12449)

Description Resets history of the echo and tank tracking.

Selection
- Reset done
- Restart tracking
- Delete history

Factory setting Reset done

Additional information

Meaning of the options

- **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 tracking**
  The echo tracking is reset. The tank trace, however, is maintained.
- **Delete history**
  The echo tracking and tank trace are reset.

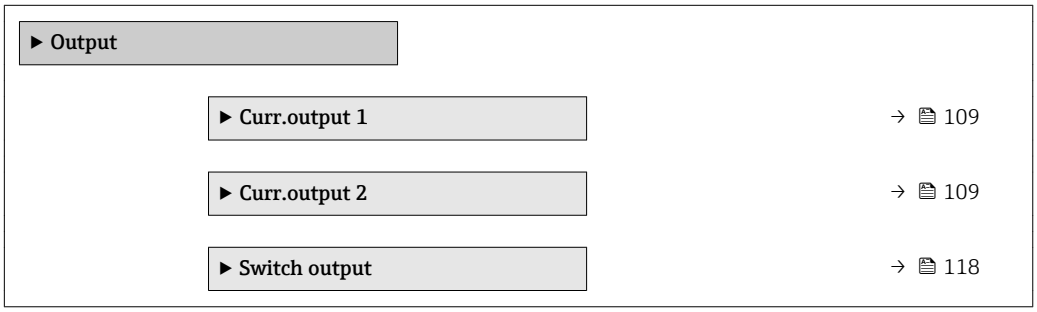
Read access	Operator
Write access	Maintenance

3.4 "Output" submenu

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

3.4.1 Structure of the submenu

Navigation Expert → Output



3.4.2 "Curr.output 1 to 2" submenu

There is a **Curr.output** submenu for each current output of the device (1 or 2 depending on the device version).

Structure of the submenu

Navigation Expert → Output → Curr.output 1 to 2

► **Curr.output 1 to 2**	
Assign curr.	→ 110
Current span	→ 111
Fixed current	→ 111
Damping out.	→ 112
Output curr. 1 to 2	→ 112
Failure mode	→ 112
Failure current	→ 113
Turn down	→ 113
4 mA value	→ 114
20 mA value	→ 114
Measuring mode	→ 115
Start-up mode	→ 115
Start-up current	→ 116
Measur. curr. 1 to 2	→ 116
Terminal volt. 1	→ 117

Description of parameters

Navigation Expert → Output → Curr.output 1 to 2

Assign curr. 1 to 2

Navigation

Expert → Output → Curr.output 1 → Assign curr. 1 (0359)

Expert → Output → Curr.output 2 → Assign curr. 2 (0359–2)

Description

Determines which process variable is transmitted via the current output.

Selection

- Level linearized
- Distance
- Electronic temp.
- Relat.echo ampl.
- Area incoupling
- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4

Factory setting

- Current output 1: Level linearized
- Current output 2 [4]: Relative echo amplitude

Additional information

Definition of the current range for the process variables

Process variable	4 mA value	20 mA value
Level linearized	0 % [1] or the associated linearized value.	100 % [2] or the associated linearized value.
Distance	0(i.e. level is at the reference point)	**Empty calibr. (→ 53)** (i.e. level is at 0 %
Electronic temp.	−50 °C (−58 °F)	100 °C (212 °F)
Relat.echo ampl.	0 dB	150 dB
Area incoupling	0	100
Analog out. AD 1/2/3/4	dependent on the parametrization of the Advanced Diagnostics	

1) The 0% level is defined by the **Empty calibr.** parameter (→ 53).
2) The 100% level is defined by the **Full calibr.** parameter (→ 54).

It may be necessary to adjust the 4mA and 20mA values to the application (especially in the case of the **Analog out. AD 1 - 4** and **Area incoupling** options).

This can be done by the following parameters:
- Expert → Output → Curr.output 1 to 2 → Turn down (0358–1 to 2)
- Expert → Output → Curr.output 1 to 2 → 4 mA value (0367–1 to 2)
- Expert → Output → Curr.output 1 to 2 → 20 mA value (0372–1 to 2)

Read access	Operator
Write access	Maintenance

4) only for devices with two current outputs

Current span

Navigation Expert → Output → Curr.output 1 to 2 → Current span (0353–1 to 2)

Description Determines the current range used to transmit the measured value. '4...20mA': Measured variable: 4 ...20 mA '4...20mA NAMUR': Measured variable: 3.8 ... 20.5 mA '4...20mA US': Measured variable: 3.9 ... 20.8 mA 'Fixed current': Measured variable transmitted via HART only Note: Currents below 3.6 mA or above 21.95 mA can be used to signal an alarm.

Selection
- 4...20 mA
- 4...20 mA NAMUR
- 4...20 mA US
- Fixed current

Factory setting 4...20 mA NAMUR

Additional information *Meaning of the options*

Option	Current range for process variable	Lower alarm signal level	Upper alarm signal level
4...20 mA	4 to 20.5 mA	< 3.6 mA	> 21.95 mA
4...20 mA NAMUR	3.8 to 20.5 mA	< 3.6 mA	> 21.95 mA
4...20 mA US	3.9 to 20.8 mA	< 3.6 mA	> 21.95 mA
Fixed current	Constant current, defined in the **Fixed current** parameter (→ 111).		

- In the case of an error, the output current assumes the value defined in the **Failure mode** parameter (→ 112).
- If the meausred value is out of the measuring range, diagnostic message **Curr.output** is issued.

In a HART multidrop loop only one device can use the analog current to transmit a signal. For all other devices one must set:
- **Current span** = **Fixed current**
- **Fixed current (→ 111)** = **4 mA**

Read access	Operator
Write access	Maintenance

Fixed current

Navigation Expert → Output → Curr.output 1 to 2 → Fixed current (0365–1 to 2)

Prerequisite **Current span (→ 111)** = **Fixed current**

Description Define constant value of the output current.

User entry 4 to 22.5 mA

Factory setting 4 mA

Additional information

Read access	Operator
Write access	Maintenance

Damping out.

Navigation Expert → Output → Curr.output 1 to 2 → Damping out. (0363–1 to 2)

Description Reaction time of the output signal on fluctuation in the measured value.

User entry 0.0 to 999.9 s

Factory setting 0.0 s

Additional information Fluctuations of the measured value affect the output current with an exponential delay, the time constant τ of which is defined in this parameter. With a small time constant the output reacts immediately to changes of the measrued value. With a big time constant the reaction of the output is more delayed. For τ = 0 (factory setting) there is no damping.

Read access	Operator
Write access	Maintenance

Output curr. 1 to 2

Navigation Expert → Output → Curr.output 1 to 2 → Output curr. 1 to 2 (0361–1 to 2)

Description The actual calculated value of the output current.

Additional information

Read access	Operator
Write access	-

Failure mode

Navigation Expert → Output → Curr.output 1 to 2 → Failure mode (0364–1 to 2)

Prerequisite **Current span (→ 111) ≠ Fixed current**

Description Defines which current the output assumes in the case of an error. 'Min.': < 3.6mA 'Max.': > 21.95mA 'Last valid value': Last valid value before occurrence of the error. 'Actual value': Output current is equal to the measured value; error is ignored. 'Defined value': User defined value.

Selection
- Min.
- Max.
- Last valid value
- Actual value
- Defined value

Factory setting
Max.

Additional information

Meaning of the options
- **Min.**
  The current output adopts the value of the lower alarm level according to the **Current span** parameter (→ 111).
- **Max.**
  The current output adopts the value of the upper alarm level according to the **Current span** parameter (→ 111).
- **Last valid value**
  The current remains constant at the last value it hat before the error occurred.
- **Actual value**
  The output current follows the actual measured value; the error is ignored.
- **Defined value**
  The output current assumes the value defined in the **Failure current** parameter (→ 113).

The error behavior of other output channels is not influenced by these settings but is defined in separate parameters.

Read access	Operator
Write access	Maintenance

Failure current

Navigation
Expert → Output → Curr.output 1 to 2 → Failure current (0352–1 to 2)

Prerequisite
Failure mode (→ 112) = Defined value

Description
Defines which current the output assumes in case of an error.

User entry
3.59 to 22.5 mA

Factory setting
22.5 mA

Additional information

Read access	Operator
Write access	Maintenance

Turn down

Navigation
Expert → Output → Curr.output 1 to 2 → Turn down (0358–1 to 2)

Prerequisite
Current span (→ 111) ≠ Fixed current

Description Switch the current turn down functionality on or off.

Selection
- Off
- On

Factory setting Off

Additional information Using the turn down functionality it is possible to map a section of the measuring range to the total range of the output current (4-20mA). The section is defined by the 4 mA value (→ 114) and 20 mA value (→ 114) parameters.

Without the turn down, the complete measuring range (0 to 100%) is mapped to the current output (4 to 20mA).

Read access	Operator
Write access	Maintenance

4 mA value

Navigation Expert → Output → Curr.output 1 to 2 → 4 mA value (0367–1 to 2)

Prerequisite **Turn down (→ 113) = On**

Description Enter 4 mA value.

User entry Signed floating-point number

Factory setting 0.0 %

Additional information

Read access	Operator
Write access	Maintenance

20 mA value

Navigation Expert → Output → Curr.output 1 to 2 → 20 mA value (0372–1 to 2)

Prerequisite **Turn down (→ 113) = On**

Description Enter 20 mA value.

User entry Signed floating-point number

Factory setting 0.0 %

Additional information If **20 mA value** is smaller than **4 mA value (→ 114)**, the current output is inverted, which means that an increase of the process variable results in a decrease of the output current.

Read access	Operator
Write access	Maintenance

Measuring mode

Navigation Expert → Output → Curr.output 1 to 2 → Measuring mode (0351–1 to 2)

Prerequisite **Current span (→ 111) ≠ Fixed current**

Description Select measuring mode for output.

Selection
- Standard
- Inverse

Factory setting Standard

Additional information

Meaning of the options
- **Standard**
  If the level increases, the output current increases as well.
- **Inverse**
  If the level increases, the output current decreases.

Read access	Operator
Write access	Maintenance

Start-up mode

Navigation Expert → Output → Curr.output 1 → Start-up mode (0368–1)

Prerequisite
- **Current span (→ 111) ≠ Fixed current**
- Only for current output 1

Description Select behavior of the current output during start-up.

Selection
- Min.
- Max.
- Defined value

Factory setting Min.

Additional information

Meaning of the options
- **Min.**
  The start-sup current corresponds to the lower edge of the range selected in the **Current span** parameter (→ 111).
- **Max.**
  The start-up current corresponds to the upper edge of the range selected in the **Current span** parameter (→ 111).
- **Defined value**
  The value of the start-up current is defined in the **Start-up current** parameter (→ 116).

Read access	Operator
Write access	Maintenance

Start-up current

Navigation Expert → Output → Curr.output 1 → Start-up current (0369–1)

Prerequisite
- **Start-up mode (→ 115)** = **Defined value**
- Only for current output 1

Description Define value the current output assumes during start-up.

User entry 3.59 to 22.5 mA

Factory setting 3.6 mA

Additional information

Read access	Operator
Write access	Maintenance

Measur. curr. 1

Navigation Expert → Output → Curr.output 1 → Measur. curr. 1 (0366–1)

Prerequisite Only available for current output 1

Description Current output value which is currently measured.

Additional information

Read access	Operator
Write access	-

Terminal volt. 1

Navigation Expert → Output → Curr.output 1 → Terminal volt. 1 (0662)

Description Terminal voltage that is applied at the output.

Additional information

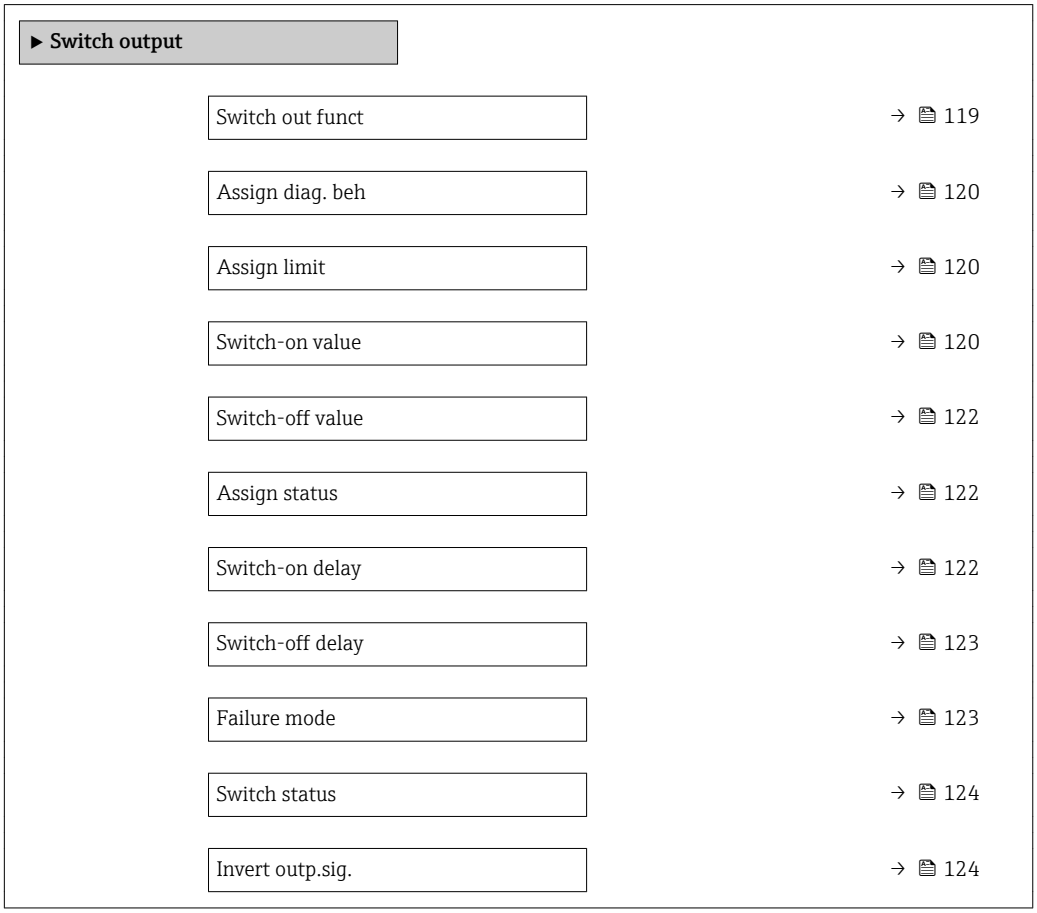
Read access	Operator
Write access	-

3.4.3 "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



Description of parameters

Navigation Expert → Output → Switch output

Switch out funct

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

Description Defines the function of the switch output. 'Off' The switch output is always open (non-conductive) 'On' The switch output is always closed (conductive). 'Diagnostic behavior' The switch output is normally closed and is only opened if a diagnostic event is present. 'Limit' The switch output is normally closed and is only opened if a measured variable exceeds a defined limit. 'Digital output' The switch output is controlled by one of the digital output blocks of the device.

Selection
- Off
- On
- Diag. 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).
- **Diag. behavior**
  The output is normally closed and is only opened if a diagnostic event is present. The **Assign diag. beh** parameter (→ 120) 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 (→ 120)**
  – **Switch-on value (→ 120)**
  – **Switch-off value (→ 122)**
- **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 (→ 122).

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

Read access	Operator
Write access	Maintenance

Assign diag. beh

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

Prerequisite **Switch out funct (→ 119) = Diag. behavior**

Description Defines to which behavior of diagnostic events the switch output reacts.

Selection
- Alarm
- Alarm or warning
- Warning

Factory setting Alarm

Additional information

Read access	Operator
Write access	Maintenance

Assign limit

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

Prerequisite **Switch out funct (→ 119) = Limit**

Selection
- Off
- Level linearized
- Distance
- Terminal volt.
- Electronic temp.
- Relat.echo ampl.
- Area incoupling

Factory setting Off

Additional information

Read access	Operator
Write access	Maintenance

Switch-on value

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

Prerequisite **Switch out funct (→ 119) = Limit**

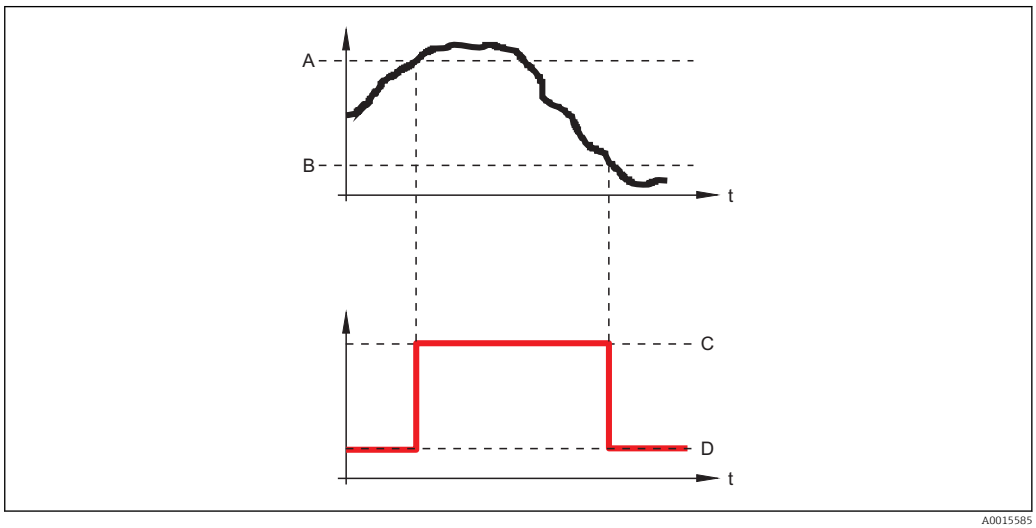
Description Defines the switch-on point. The output is closed if the assigned process variable rises above this point.

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:

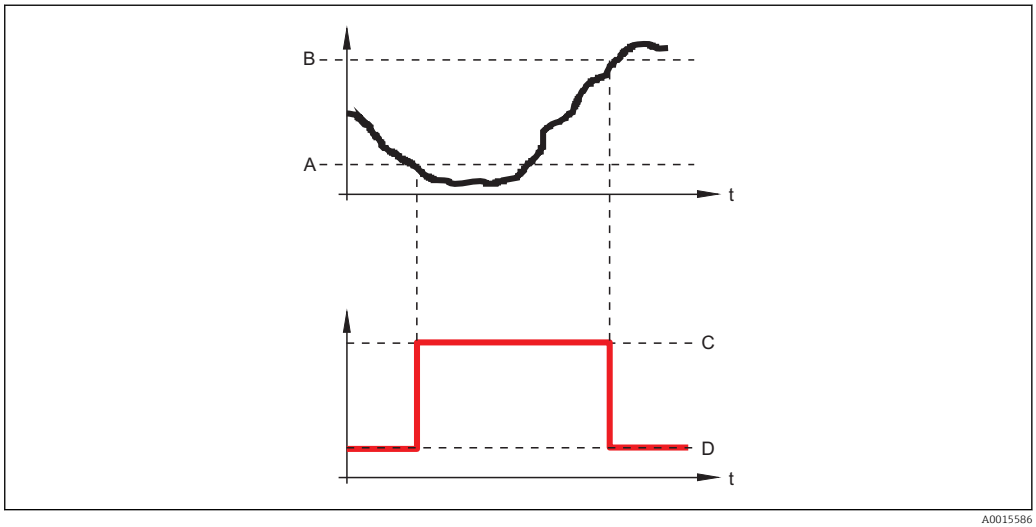
Switch-on value > Switch-off value
– The output is closed if the measured value is larger than **Switch-on value**.
– The output is opened if the measured value is smaller than **Switch-off value**.



A0015585

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**.



A0015586

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

Read access	Operator
Write access	Maintenance

Switch-off value

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

Prerequisite **Switch out funct (→ 119)** = **Limit**

Description Defines the switch-off point. The output is opened if the assigned process variable falls below this 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 (→ 120).

Read access	Operator
Write access	Maintenance

Assign status

Navigation Expert → Output → Switch output → Assign status (0485)

Prerequisite **Switch out funct (→ 119)** = **Digital Output**

Selection
- Off
- Digital out AD 1
- Digital out AD 2
- Digital out AD 3
- Digital out AD 4

Factory setting Off

Additional information The **Digital out AD 1/2/3/4** options refer to the Advanced Diagnostic Blocks → 173. A switch signal generated in these blocks can be transmitted via the switch output.

Read access	Operator
Write access	Maintenance

Switch-on delay

Navigation Expert → Output → Switch output → Switch-on delay (0467)

Prerequisite
- **Switch out funct (→ 119)** = **Limit**
- **Assign limit (→ 120)** ≠ **Off**

Description Defines the delay applied before the output is switched on.

User entry 0.0 to 100.0 s

Factory setting 0.0 s

Additional information

Read access	Operator
Write access	Maintenance

Switch-off delay

Navigation Expert → Output → Switch output → Switch-off delay (0465)

Prerequisite
- **Switch out funct (→ 119)** = **Limit**
- **Assign limit (→ 120)** ≠ **Off**

Description Defines the delay applied before the output is switched off.

User entry 0.0 to 100.0 s

Factory setting 0.0 s

Additional information

Read access	Operator
Write access	Maintenance

Failure mode

Navigation Expert → Output → Switch output → Failure mode (0486)

Prerequisite **Switch out funct (→ 119)** = **Limit** or **Digital Output**

Description Defines the state of the switch output in case of an error.

Selection
- Actual status
- Open
- Closed

Factory setting Open

Additional information

Read access	Operator
Write access	Maintenance

Switch status

Navigation Expert → Output → Switch output → Switch status (0461)

Description Current status of the switch output.

Additional information

Read access	Operator
Write access	-

Invert outp.sig.

Navigation Expert → Output → Switch output → Invert outp.sig. (0470)

Description 'No' The switch output behaves as per its parameter setting. 'Yes' The switching behavior is inverted as compared to its parameter setting.

Selection
- 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.

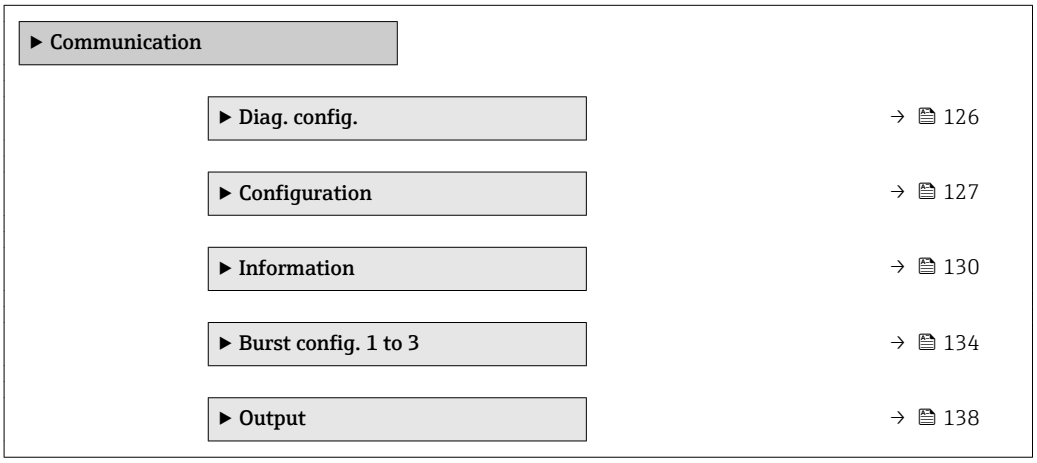
Read access	Operator
Write access	Maintenance

3.5 "Communication" submenu

The **Communication** submenu contains all parameters needed to configure the HART communication interface.

3.5.1 Structure of the submenu

Navigation Expert → Communication



3.5.2 "Diagnostic configuration" submenu

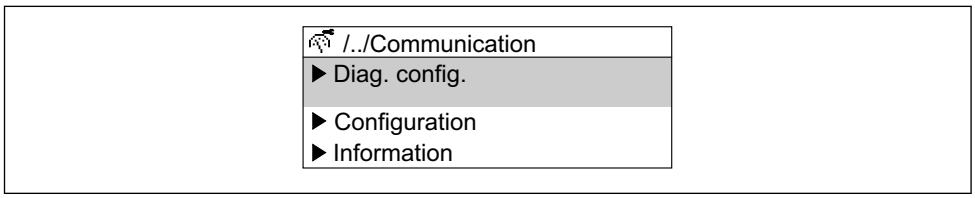
This submenu is used to allocate a status according to NAMUR recommendation NE107 to individual error messages. This applies to the following error messages:

- **In safety dist.**
- **Echo lost**
- **AD occured** (if an advanced diagnostics has been activated.)

Navigation Expert → Communication → Diag. config.

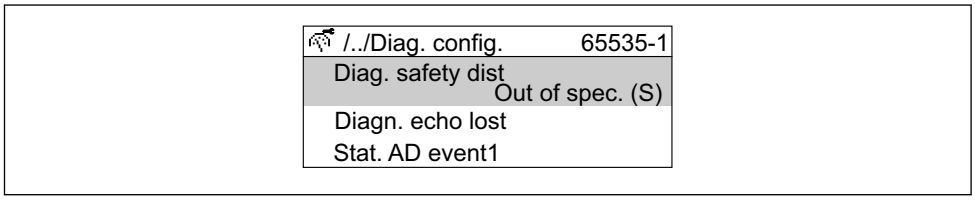
Configuration via local display

1.



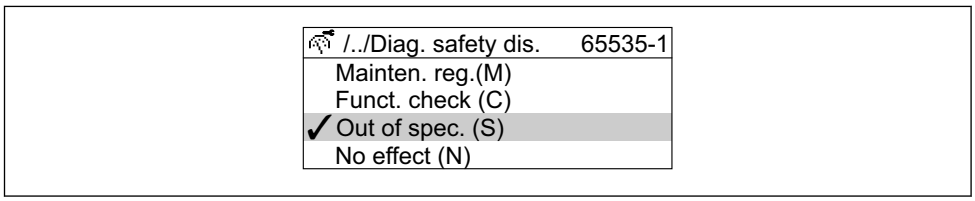
Go to the **Diag. config.** submenu.

2.



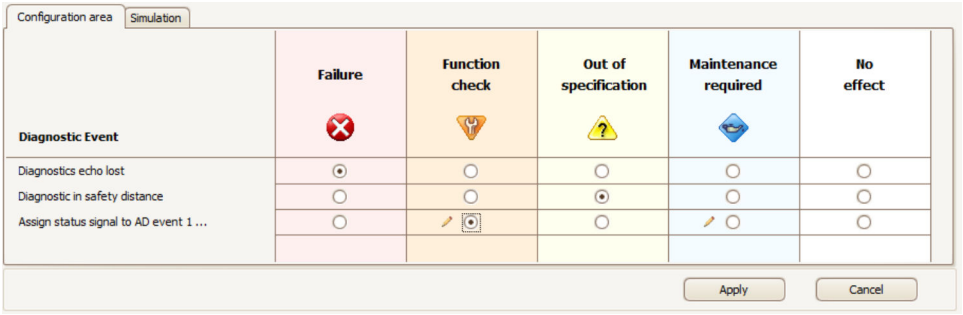
Select an error message.

3.

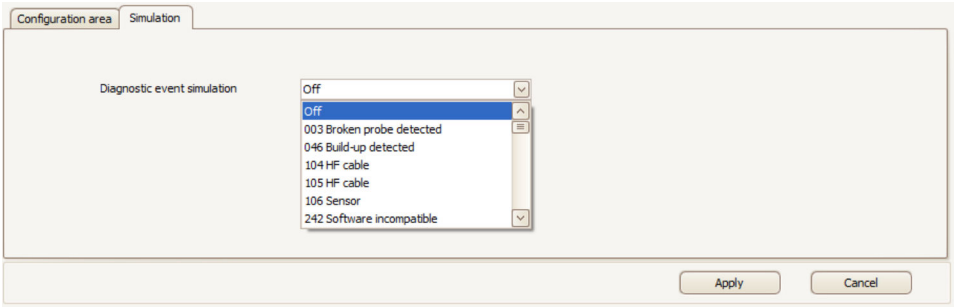


Select a status according to NE107.

Configuration via FieldCare

1. Go to the **Diag. config.** submenu.
2. 

   Mark the desired behavior of the individual error messages in the table and click "Apply" to confirm your selection.

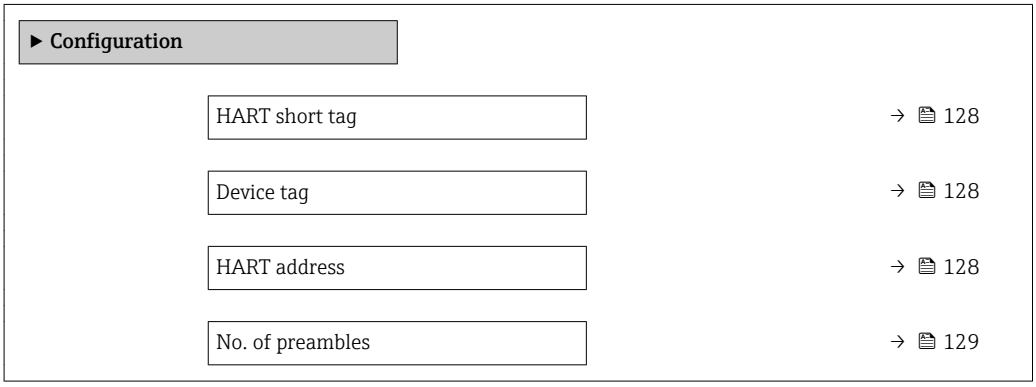
3. 

   Error messages can be simulated in the "Simulation" dialog in order to check the correct behavior.

3.5.3 "Configuration" submenu

Structure of the submenu

Navigation Expert → Communication → Configuration



Description of parameters

Navigation Expert → Communication → Configuration

HART short tag

Navigation Expert → Communication → Configuration → HART short tag (0220)

Description Defines the short tag for the measuring point. Maximum length: 8 characters Allowed characters: A-Z, 0-9, certain special characters.

User entry Max. 8 characters: A-Z, 0-9 and certain special characters (e.g. punctuation marks, @, %).

Factory setting SHORTTAG

Additional information

Read access	Operator
Write access	Maintenance

Device tag

Navigation Expert → Communication → Configuration → Device tag (0215)

Description Enter a unique name for the measuring point to identify the device quickly within the plant.

Factory setting FMR6x

HART address

Navigation Expert → Communication → Configuration → HART address (0219)

Description Define HART address of the device.

User entry 0 to 63

Factory setting 0

Additional information

- Measured value transmission via the current value is only possible for address "0". For any other address the current is fixed at 4.0 mA (multidrop mode).
- For a system according to HART 5.0 possible addresses are 0 to 15.
- For a system according to HART 6.0 possible addresses are 0 to 63.

Read access	Operator
Write access	Maintenance

No. of preambles

Navigation Expert → Communication → Configuration → No. of preambles (0217)

Description Number o preambles in the HART telegram.

User entry 5 to 20

Factory setting 5

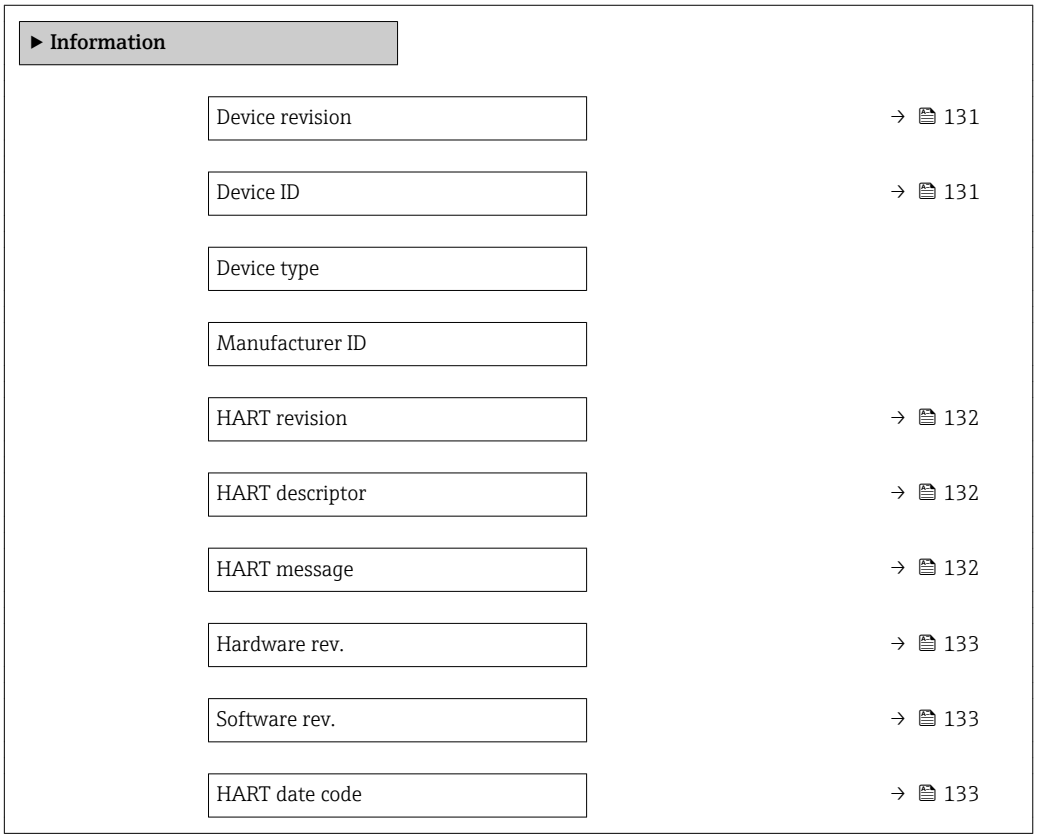
Additional information

Read access	Operator
Write access	Maintenance

3.5.4 "Information" submenu

Structure of the submenu

Navigation Expert → Communication → Information



Description of parameters

Navigation Expert → Communication → Information

Device revision

Navigation Expert → Communication → Information → Device revision (0204)

Description For registration with HART Communic. Foundation.

Additional information The device revision is used to allocate the correct Device Description file (DD) to the device.

Read access	Operator
Write access	-

Device ID

Navigation Expert → Communication → Information → Device ID (0221)

Description For identifying the device in a HART network.

Additional information In addition to the Device type and Manufacturer ID, the Device ID is part of the unique device identification (Unique ID) which characterizes each HART device unambiguously.

Read access	Operator
Write access	-

Device type

Navigation Expert → Communication → Information → Device type (0209)

Description For registration with HART Communic. Foundation.

Additional information Der Gerätetyp wird benötigt, um dem Gerät die passende Gerätebeschreibungsdatei (DD) zuzuordnen.

Lesezugriff	Operator
Schreibzugriff	-

Manufacturer ID

Navigation Expert → Communication → Information → Manufacturer ID (0259)

Description For registration with HART Communic. Foundation.

User interface 2-digit hexadecimal number

Factory setting 0x11 (for Endress+Hauser)

Additional information

Read access	Operator
Write access	-

HART revision

Navigation Expert → Communication → Information → HART revision (0205)

Description Indicates HART revision of the device.

Additional information

Read access	Operator
Write access	Maintenance

HART descriptor

Navigation Expert → Communication → Information → HART descriptor (0212)

Description Descriptor for the measuring point.

Factory setting FMR6x

Additional information

Read access	Operator
Write access	Maintenance

HART message

Navigation Expert → Communication → Information → HART message (0216)

Description HART message which is sent via the HART protocol if requested by the master.

Factory setting FMR6x

Additional information

Read access	Operator
Write access	Maintenance

Hardware rev.

Navigation Expert → Communication → Information → Hardware rev. (0206)

Description Indicates hardware revision of the device.

Additional information

Read access	Operator
Write access	-

Software rev.

Navigation Expert → Communication → Information → Software rev. (0224)

Description Indicates software revision of the device.

Additional information

Read access	Operator
Write access	-

HART date code

Navigation Expert → Communication → Information → HART date code (0202)

Description Date of the last configuration change

Additional information Datum format: YYYY-MM-DD

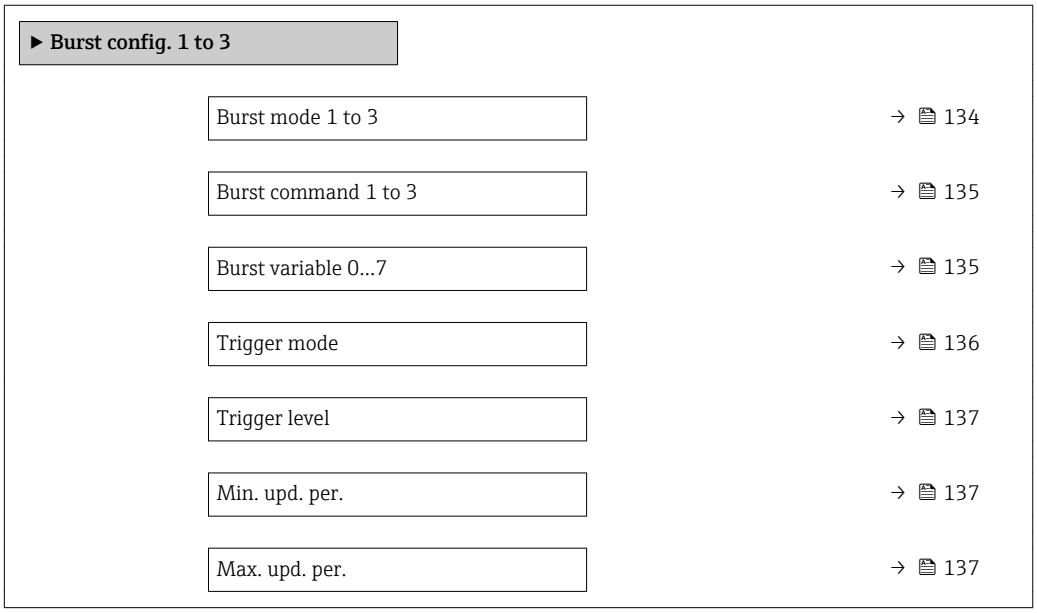
It is essential to use this datum format. Otherwise some HART commands will not function correctly.

Read access	Operator
Write access	Maintenance

3.5.5 "Burst config. 1 to 3" submenu

Structure of the submenu

Navigation Expert → Communication → Burst config. 1 to 3



Description of parameters

Navigation Expert → Communication → Burst config. 1 to 3

Burst mode

Navigation Expert → Communication → Burst config. 1 to 3 → Burst mode 1 to 3 (2032–1 to 3)

Description Switch HART burst mode for burst message on.

Selection
- Off
- On

Factory setting Off

Additional information

Read access	Operator
Write access	Maintenance

Burst command

Navigation Expert → Communication → Burst config. 1 to 3 → Burst command 1 to 3 (2031–1 to 3)

Description Select the command that is sent to the HART master.

Selection
- Primary var (PV)
- Loop Cur./%Range
- Dynamic Variable
- Dev.Vari w.statu
- Device Varibles
- Add. Dev. Status

Factory setting Loop Cur./%Range

Additional information

Read access	Operator
Write access	Maintenance

Burst variable 0...3

Navigation Expert → Communication → Burst config. 1 to 3 → Burst variable 0 (2033)

Prerequisite **Burst command (→ 135)** = **Dev.Vari w.statu** or **"Device Varibles" option**

Description Command 9, 33: assign a variable to burst variable.

Selection
- Level linearized
- Distance
- Terminal volt.
- Electronic temp.
- Abs. echo ampl.
- Relat.echo ampl.
- Area incoupling
- Abs. EOP ampl.
- Analog out. AD 1
- Analog out. AD 2
- Not used
- Percent of range
- Measur. curr.
- Primary var (PV)
- Second.var(SV)
- Tertiary var(TV)
- Quaterna.var(QV)

Factory setting Not used

Additional information

Read access	Operator
Write access	Maintenance

Burst variable 4...7

Navigation Expert → Communication → Burst config. 1 to 3 → Burst variable 4 (2037)

Prerequisite **Burst command (→ 135) = Dev.Vari w.statu**

Description Command 33: assign a variable to burst variable.

Selection
- Level linearized
- Distance
- Terminal volt.
- Electronic temp.
- Abs. echo ampl.
- Relat.echo ampl.
- Area incoupling
- Abs. EOP ampl.
- Analog out. AD 1
- Analog out. AD 2
- Not used
- Percent of range
- Measur. curr.
- Primary var (PV)
- Second.var(SV)
- Tertiary var(TV)
- Quaterna.var(QV)

Factory setting Not used

Additional information

Read access	Operator
Write access	Maintenance

Trigger mode

Navigation Expert → Communication → Burst config. 1 to 3 → Trigger mode (2044–1 to 3)

Description Select the event that triggers the burst message.

Selection
- Continuous
- Window
- Rising
- Falling
- On change

Factory setting Continuous

Additional information

Read access	Operator
Write access	Maintenance

Trigger level

Navigation Expert → Communication → Burst config. 1 to 3 → Trigger level (2043–1 to 3)

Prerequisite **Trigger mode (→ 136)** = **Window**, **Rising** or **Falling**

Description Define point of time when burst message is sent.

User entry Signed floating-point number

Factory setting 2.0E-38

Additional information

Read access	Operator
Write access	Maintenance

Min. upd. per.

Navigation Expert → Communication → Burst config. 1 to 3 → Min. upd. per. (2042–1 to 3)

Description Min. time span between 2 responses of one message.

User entry Positive integer

Factory setting 1 000 ms

Additional information

Read access	Operator
Write access	Maintenance

Max. upd. per.

Navigation Expert → Communication → Burst config. 1 to 3 → Max. upd. per. (2041–1 to 3)

Prerequisite **Trigger mode (→ 136)** = **Rising**, **Falling** or **On change**

Description Max. time span between 2 responses of one message.

User entry Positive integer

Factory setting 2 000 ms

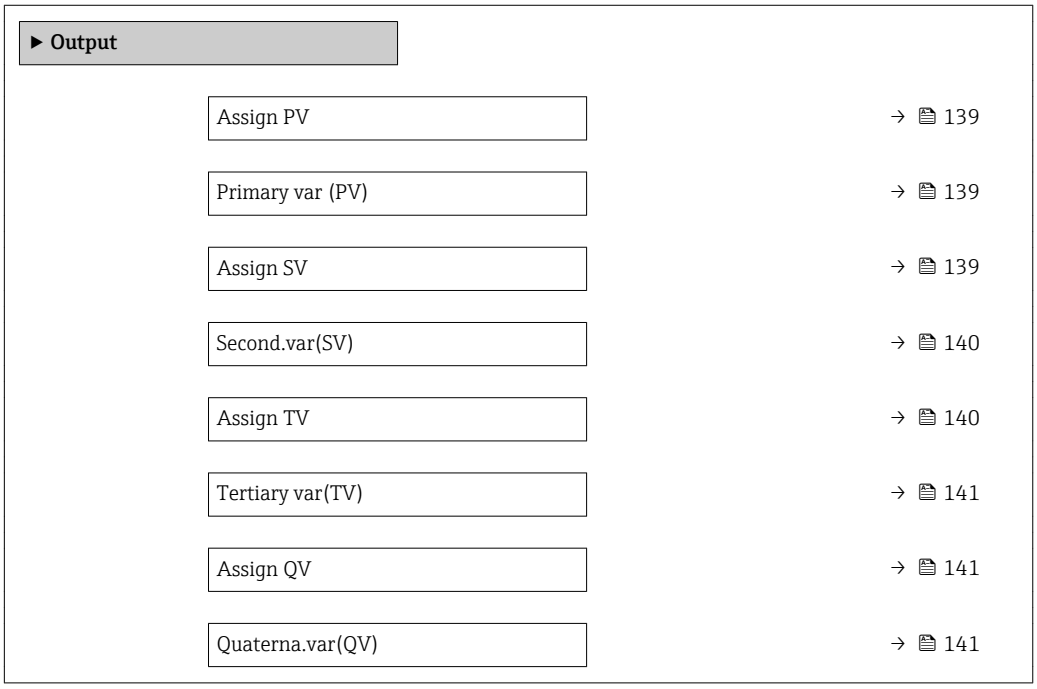
Additional information

Read access	Operator
Write access	Maintenance

3.5.6 "Output" submenu

Structure of the submenu

Navigation Expert → Communication → Output



Description of parameters

Navigation Expert → Communication → Output

Assign PV

Navigation Expert → Communication → Output → Assign PV (0234)

Selection
- Level linearized
- Distance
- Electronic temp.
- Relat.echo ampl.
- Area incoupling
- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4

Factory setting Level linearized

Additional information

Read access	Operator
Write access	Maintenance

Primary var (PV)

Navigation Expert → Communication → Output → Primary var (PV) (0201)

Description Displays primary HART variable (PV).

Additional information

Read access	Operator
Write access	-

Assign SV

Navigation Expert → Communication → Output → Assign SV (0235)

Description Select measuring variable for secondary HART variable (SV).

Selection
- Level linearized
- Distance
- Terminal volt.
- Electronic temp.
- Abs. echo ampl.
- Abs. EOP ampl.
- Relat.echo ampl.
- Area incoupling

- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4
- Not used

Factory setting Distance

Additional information

Read access	Operator
Write access	Maintenance

Second.var(SV)

Navigation Expert → Communication → Output → Second.var(SV) (0226)

Description Displays secondary HART variable (SV).

Additional information

Read access	Operator
Write access	-

Assign TV

Navigation Expert → Communication → Output → Assign TV (0236)

Description Select measuring variable for third HART variable (TV).

Selection

- Level linearized
- Distance
- Terminal volt.
- Electronic temp.
- Abs. echo ampl.
- Abs. EOP ampl.
- Relat.echo ampl.
- Area incoupling
- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4
- Not used

Factory setting Abs. echo ampl.

Additional information

Read access	Operator
Write access	Maintenance

Tertiary var(TV)

Navigation Expert → Communication → Output → Tertiary var(TV) (0228)

Description Displays third HART variable (TV).

Additional information

Read access	Operator
Write access	-

Assign QV

Navigation Expert → Communication → Output → Assign QV (0237)

Description Select measuring variable for fourth HART variable (QV).

Selection
- Level linearized
- Distance
- Terminal volt.
- Electronic temp.
- Abs. echo ampl.
- Abs. EOP ampl.
- Relat.echo ampl.
- Area incoupling
- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4
- Not used

Factory setting Relat.echo ampl.

Additional information

Read access	Operator
Write access	Maintenance

Quaterna.var(QV)

Navigation Expert → Communication → Output → Quaterna.var(QV) (0203)

Description Displays fourth HART variable (QV).

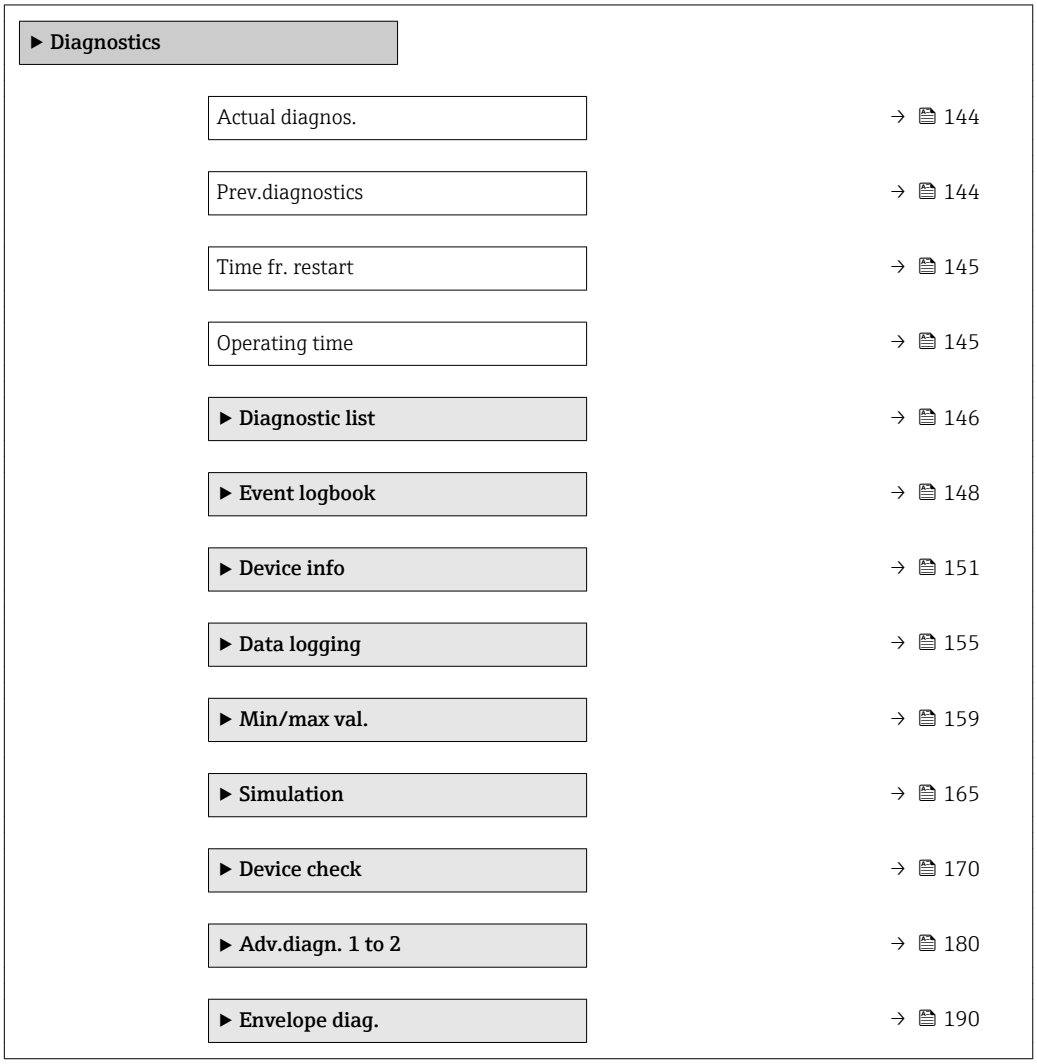
Additional information

Read access	Operator
Write access	-

3.6 "Diagnostics" submenu

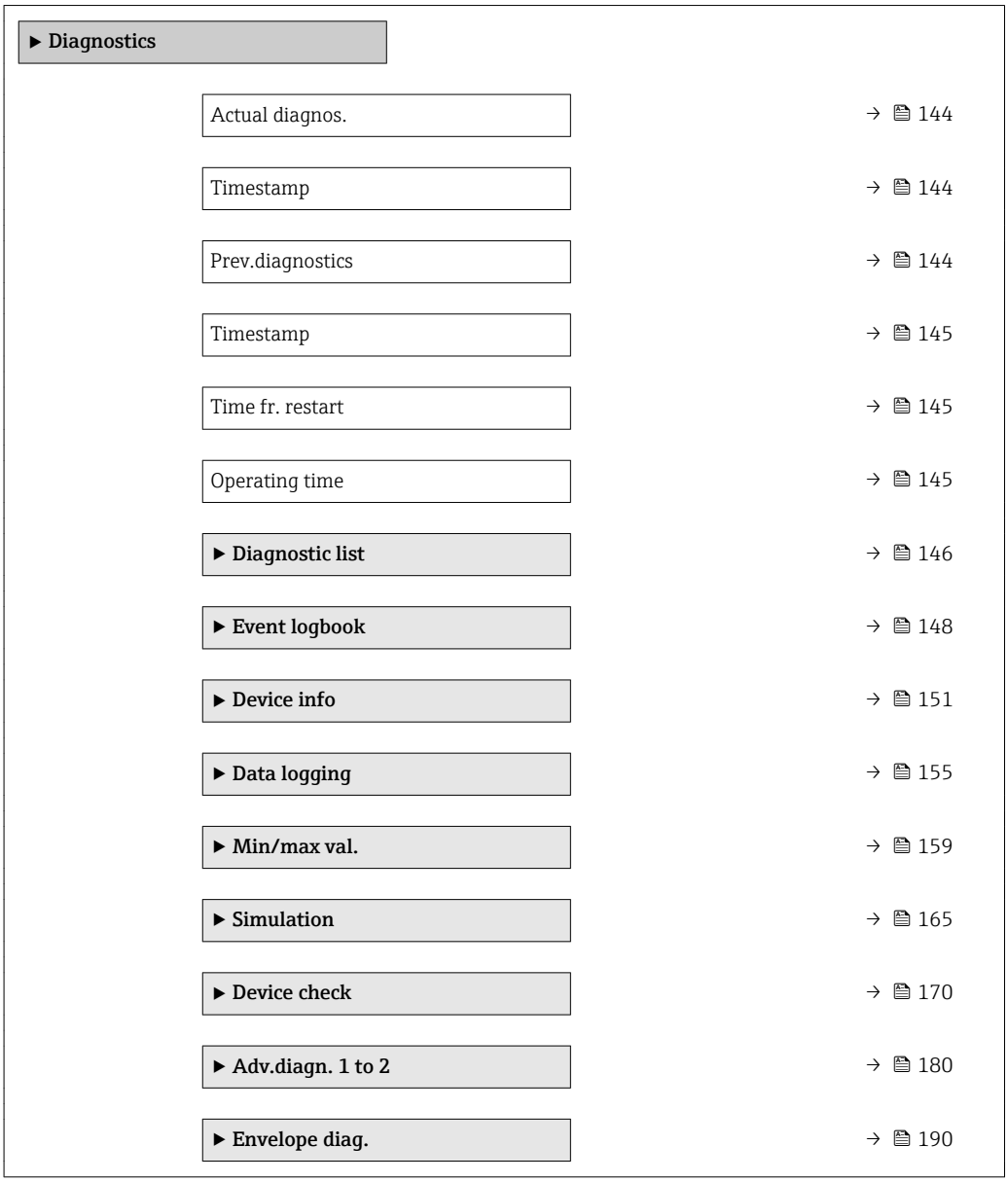
3.6.1 Structure of the submenu on the local display

Navigation Expert → Diagnostics



3.6.2 Structure of the submenu in an operating tool

Navigation Expert → Diagnostics



3.6.3 Description of parameters

Navigation Expert → Diagnostics

Actual diagnos.

Navigation Expert → Diagnostics → Actual diagnos. (0691)

Description Displays current diagnostic message.

Additional information The display consists of:
- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text

If several messages are active at the same time, the messages with the highest priority is displayed.

Information on what is causing the message, and remedy measures, can be viewed via the ⓘ symbol on the display.

Read access	Operator
Write access	-

Timestamp

Navigation Expert → Diagnostics → Timestamp (0667)

Description Timestamp for the current diagnostic message.

Additional information

Read access	Operator
Write access	-

Prev.diagnostics

Navigation Expert → Diagnostics → Prev.diagnostics (0690)

Description Displays the last diagnostic message which has been active before the current message.

Additional information The display consists of:
- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text

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.

Read access	Operator
Write access	-

Timestamp

Navigation Expert → Diagnostics → Timestamp (0672)

Description Timestamp of the previous diagnostic message.

Additional information

Read access	Operator
Write access	-

Time fr. restart

Navigation Expert → Diagnostics → Time fr. restart (0653)

Description Displays the time the device has been in operation since the last device restart.

Additional information

Read access	Operator
Write access	-

Operating time

Navigation Expert → Diagnostics → Operating time (0652)

Description Indicates how long device has been in operation.

Additional information *Maximum time*

9 999 d (≈ 27 years)

Read access	Operator
Write access	-

3.6.4 "Diagnostic list" submenu

Structure of the submenu on the local display

Navigation Expert → Diagnostics → Diagnostic list

▶ **Diagnostic list**		
	Diagnostics 1 to 5	→ 147

Structure of the submenu in an operating tool

Navigation Expert → Diagnostics → Diagnostic list

▶ **Diagnostic list**		
	Diagnostics 1 to 5	→ 147
	Timestamp 1 to 5	→ 147

Description of parameters

Navigation Expert → Diagnostics → Diagnostic list

Diagnostics 1 to 5

Navigation Expert → Diagnostics → Diagnostic list → Diagnostics 1 (0692)

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

Read access	Operator
Write access	-

Timestamp 1 to 5

Navigation Expert → Diagnostics → Diagnostic list → Timestamp (0683)

Description Timestamp of the diagnostic message.

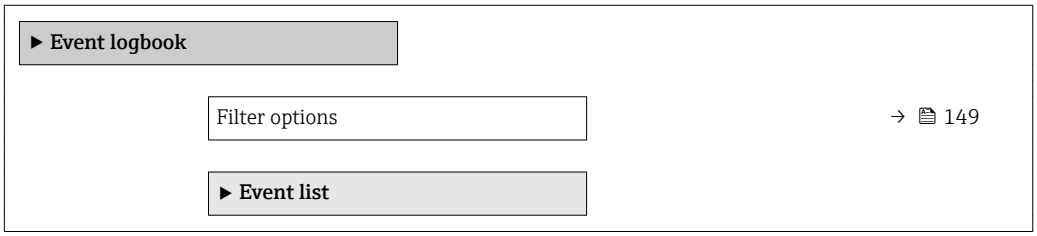
Additional information

Read access	Operator
Write access	-

3.6.5 "Event logbook" submenu

Structure of the submenu on the local display

Navigation Expert → Diagnostics → Event logbook



Description of parameters

Navigation Expert → Diagnostics → Event logbook

Filter options

Navigation Expert → Diagnostics → Event logbook → Filter options (0705)

Description Define category of messages shown in Events list.

Selection
- All
- Failure (F)
- Funct. check (C)
- Out of spec. (S)
- Mainten. req.(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.

Read access	Operator
Write access	Maintenance

"Event list" submenu

The **Event list** submenu (→ 150) is only available when operating via the local display.

The **Event list** submenu doesn't contain any parameters but only the list of events of the category selected in the **Filter options** parameter. A maximum of 100 event messages is displayed in chronological order.

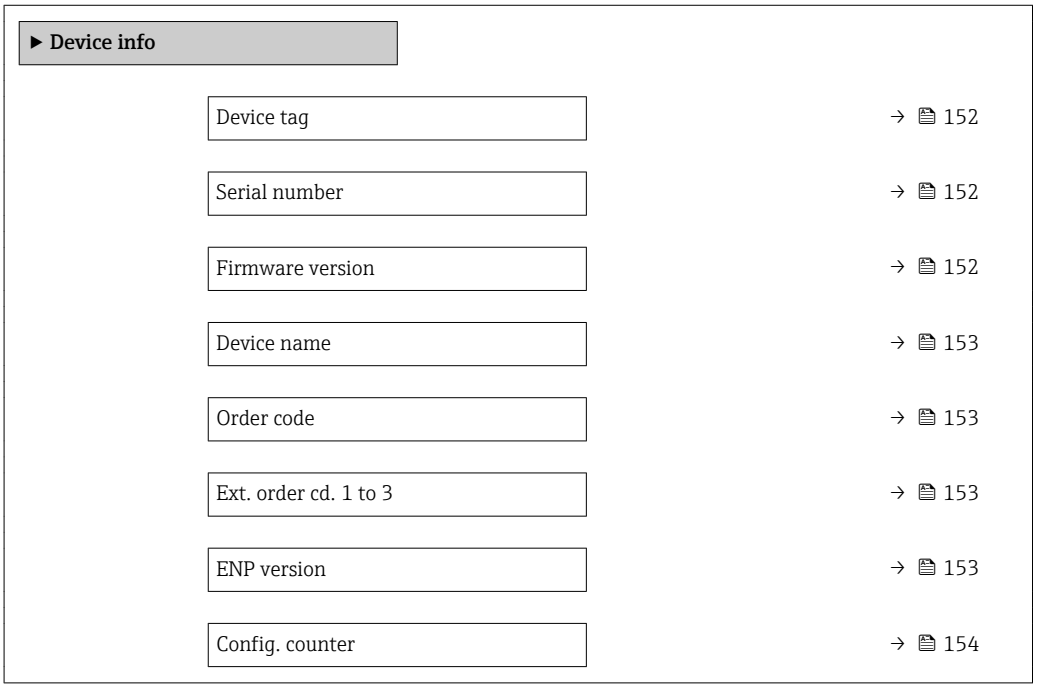
The following status symbols indicate, whether an event has appeared or disappeared at the time stated:
- : Event appeared
- : Event disappeared

Remedy measures concerning the cause of the message can be called up via the symbol on the display.

3.6.6 "Device info" submenu

Structure of the submenu

Navigation Expert → Diagnostics → Device info



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 FMR6x

Additional information

Read access	Operator
Write access	-

Serial number

Navigation Expert → Diagnostics → Device info → Serial number (0009)

Description Shows the serial number of the measuring device.

Additional information

Uses of the serial number
- 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

The serial number is also indicated on the nameplate.

Read access	Operator
Write access	-

Firmware version

Navigation Expert → Diagnostics → Device info → Firmware version (0010)

Description Shows the device firmware version installed.

User interface xx.yy.zz

Additional information For firmware versions differing only in the last two digits ("zz") there is no difference concerning functionality or operation.

Read access	Operator
Write access	-

Device name

Navigation Expert → Diagnostics → Device info → Device name (0013)

Description Shows the name of the transmitter.

Additional information

Read access	Operator
Write access	-

Order code

Navigation Expert → Diagnostics → Device info → Order code (0008)

Description Shows the device order code.

Additional information The order code is generated from the extended roder code, which defines all device features of the product structure. In contrast, the device features can not be read directly from the order code.

Read access	Operator
Write access	Service

Ext. order cd. 1 to 3

Navigation Expert → Diagnostics → Device info → Ext. order cd. 1 (0023)

Description Display 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.

Read access	Operator
Write access	Service

ENP version

Navigation Expert → Diagnostics → Device info → ENP version (0012)

Description Shows the version of the electronic nameplate.

User interface xx.yy.zz

Additional information

Read access	Operator
Write access	-

Config. counter

Navigation Expert → Diagnostics → Device info → Config. counter (0233)

Description Displays configuration counter.

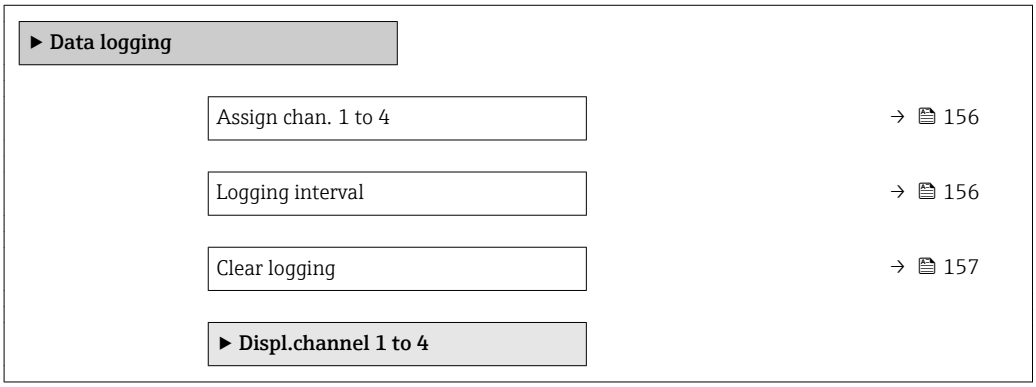
Additional information

Read access	Operator
Write access	-

3.6.7 "Data logging" submenu

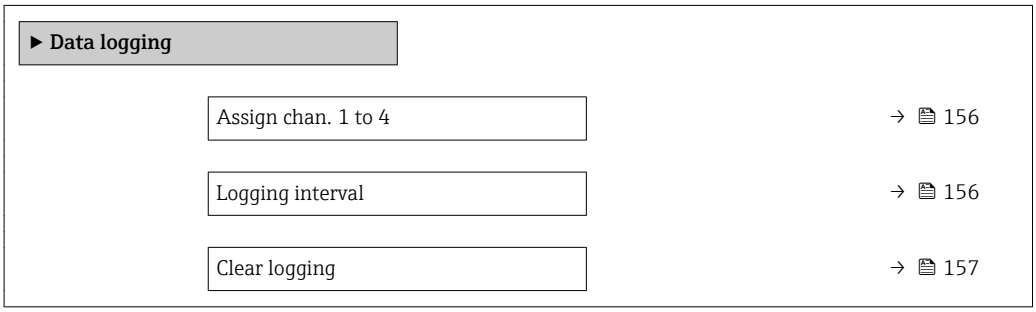
Structure of the submenu on the local display

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 chan. 1 to 4

Navigation Expert → Diagnostics → Data logging → Assign chan. 1 (0851)

Description Assign a process variable to logging channel.

Selection
- Off
- Level linearized
- Distance
- Curr.output 1
- Measur. curr.
- Curr.output 2 *
- Terminal volt.
- Electronic temp.
- Analog out. AD 1
- Analog out. AD 2
- Analog out. AD 3
- Analog out. AD 4

Factory setting Off

Additional information A total of 1000 measured values can be logged. This means:
- 1000 data points if 1 logging channel is used
- 500 data points if 2 logging channels are used
- 333 data points if 3 logging channels are used
- 250 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 1000, 500, 333 or 250 measured values are always in the log (ring memory principle).

The logged data are deleted if a new option is selected in this parameter.

Read access	Operator
Write access	Maintenance

Logging interval

Navigation Expert → Diagnostics → Data logging → Logging interval (0856)
Expert → Diagnostics → Data logging → Logging interval (0856)

Description Defines the logging interval for data logging.

User entry 1.0 to 3 600.0 s

* Visibility depends on order options or device settings

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: $T_{log} = 1000 \cdot t_{log}$
- If 2 logging channels are used: $T_{log} = 500 \cdot t_{log}$
- If 3 logging channels are used: $T_{log} = 333 \cdot t_{log}$
- If 4 logging channels are used: $T_{log} = 250 \cdot t_{log}$

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
- $T_{log} = 1000 \cdot 1\ s = 1\,000\ s \approx 16.5\ min$
- $T_{log} = 1000 \cdot 10\ s = 1\,000\ s \approx 2.75\ h$
- $T_{log} = 1000 \cdot 80\ s = 80\,000\ s \approx 22\ h$
- $T_{log} = 1000 \cdot 3\,600\ s = 3\,600\,000\ s \approx 41\ d$

Read access	Operator
Write access	Maintenance

Clear logging

Navigation
Expert → Diagnostics → Data logging → Clear logging (0855)
Expert → Diagnostics → Data logging → Clear logging (0855)

Description Clear the entire logging data.

Selection
- Cancel
- Clear data

Factory setting Cancel

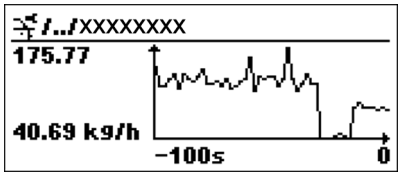
Additional information

Read access	Operator
Write access	Maintenance

"Displ.channel 1 to 4" submenu

The **Displ.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 **Displ.channel 1 to 4** submenu displays the measured value trend of the respective logging channel.



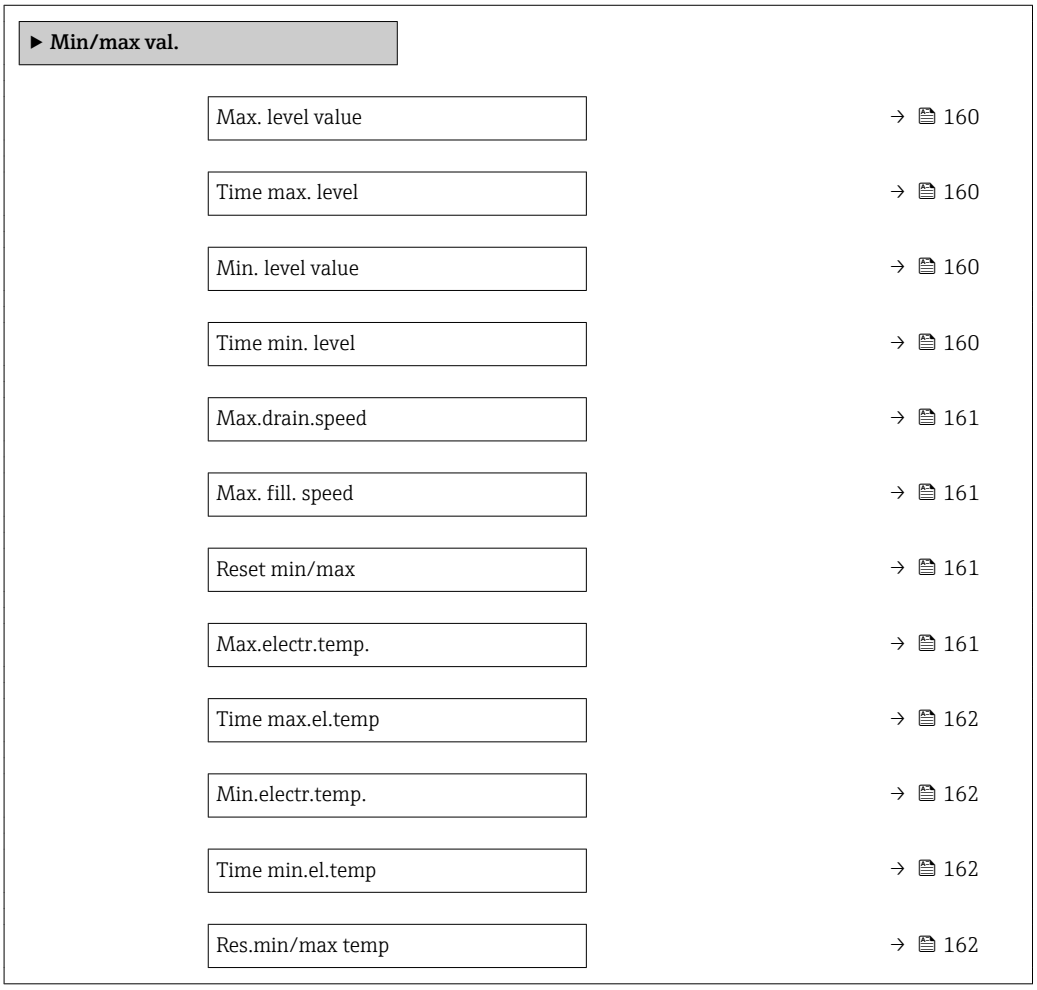
- x-axis: displays 125 to 500 measured values of a process variable (the number of values depending on the number of selected channels).
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

To quit the diagram and to return to the operating menu, press ⊞ and ⊟ simultaneously.

3.6.8 "Min/max val." submenu

Structure of the submenu

Navigation Expert → Diagnostics → Min/max val.



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.

Additional information

Read access	Operator
Write access	-

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.

Additional information

Read access	Operator
Write access	-

Min. level value

Navigation Expert → Diagnostics → Min/max val. → Min. level value (2358)

Description Displays minimum level measured in the past.

Additional information

Read access	Operator
Write access	-

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.

Additional information

Read access	Operator
Write access	-

Max.drain.speed

Navigation Expert → Diagnostics → Min/max val. → Max.drain.speed (2320)

Description Displays maximum draining speed measured in the past.

Additional information

Read access	Operator
Write access	-

Max. fill. speed

Navigation Expert → Diagnostics → Min/max val. → Max. fill. speed (2360)

Description Displays maximum filling speed measured in the past.

Additional information

Read access	Operator
Write access	-

Reset min/max

Navigation Expert → Diagnostics → Min/max val. → Reset min/max (2324)

Description Select which min/max values are to be reset.

Selection
- None
- Drain/fill speed
- Level
- Reset all

Factory setting None

Additional information

Read access	Operator
Write access	Maintenance

Max.electr.temp.

Navigation Expert → Diagnostics → Min/max val. → Max.electr.temp. (12506)

Description Displays maximum electronics temperature measured in the past.

Additional information

Read access	Operator
Write access	-

Time max.el.temp

Navigation Expert → Diagnostics → Min/max val. → Time max.el.temp (12507)

Description Displays operating time at which the maximum electronics temperature has been obtained.

Additional information

Read access	Operator
Write access	-

Min.electr.temp.

Navigation Expert → Diagnostics → Min/max val. → Min.electr.temp. (12508)

Description Displays minimum electronics temperature measured in the past.

Additional information

Read access	Operator
Write access	-

Time min.el.temp

Navigation Expert → Diagnostics → Min/max val. → Time min.el.temp (12509)

Description Displays operating time at which the minimum electronics temperature has been obtained.

Additional information

Read access	Operator
Write access	-

Res.min/max temp

Navigation Expert → Diagnostics → Min/max val. → Res.min/max temp (12510)

Description Select which min/max values are to be reset.

User interface
- None
- Electronic temp.
- Reset all

Factory setting None

Additional information

Read access	Operator
Write access	Service

3.6.9 "Simulation" submenu

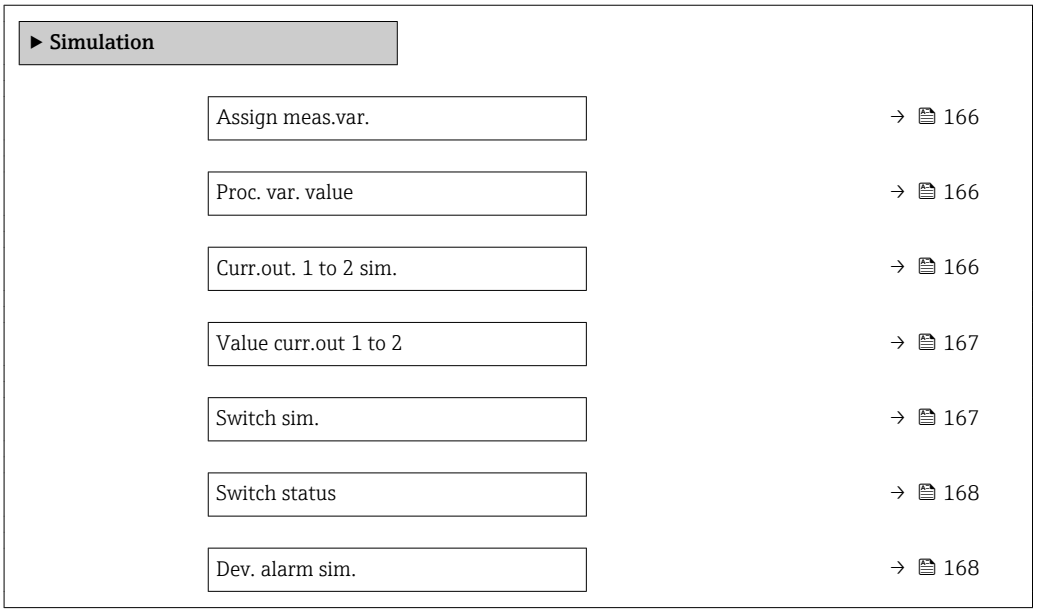
The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	▪ Assign meas.var. (→ 🖹 166) ▪ Proc. var. value (→ 🖹 166)
Specific value of the output current	▪ Curr.out. sim. (→ 🖹 166) ▪ Value curr.out (→ 🖹 167)
Specific state of the switch output	▪ Switch sim. (→ 🖹 167) ▪ Switch status (→ 🖹 168)
Existence of an alarm	Dev. alarm sim. (→ 🖹 168)

Structure of the submenu

Navigation Expert → Diagnostics → Simulation



Description of parameters

Navigation Expert → Diagnostics → Simulation

Assign meas.var.

Navigation Expert → Diagnostics → Simulation → Assign meas.var. (2328)

Selection
- Off
- Level
- Level linearized

Factory setting Off

Additional information
- The value of the variable to be simulated is defined in the **Proc. var. value** parameter (→ 166).
- If **Assign meas.var.** ≠ **Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

Read access	Maintenance
Write access	Maintenance

Proc. var. value

Navigation Expert → Diagnostics → Simulation → Proc. var. value (2329)

Prerequisite **Assign meas.var. (→ 166) ≠ Off**

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.

Read access	Operator
Write access	Maintenance

Curr.out. 1 to 2 sim.

Navigation Expert → Diagnostics → Simulation → Curr.out. 1 to 2 sim. (0354–1 to 2)

Description Switch simulation of the current output on and off.

Selection
- Off
- On

Factory setting Off

Additional information An active simulation is indicated by a diagnostic message of the *Function check (C)* category.

Read access	Operator
Write access	Maintenance

Value curr.out 1 to 2

Navigation Expert → Diagnostics → Simulation → Value curr.out 1 to 2 (0355–1 to 2)

Prerequisite **Curr.out. sim. (→ 166) = On**

Description Defines the value of the simulated output current.

User entry 3.59 to 22.5 mA

Factory setting 3.59 mA

Additional information The current output assumes the value specified in this parameter. In this way, users can verify the correct adjustment of the current output and the correct function of connected control units.

Read access	Operator
Write access	Maintenance

Switch sim.

Navigation Expert → Diagnostics → Simulation → Switch sim. (0462)

Description Switch simulation of the switch output on and off.

Selection
- Off
- On

Factory setting Off

Additional information

Read access	Operator
Write access	Maintenance

Switch status

Navigation Expert → Diagnostics → Simulation → Switch status (0463)

Prerequisite **Switch sim. (→ 167)** = **On**

Description Current status of the switch output.

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.

Read access	Operator
Write access	Maintenance

Dev. alarm sim.

Navigation Expert → Diagnostics → Simulation → Dev. alarm sim. (0654)

Description Switch the device alarm on and 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 Failure mode sim**.

Read access	Operator
Write access	Maintenance

Diag. event sim.

Navigation Expert → Diagnostics → Simulation → Diag. event sim. (0737)

Description Select the diagnostic event to be simulated. Note: To terminate the simulation, select 'Off'.

Factory setting Off

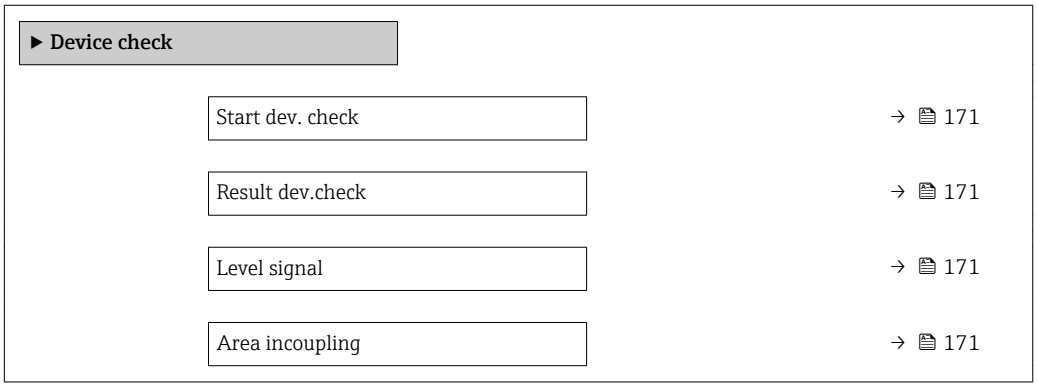
Additional information When operated via the local display, the selection list can be filtered according to the event categories (**Event category** parameter).

Read access	Operator
Write access	Maintenance

3.6.10 "Device check" submenu

Structure of the submenu

Navigation Expert → Diagnostics → Device check



Description of parameters

Navigation Expert → Diagnostics → Device check

Start dev. check

Navigation Expert → Diagnostics → Device check → Start dev. check (12481)

Description **Yes** option starts a device check.

Selection
- No
- Yes

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

Result dev.check

Navigation Expert → Diagnostics → Device check → Result dev.check (12482)

Additional information

Read access	Operator
Write access	-

Level signal

Navigation Expert → Diagnostics → Device check → Level signal (12483)

Description Shows the result of the device check for the level signal.

Additional information

Read access	Operator
Write access	-

Area incoupling

Navigation Expert → Diagnostics → Device check → Area incoupling (12525)

Description Indicates the area of the ringing signal.

Additional information

Read access	Operator
Write access	-

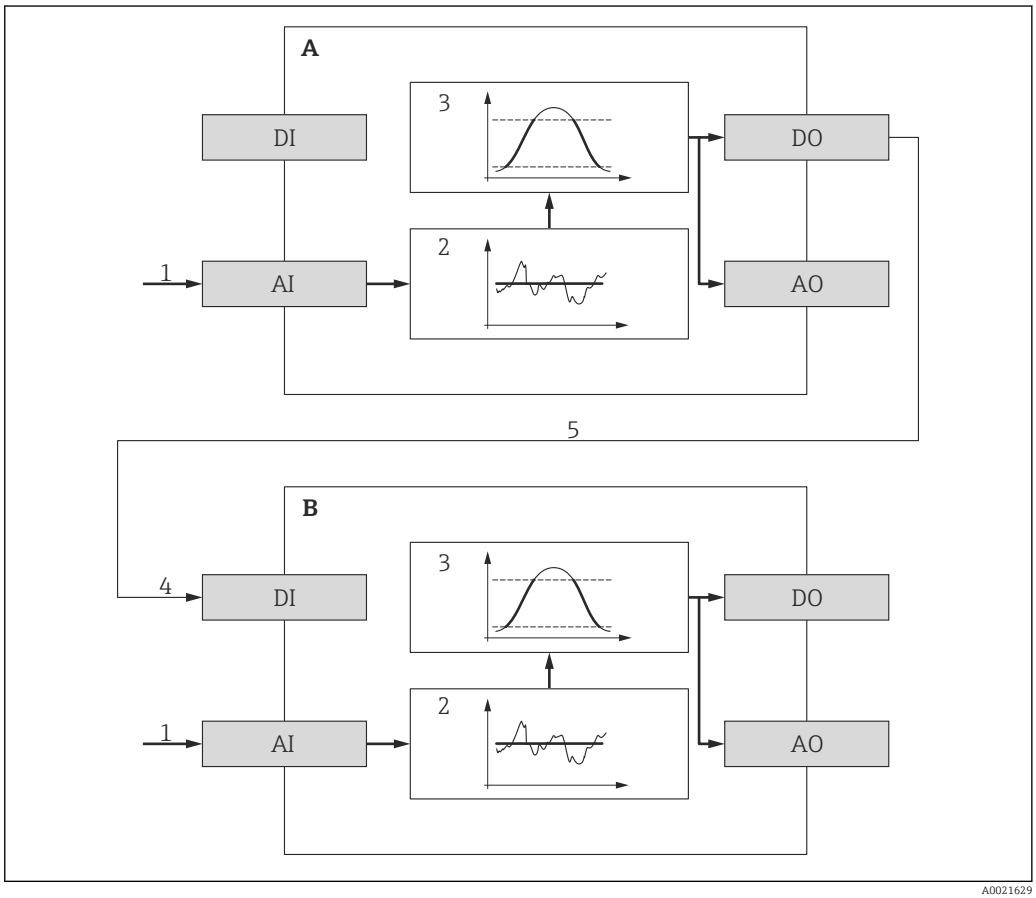
3.6.11 "Adv.diagn. 1 to 4" submenu

Mode of operation

The Advanced Diagnostics offers additional options to monitor the process. The device contains four 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 another Advanced Diagnostic block and thus it is possible to combine the two results by the logical operators AND or OR.



38 *Combined Advanced Diagnostic blocks*

A Advanced Diagnsotics 1
B Advanced Diagnsotics 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 signal (→ 181)
Linking the digital input to the digital output of the other block.	▪ Link AD to (→ 181) ▪ Link. logic AD (→ 182)
Calculation of one of the following quantities for a freely configurable sampling interval: ▪ Maximum ▪ Minimum ▪ Mean ▪ Std. deviation ▪ Diff.Max. - Min. ▪ Slope	▪ Sample time (→ 182) ▪ Calc. type (→ 182) ▪ Calc. unit (→ 184)
Drag indicator for the calculated quantity	▪ Maximum value (→ 186) ▪ Minimum value (→ 187) ▪ Reset min/max (→ 187)
Limit check	▪ Check mode (→ 183) ▪ Upper limit (→ 185) ▪ Lower limit (→ 185) ▪ Hysteresis (→ 186)
Reaction in case of a limit violation	▪ Application (→ 187) ▪ Stat. AD event (→ 188) ▪ Evt behaviour (→ 188) ▪ Alarm delay (→ 189)

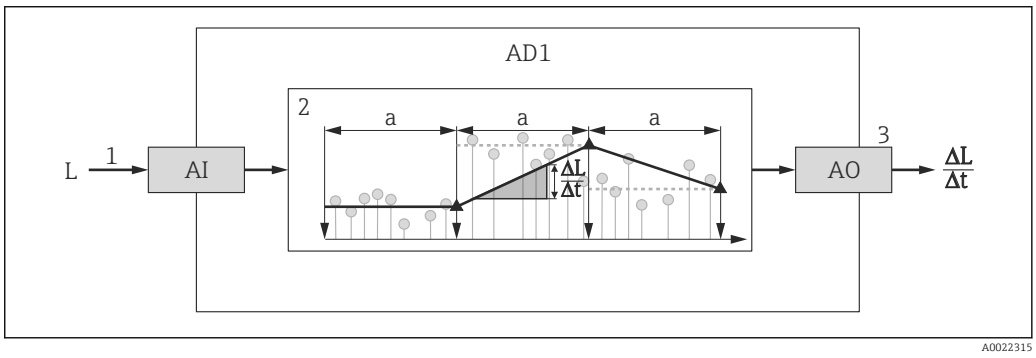
Example 1: Draining/filling speed

Only one Advanced Diagnostic Block is needed for this application. In the example this is **Adv.diagn. 1**.

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.



39 *Calculation of the draining or filling speed*

1 *Allocation of the (linearized) level to Advanced Diagnsotic Block AD1*
2 *Calculation of the draining or filling speed ΔL/Δt within the sampling interval a.*
3 *ΔL/Δt 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 signal 1** = **Level linearized**.
2. Define **Sample time 1** in accordance with the expected draining or filling speed.
3. Select **Calc. type 1** = **Slope**.
4. Select a suitable option in **Calc. unit 1**, e.g.: **"Level unit" / s**

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**
- **Stat. AD event** (→ 188)
- **Evt behaviour** (→ 188)
- **Alarm delay** (→ 189)

With this configuration, the **Maximum value 1** and **Minimum value 1** drag indicators display the maximum or minimum value the rate of lavel 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 curr. (→ 110)** = **Analog out. AD 1**.
3. Select **Turn down (→ 113)** = **On**.
4. Enter maximum expected draining speed (negative value) in **4 mA value (→ 114)**.
5. Enter maximum expected filling speed (positive value) in **20 mA value (→ 114)**.

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:

$$\frac{\Delta L}{\Delta t} = \frac{5W_4 - W_{20}}{4} + \frac{W_{20} - W_4}{16\ mA}\ I$$

A0022342

Where:
- $\Delta L/\Delta t$: Rate of level change [5]
- W_4 : **4 mA value (→ 114)**
- W_{20} : **20 mA value (→ 114)**
- I: Output current

In the case of a constant level ($\Delta L/\Delta t = 0$) the current is:

$$I_0 = 4\ mA - \frac{W_4}{W_{20} - W_4}\ 16\ mA$$

A0022343

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 (→ 139)** = **Analog out. AD 1**.

With this configuration, the **Primary var (PV)** parameter (→ 139) 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.

5) Negative values: draining speed; Positive values: filling speed

Example 2: Foam detection

For devices with Heartbeat Monitoring functionality, the foam detection can be configured by the corresponding wizard in FieldCare, DeviceDare, PACTware or a DTM based process control system. In this case all settings described below are automatically performed by the wizard.

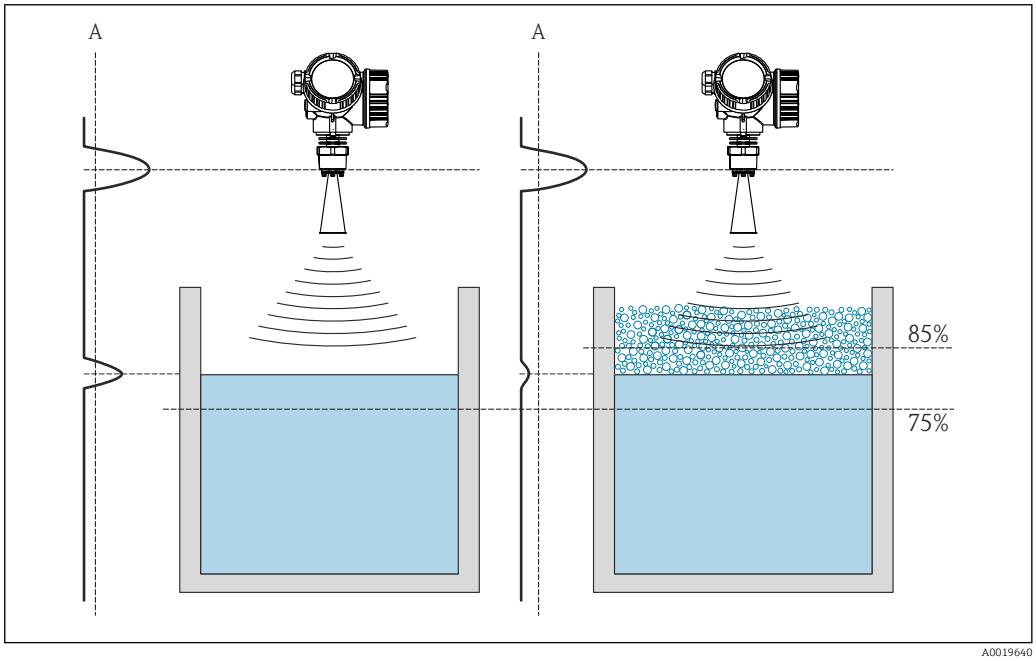
Two Advanced Diagnostic Blocks are required for this application. In the example **Adv.diagn. 1** and **Adv.diagn. 2** are used.

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 %.



40 *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 **Adv.diagn. 1** submenu (→ 180) submenu as follows:

1. Navigate to the **Adv.diagn. 1** submenu (→ 180)
2. Select **Assign signal 1** = **Level linearized**.
3. Select **Check mode 1** = **Out of range**
4. Set **Upper limit 1** = 85 %.
5. Set **Lower limit 1** = 75 %.

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 **Adv.diagn. 2** submenu (→ 🖹 180) as follows:

1. Select **Assign signal 2** = **Relat.echo ampl.**.
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 **Calc. 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 **Adv.diagn. 2** submenu (→ 🖹 180):

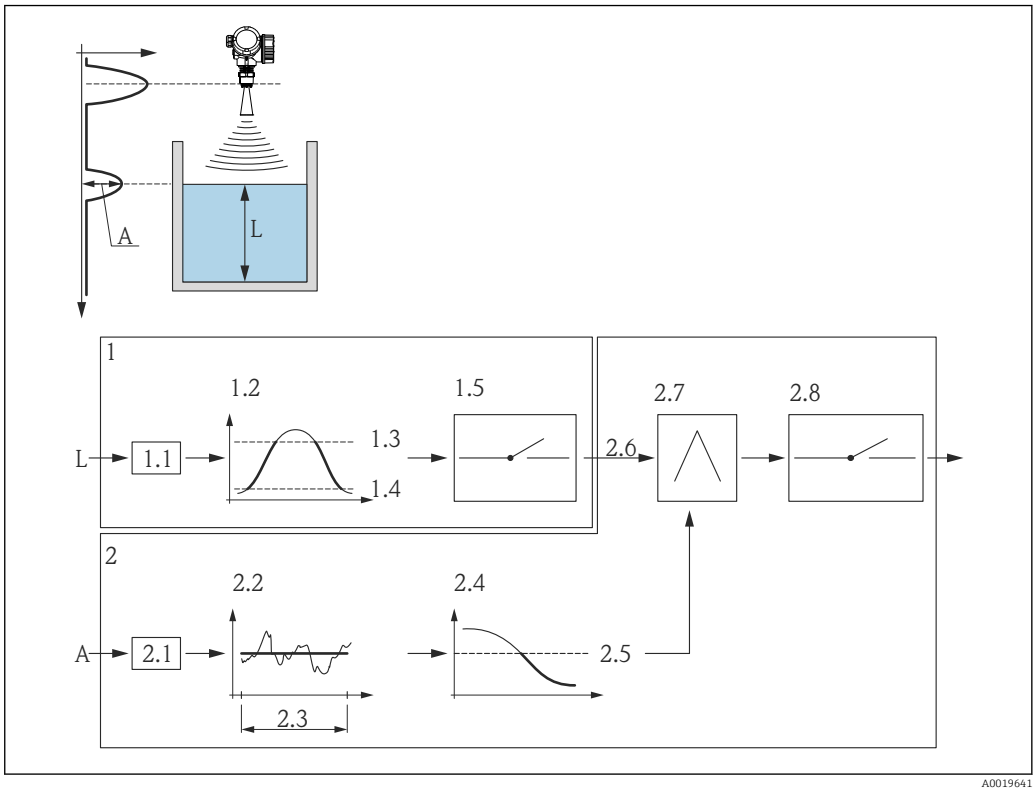
1. Select **Link AD 2 to** = **Digital out AD 1**.
2. **Select Link. logic AD 2** = **AND**.

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 **Adv.diagn. 2** can be linked to the switch output of the device:

Expert → Output → Switch output → Assign status (0485) = Digital out AD 2

Overview: Foam detection with the advanced diagnostics

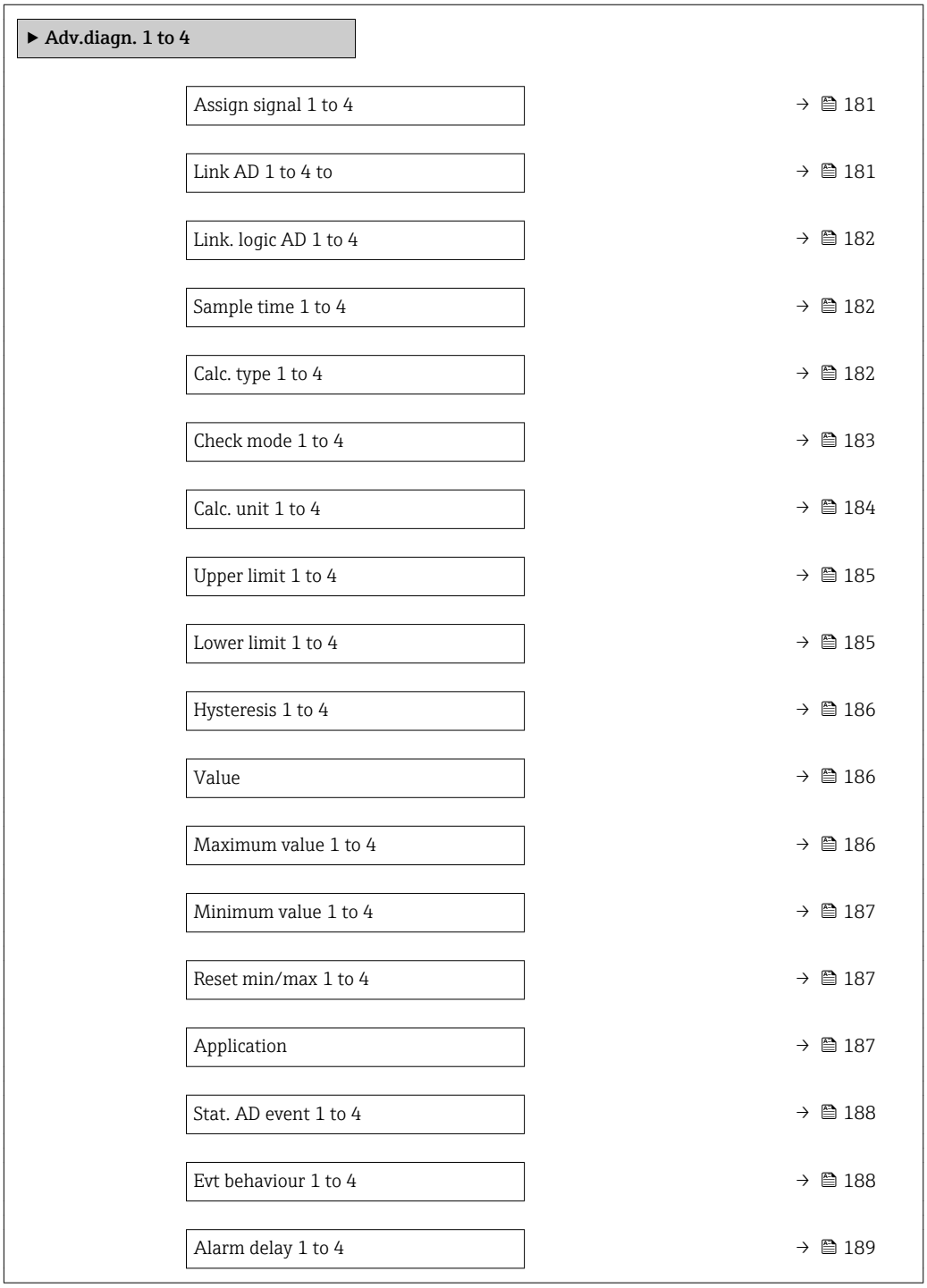


41 *Configuration of the Advanced Diagnostics for foam detection*

L Level
A Amplitude
1 Advanced diagnostics 1: Monitoring the level
1.1 "Assign signal 1" = "Relat.echo ampl."
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 signal 2" = "Relat.echo ampl."
2.2 "Calc. 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 out AD 1"
2.7 "Link. logic AD 2" = "AND"
2.8 Digital output of Advanced Diagnostics 2

Structure of the submenu

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4



Description of parameters

Navigation Expert → Diagnostics → Adv.diagn. 1 to 2

Assign signal 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Assign signal 1 to 4 (11179–1 to 4)

Description Allocate a measuring variable to the Advanced Diagnostic Block.

Selection
- None
- Level linearized
- Distance
- Unfiltered distance
- Electronic temperature
- Relative echo amplitude
- Absolute echo amplitude
- Noise of signal
- Measured current
- Terminal voltage

Factory setting None

Additional information

Read access	Operator
Write access	Maintenance

Link AD 1 to 4 to

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Link AD 1 to 4 to (11180–1 to 4)

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 out AD 1
- Digital out AD 2
- Digital out AD 3
- Digital out AD 4

Factory setting None

Additional information

Read access	Maintenance
Write access	Maintenance

Link. logic AD 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Link. logic AD 1 to 4 (11181–1 to 4)

Prerequisite **Link AD to (→ 181) ≠ None**

Description Select linking logic between the two Advanced Diagnostic Blocks.

Selection
- AND
- OR

Factory setting AND

Additional information

Read access	Operator
Write access	Maintenance

Sample time 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Sample time 1 to 4 (11187–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Specify sampling interval for the calculation.

User entry 1 to 3 600 s

Factory setting 10 s

Additional information

Read access	Operator
Write access	Maintenance

Calc. type 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Calc. type 1 to 4 (11174–1 to 4)

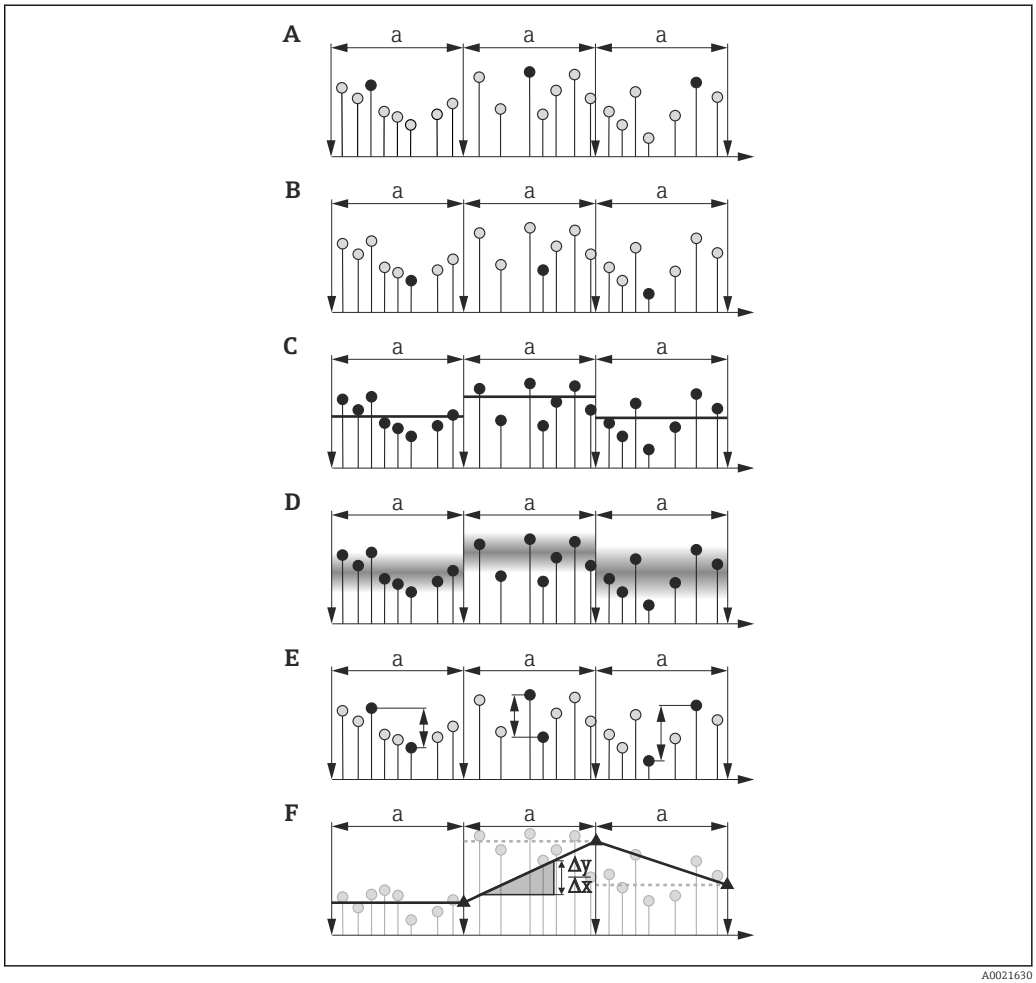
Prerequisite **Assign signal (→ 181) ≠ None**

Description Select quantity to be calculated from the measured variable.

Selection
- Off
- Maximum
- Minimum
- Mean
- Std. deviation
- Diff.Max. - Min.
- Slope

Factory setting Off

Additional information



42 *Options of the "Calc. type " parameter*

a Sample time (→ 182)
A "Calc. type " = "Maximum"
B "Calc. type " = "Minimum"
C "Calc. type " = "Mean"
D "Calc. type " = "Std. deviation"
E "Calc. type " = "Diff.Max. - Min."
F "Calc. type " = "Slope"

The calculation is performed based on the sampling interval defined in the **Sample time** parameter (→ 182).

Read access	Operator
Write access	Maintenance

Check mode 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Check mode 1 to 4 (11175–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Define check mode for limit monitoring.

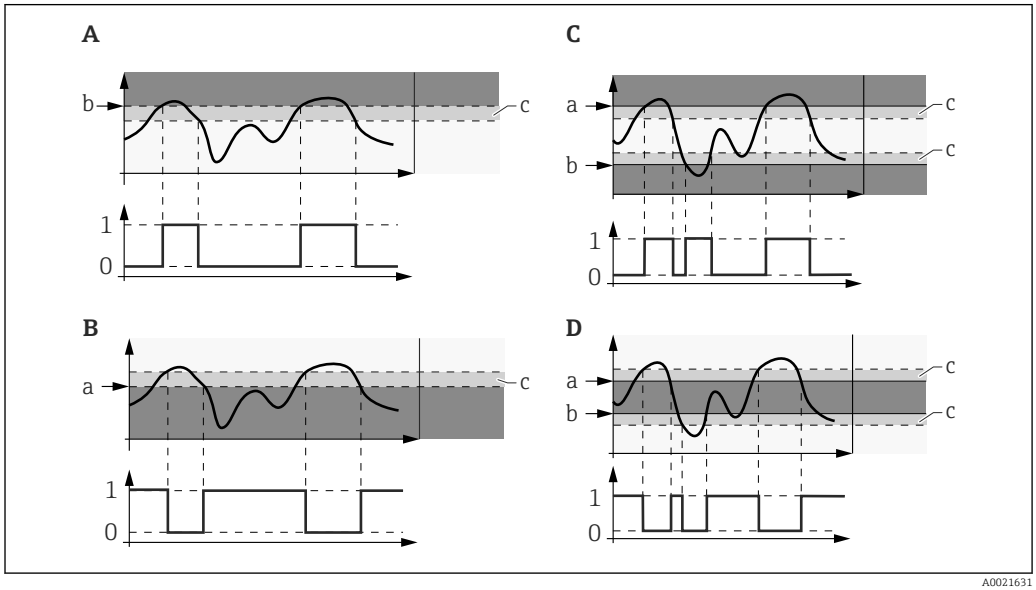
Selection

- Off
- Upper limit
- Lower limit
- In range
- Out of range

Factory setting

Off

Additional information



43 *Limit monitoring in the Advanced Diagnostic Block*

0 Status of digital output: 0 ("INACTIVE")
1 Status of digital output: 1 ("ACTIVE")
a Upper limit (→ 185)
b Lower limit (→ 185)
c Hysteresis (→ 186)
A "Check mode " = "Lower limit"
B "Check mode " = "Upper limit"
C "Check mode " = "In range"
D "Check mode " = "Out of range"

If a calculation has been selected in the **Calc. type** parameter (→ 182), the check does not refer to the assigned measuring variable but to the quantity calculated from it.

Read access	Operator
Write access	Maintenance

Calc. unit 1 to 4

Navigation

Expert → Diagnostics → Adv.diagn. 1 to 4 → Calc. unit 1 to 4 (11188–1 to 4)

Prerequisite

Assign signal (→ 181) ≠ None

Description

Select unit for the calculation.

Selection
Dependent on the following parameters:
- Assign diagnostic signal (→ 181)
- Calculation type (→ 182)

Factory setting
Dependent on the following parameters:
- Assign diagnostic signal (→ 181)
- Calculation type (→ 182)

Additional information

Read access	Operator
Write access	Operator

Upper limit 1 to 4

Navigation
Expert → Diagnostics → Adv.diagn. 1 to 4 → Upper limit 1 to 4 (11182–1 to 4)

Prerequisite
Check mode parameter (→ 183) 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 (→ 181)
- Calculation type (→ 182)

Factory setting
Dependent on the following parameters:
- Assign diagnostic signal (→ 181)
- Calculation type (→ 182)

Additional information

Read access	Operator
Write access	Maintenance

Lower limit 1 to 4

Navigation
Expert → Diagnostics → Adv.diagn. 1 to 4 → Lower limit 1 to 4 (11184–1 to 4)

Prerequisite
Check mode parameter (→ 183) 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 (→ 181)
- Calculation type (→ 182)

Factory setting

Dependent on the following parameters:
- Assign diagnostic signal (→ 181)
- Calculation type (→ 182)

Additional information

Read access	Operator
Write access	Maintenance

Hysteresis 1 to 4

Navigation

Expert → Diagnostics → Adv.diagn. 1 to 4 → Hysteresis 1 to 4 (11178–1 to 4)

Prerequisite

Check mode parameter (→ 183) has one of the following values:
- Upper limit
- Lower limit
- In range
- Out of range

Description

Select hysteresis for the limit monitoring.

User entry

Dependent on the following parameters:
- Assign diagnostic signal (→ 181)
- Calculation type (→ 182)

Factory setting

Dependent on the following parameters:
- Assign diagnostic signal (→ 181)
- Calculation type (→ 182)

Additional information

Read access	Operator
Write access	Maintenance

Value

Navigation

Expert → Diagnostics → Adv.diagn. 1 to 4 → Value (11172–1 to 4)

Description

Displays the current value of the calculated process variable.

Additional information

Read access	Operator
Write access	-

Maximum value 1 to 4

Navigation

Expert → Diagnostics → Adv.diagn. 1 to 4 → Maximum value 1 to 4 (11183–1 to 4)

Prerequisite

Assign signal (→ 181) ≠ None

Description Indicates the maximum value the assigned measuring variable has obtained in the past (drag indicator).

Additional information

Read access	Operator
Write access	-

Minimum value 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Minimum value 1 to 4 (11185–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Indicates minimum value the assigned measuring variable has obtained in the past (drag indicator).

Additional information

Read access	Operator
Write access	-

Reset min/max 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Reset min/max 1 to 4 (11186–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Reset drag indicators (**Maximum value (→ 186)** and/or **Minimum value (→ 187)**).

Selection
- Off
- Reset max.
- Reset min.
- Reset min/max

Factory setting Off

Additional information

Read access	Operator
Write access	Maintenance

Application

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Application (11173–1 to 4)

Description Indicates whether the Advanced Diagnostic Block is used for foam or build-up detection.

Selection
- Std. application
- Foam detection
- Build-up detect.

Factory setting Std. application

Additional information

- If a foam or build-up detection has been configured via the Heartbeat wizards in FieldCare, DeviceCare, PACTware or a DTM based process-control system, this parameter is automatically set to the appropriate value.
- If a foam or build-up detection has been congfigured via the operating menu, this parameter must be manually set to the appropriate value.
- The setting of this parameter causes that the **Foam detected** or **Build-up detect.** diagnostic message is generated if foam or build-up is detected.

Read access	Maintenance
Write access	Operator

Stat. AD event 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Stat. AD event 1 to 4 (11176–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Assign a category according to NAMUR NE107 to the event of the Advanced Diagnostic Block.

Selection

- Failure (F)
- Mainten. req.(M)
- Funct. check (C)
- Out of spec. (S)
- No effect (N)

Factory setting Mainten. req.(M)

Additional information

Read access	Operator
Write access	Maintenance

Evt behaviour 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Evt behaviour 1 to 4 (11177–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Assign an event behavior to the event of the Advanced Diagnostic Block.

Selection

- Off
- Alarm
- Warning
- Logbook only

Factory setting Warning

Additional information

Read access	Operator
Write access	Maintenance

Alarm delay 1 to 4

Navigation Expert → Diagnostics → Adv.diagn. 1 to 4 → Alarm delay 1 to 4 (11171–1 to 4)

Prerequisite **Assign signal (→ 181) ≠ None**

Description Define alarm delay for the Advanced Diagnostic Block.

User entry 0.0 to 3 600.0 s

Factory setting 10.0 s

Additional information

Read access	Operator
Write access	Maintenance

3.6.12 "Envelope diag." submenu

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 ref. curve** parameter.

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 diag.**		
	Save ref. curve	→ 191
	Time ref. curve	→ 191

Description of parameters

Navigation Expert → Diagnostics → Envelope diag.

Save ref. curve

Navigation Expert → Diagnostics → Envelope diag. → Save ref. curve (12513)

Description Save current envelope curve as reference curve in the device.

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 in the device.

Read access	Operator
Write access	Maintenance

Time ref. curve

Navigation Expert → Diagnostics → Envelope diag. → Time ref. curve (12514)

Description Indicates at which time the existing reference curve has been recorded.

Additional information

Read access	Operator
Write access	-

4 Overview of information events

Info number	Info name
I1000	--------(Device ok)
I1089	Power on
I1090	Config. reset
I1091	Config. changed
I1092	Embedd.HistoROM
I1110	Prot.swit.chang.
I1137	Electr. changed
I1151	History reset
I1154	Res.v.min/max
I1155	Res.electr.temp.
I1156	Mem.error trend
I1157	Mem.err. ev.list
I1184	Disp.connected
I1185	Disp.backup done
I1186	Restore done
I1187	Set.downl. disp.
I1188	Disp.data clear.
I1189	Backup compared
I1256	Disp.stat.change
I1264	Safety seq.abort
I1335	Firmw. changed
I1397	Bus stat. change
I1398	CDI stat. change
I1512	Downl. started
I1513	Downl. finished
I1514	Upload started
I1515	Upload finished
I1554	Safety seq.start
I1555	Safety seq.conf.
I1556	Safety mode off

5 Overview of diagnostic events

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
046	Build-up detect.	Clean sensor	F	Alarm [1)]
102	Sensor incompat	1. Restart device 2. Contact service	F	Alarm
151	SensorElectrFail	Replace sensor electronic module	F	Alarm
Diagnostic of electronic				
242	Software incomp.	1. Check SW 2. Flash or change main elect.module	F	Alarm
252	Modules incomp.	Check or change I/O or main electronic module	F	Alarm
261	Electr. modules	1. Restart device 2. Check or change electr.modules	F	Alarm
262	Module connect.	1. Check module conn. 2. Change elect. modules	F	Alarm
270	Main electronics	Change main electronic module	F	Alarm
271	Main electronics	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronics	1. Restart device 2. Contact service	F	Alarm
273	Main electronics	1. Use display backup 2. Change main elect.	F	Alarm
275	I/O defective	Change I/O module	F	Alarm
276	I/O faulty	1. Restart device 2. Change I/O module	F	Alarm
276	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	Electr. failure	Maintenance req. 1. Don't reset 2. Contact service	M	Warning
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
411	Up-/download act	Up-/download active, please wait	C	Warning
412	Process. downl.	Download active, please wait	C	Warning
431	Trim 1 to 2	Carry out trim	C	Warning
435	Linearization	Check linearization table	F	Alarm
437	Config. incomp.	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device config.	M	Warning
441	Curr.output 1 to 2	1. Check process 2. Check current output settings	S	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
484	Failure mode sim	Deactivate simulation	C	Alarm
485	Simulation value	Deactivate simulation	C	Warning
491	Curr.out. 1 to 2 sim.	Deactivate simulation	C	Warning
494	Switch sim.	Deactivate simulation switch output	C	Warning
495	Diag. event sim.	Deactivate simulation	C	Warning
585	Sim 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
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
825	Operating temp.	1. Check ambient temp. 2. Check process temp.	S	Warning
825	Operating temp.		F	Alarm
921	Change of refer.	Check reference configuration, pressure, sensor	S	Warning
941	Echo lost	Check parameter 'DC value'	S	Warning [1]
942	In safety dist.	1. Chk level 2. Chk safe dist 3. Reset self hold	S	Alarm [1]
943	In blocking dist	Reduced accuracy Check level	S	Warning
950	AD 1 to 4 occured	Maintain your diagnostic event	M	Warning [1]
952	Foam detected	Check process conditions	F	Alarm [1]

1) Diagnostic behavior can be changed.

Index

0 ... 9

4 mA value (Parameter) 114
20 mA value (Parameter) 114

A

Absolute echo amplitude (Parameter) 75
Access status display (Parameter) 20, 31
Access status tooling (Parameter) 21
Acknowledge alarm (Parameter) 93
Activate SW option (Parameter) 39
Activate table (Parameter) 73
Actual diagnostics (Parameter) 144
Actual IF gain (Parameter) 76
Administration (Submenu) 38, 39
Advanced diagnostics 1 to 2 (Submenu) 181
Advanced diagnostics 1 to 4 (Submenu) 180
Alarm delay 1 to 4 (Parameter) 189
Application (Parameter) 187
Area of incoupling (Parameter) 171
Assign channel 1 (Parameter) 156
Assign current output 1 (Parameter) 110
Assign current output 2 (Parameter) 110
Assign diagnostic behavior (Parameter) 120
Assign diagnostic signal 1 to 4 (Parameter) 181
Assign event behaviour 1 to 4 (Parameter) 188
Assign limit (Parameter) 120
Assign measurement variable (Parameter) 166
Assign PV (Parameter) 139
Assign QV (Parameter) 141
Assign status (Parameter) 122
Assign status signal to AD event 1 to 4 (Parameter) 188
Assign SV (Parameter) 139
Assign TV (Parameter) 140

B

Backlight (Parameter) 31
Backup state (Parameter) 36
Bin type (Parameter) 44
Blocking distance (Parameter) 81
Burst command 1 to 3 (Parameter) 135
Burst configuration 1 to 3 (Submenu) 134
Burst mode 1 to 3 (Parameter) 134
Burst trigger level (Parameter) 137
Burst trigger mode (Parameter) 136
Burst variable 0 (Parameter) 135
Burst variable 4 (Parameter) 136

C

Calculation type 1 to 4 (Parameter) 182
Calculation unit 1 to 4 (Parameter) 184
Check mode 1 to 4 (Parameter) 183
Clear logging data (Parameter) 157
Communication (Submenu) 125
Comparison result (Parameter) 37
Configuration (Submenu) 127, 128
Configuration backup display (Submenu) 34, 35
Configuration counter (Parameter) 154
Configuration management (Parameter) 35
Confirm access code (Parameter) 41
Confirm distance (Parameter) 101
Contrast display (Parameter) 30
Current output 1 to 2 (Submenu) 109, 110
Current output 1 to 2 simulation (Parameter) 166
Current span (Parameter) 111
Customer value (Parameter) 72

D

Damping output (Parameter) 112
Data logging (Submenu) 155, 156
Dead time (Parameter) 80
Decimal places 1 (Parameter) 27
Decimal places menu (Parameter) 30
Define access code (Parameter) 39, 41
Define access code (Wizard) 41
Delay time echo lost (Parameter) 92
Device alarm simulation (Parameter) 168
Device check (Submenu) 170, 171
Device ID (Parameter) 131
Device information (Submenu) 151, 152
Device name (Parameter) 153
Device reset (Parameter) 40
Device revision (Parameter) 131
Device tag (Parameter) 128, 152
Device type (Parameter) 131
Diagnostic configuration (Submenu) 126
Diagnostic event simulation (Parameter) 168
Diagnostic list (Submenu) 146, 147
Diagnostics (Submenu) 142, 143, 144
Diagnostics 1 (Parameter) 147
Diameter (Parameter) 69
Direct access
- 4 mA value
  - Current output 1 to 2 (0367–1 to 2) 114
- 20 mA value
  - Current output 1 to 2 (0372–1 to 2) 114
- Absolute echo amplitude (12457) 75
- Access status display (0091) 20, 31
- Access status tooling (0005) 21
- Acknowledge alarm (12536) 93
- Activate SW option (0029) 39
- Activate table (2304) 73
- Actual diagnostics (0691) 144
- Actual IF gain (12540) 76
- Alarm delay 1 to 4 (11171–1 to 4) 189
- Application
  - Advanced diagnostics 1 to 4 (11173–1 to 4) . 187
- Area of incoupling (12525) 171
- Assign channel 1 (0851) 156
- Assign current output 1
  - Current output 1 (0359) 110
- Assign current output 2 (0359–2) 110
- Assign diagnostic behavior (0482) 120

Assign diagnostic signal 1 to 4 (11179–1 to 4) . . 181
Assign event behaviour 1 to 4 (11177–1 to 4) . . 188
Assign limit (0483) 120
Assign measurement variable (2328) 166
Assign PV (0234) 139
Assign QV (0237) 141
Assign status (0485) 122
Assign status signal to AD event 1 to 4 (11176–1 to 4) 188
Assign SV (0235) 139
Assign TV (0236) 140
Backlight (0111) 31
Backup state (0121) 36
Bin type (12535) 44
Blocking distance (12424) 81
Burst command 1 to 3 (2031–1 to 3) 135
Burst mode 1 to 3 (2032–1 to 3) 134
Burst trigger level
  Burst configuration 1 to 3 (2043–1 to 3) 137
Burst trigger mode
  Burst configuration 1 to 3 (2044–1 to 3) 136
Burst variable 0
  Burst configuration 1 to 3 (2033) 135
Burst variable 4
  Burst configuration 1 to 3 (2037) 136
Calculation type 1 to 4 (11174–1 to 4) 182
Calculation unit 1 to 4 (11188–1 to 4) 184
Check mode 1 to 4 (11175–1 to 4) 183
Clear logging data (0855) 157
Comparison result (0103) 37
Configuration counter (0233) 154
Configuration management (0100) 35
Confirm distance (12462) 101
Contrast display (0105) 30
Current output 1 to 2 simulation (0354–1 to 2) . . 166
Current span
  Current output 1 to 2 (0353–1 to 2) 111
Customer value (2384) 72
Damping output
  Current output 1 to 2 (0363–1 to 2) 112
Dead time (12521) 80
Decimal places 1 (0095) 27
Decimal places menu (0573) 30
Define access code (0093) 39
Delay time echo lost (12456) 92
Device alarm simulation (0654) 168
Device ID (0221) 131
Device name (0013) 153
Device reset (0000) 40
Device revision (0204) 131
Device tag (0011) 152
Device tag (0215) 128
Device type (0209) 131
Diagnostic event simulation (0737) 168
Diagnostics 1 (0692) 147
Diameter (2342) 69
Direct access (0106) 20
Display damping (0094) 28
Display interval (0096) 28
Distance (2231) 58
Distance (12401) 79, 100
Distance offset (2309) 57
Distance unit (0551) 43
Empty calibration (2343) 53
End map. ampl. (12478) 103
End of mapping (12461) 103
ENP version (0012) 153
Enter access code (0003) 21
Evaluation mode (12411) 106
Extended order code 1 (0023) 153
Failure current
  Current output 1 to 2 (0352–1 to 2) 113
Failure mode
  Current output 1 to 2 (0364–1 to 2) 112
Failure mode (0486) 123
Filter options (0705) 149
Firmware version (0010) 152
Fixed current
  Current output 1 to 2 (0365–1 to 2) 111
Format display (0098) 25
Found echoes (12492) 76
Free text (2341) 68
Full calibration (2308) 54
Hardware revision (0206) 133
HART address (0219) 128
HART date code (0202) 133
HART descriptor (0212) 132
HART message (0216) 132
HART revision (0205) 132
HART short tag (0220) 128
Header (0097) 28
Header text (0112) 29
High limit (2312) 60
History reset (12449) 106
Hysteresis 1 to 4 (11178–1 to 4) 186
In safety distance (12530) 92
Integration time (12489) 80
Intermediate height (2310) 70
Invert output signal (0470) 124
Language (0104) 25
Last backup (0102) 35
Level (2319) 61
Level (2383) 72
Level (2389) 72
Level correction (2325) 61
Level limit mode (2314) 59
Level linearized (2318) 62, 69
Level signal (12483) 171
Level unit (0576) 56
Linearization type (2339) 66
Link AD 1 to 4 to (11180–1 to 4) 181
Linking logic AD 1 to 4 (11181–1 to 4) 182
Locking status (0004) 20
Logging interval (0856) 156
Low limit (2313) 61
Lower limit 1 to 4 (11184–1 to 4) 185
Manufacturer ID (0259) 132
Mapping end point (12459) 102

Max. draining speed (2320) 161
Max. draining speed liquid (12531) 44
Max. draining speed solid (12533) 46
Max. electronics temperature (12506) 161
Max. filling speed (2360) 161
Max. filling speed liquid (12532) 45
Max. filling speed solid (12534) 46
Max. level value (2357) 160
Max. update period
Burst configuration 1 to 3 (2041–1 to 3) 137
Maximum value (2315) 69
Maximum value 1 to 4 (11183–1 to 4) 186
Measured current 1 (0366–1) 116
Measuring mode
Current output 1 to 2 (0351–1 to 2) 115
Medium group (12528) 49
Medium property (12529) 50
Medium type (12527) 49
Min. electronics temperature (12508) 162
Min. level value (2358) 160
Min. update period
Burst configuration 1 to 3 (2042–1 to 3) 137
Minimum value 1 to 4 (11185–1 to 4) 187
No. of preambles (0217) 129
Number format (0099) 30
Operating time (0652) 35, 145
Operating time from restart (0653) 145
Order code (0008) 153
Output current 1 to 2 (0361–1 to 2) 112
Output echo lost (2307) 90
Output mode (2317) 57
Present mapping (12487) 102
Previous diagnostics (0690) 144
Primary variable (PV) (0201) 139
Process variable value (2329) 166
Quaternary variable (QV) (0203) 141
Ramp at echo lost (2323) 91
Record map (12448) 103
Relative echo amplitude (12468) 75
Reset min./max. (2324) 161
Reset min./max. 1 to 4 (11186–1 to 4) 187
Reset min./max. temp. (12510) 162
Result device check (12482) 171
Result self check (12497) 84
Safety distance (12517) 92
Sample time 1 to 4 (11187–1 to 4) 182
Save reference curve (12513) 191
Secondary variable (SV) (0226) 140
Sensor temperature (12499) 76
Separator (0101) 29
Serial number (0009) 152
Signal quality (12477) 75
Software revision (0224) 133
Start device check (12481) 171
Start self check (12496) 84
Start-up current
Current output 1 (0369–1) 116
Start-up mode
Current output 1 (0368–1) 115
Switch output function (0481) 119
Switch output simulation (0462) 167
Switch status (0461) 124
Switch status (0463) 168
Switch-off delay (0465) 123
Switch-off value (0464) 122
Switch-on delay (0467) 122
Switch-on value (0466) 120
Table mode (2303) 70
Table number (2370) 71
Tank bottom echo amplitude (12467) 75
Tank bottom range (12463) 104
Tank type (12519) 43
Tank/silo height (12403) 55
Temperature unit (0557) 43
Terminal voltage 1
Current output 1 (0662) 117
Tertiary variable (TV) (0228) 141
Time max. electronics temperature (12507) 162
Time max. level (2385) 160
Time min. electronics temperature (12509) 162
Time min. level (2386) 160
Time reference curve (12514) 191
Timestamp (0667) 144
Timestamp (0672) 145
Timestamp (0683) 147
Turn down
Current output 1 to 2 (0358–1 to 2) 113
Unit after linearization (2340) 68
Upper limit 1 to 4 (11182–1 to 4) 185
Used calculation (12488) 76
Value
Advanced diagnostics 1 to 4 (11172–1 to 4) . 186
Value 1 display (0107) 27
Value current output 1 to 2 (0355–1 to 2) 167
Value echo lost (2316) 90
Direct access (Parameter) 20
Display (Submenu) 24, 25
Display damping (Parameter) 28
Display interval (Parameter) 28
Distance (Parameter) 58, 79, 100
Distance (Submenu) 78, 79
Distance offset (Parameter) 57
Distance unit (Parameter) 43
Document
Function 4
Document function 4

E

Echo tracking (Submenu) 106
Empty calibration (Parameter) 53
End map. ampl. (Parameter) 103
End of mapping (Parameter) 103
ENP version (Parameter) 153
Enter access code (Parameter) 21
Envelope diagnostics (Submenu) 190, 191
Evaluation mode (Parameter) 106
Event logbook (Submenu) 148, 149
Expert (Menu) 8, 20

Extended order code 1 (Parameter) 153

F
Failure current (Parameter) 113
Failure mode (Parameter) 112, 123
Filter options (Parameter) 149
Firmware version (Parameter) 152
Fixed current (Parameter) 111
Format display (Parameter) 25
Found echoes (Parameter) 76
Free text (Parameter) 68
Full calibration (Parameter) 54

H
Hardware revision (Parameter) 133
HART address (Parameter) 128
HART date code (Parameter) 133
HART descriptor (Parameter) 132
HART message (Parameter) 132
HART revision (Parameter) 132
HART short tag (Parameter) 128
Header (Parameter) 28
Header text (Parameter) 29
High limit (Parameter) 60
History reset (Parameter) 106
Hysteresis 1 to 4 (Parameter) 186

I
In safety distance (Parameter) 92
Information (Submenu) 74, 75, 130, 131
Integration time (Parameter) 80
Intermediate height (Parameter) 70
Invert output signal (Parameter) 124

L
Language (Parameter) 25
Last backup (Parameter) 35
Level (Parameter) 61, 72
Level (Submenu) 52, 53
Level correction (Parameter) 61
Level limit mode (Parameter) 59
Level linearized (Parameter) 62, 69
Level signal (Parameter) 171
Level unit (Parameter) 56
Linearization (Submenu) 65, 66
Linearization type (Parameter) 66
Link AD 1 to 4 to (Parameter) 181
Linking logic AD 1 to 4 (Parameter) 182
Locking status (Parameter) 20
Logging interval (Parameter) 156
Low limit (Parameter) 61
Lower limit 1 to 4 (Parameter) 185

M
Manufacturer ID (Parameter) 132
Mapping (Submenu) 98, 99, 100
Mapping end point (Parameter) 102
Max. draining speed (Parameter) 161
Max. draining speed liquid (Parameter) 44
Max. draining speed solid (Parameter) 46
Max. electronics temperature (Parameter) 161
Max. filling speed (Parameter) 161
Max. filling speed liquid (Parameter) 45
Max. filling speed solid (Parameter) 46
Max. level value (Parameter) 160
Max. update period (Parameter) 137
Maximum value (Parameter) 69
Maximum value 1 to 4 (Parameter) 186
Measured current 1 (Parameter) 116
Measuring mode (Parameter) 115
Medium (Submenu) 48, 49
Medium group (Parameter) 49
Medium property (Parameter) 50
Medium type (Parameter) 49
Menu
  Expert 8, 20
Min. electronics temperature (Parameter) 162
Min. level value (Parameter) 160
Min. update period (Parameter) 137
Min/max values (Submenu) 159, 160
Minimum value 1 to 4 (Parameter) 187

N
No. of preambles (Parameter) 129
Number format (Parameter) 30

O
Operating time (Parameter) 35, 145
Operating time from restart (Parameter) 145
Order code (Parameter) 153
Output (Submenu) 108, 138, 139
Output current 1 to 2 (Parameter) 112
Output echo lost (Parameter) 90
Output mode (Parameter) 57

P
Present mapping (Parameter) 102
Previous diagnostics (Parameter) 144
Primary variable (PV) (Parameter) 139
Process variable value (Parameter) 166

Q
Quaternary variable (QV) (Parameter) 141

R
Ramp at echo lost (Parameter) 91
Record map (Parameter) 103
Registered trademarks 7
Relative echo amplitude (Parameter) 75
Reset min./max. (Parameter) 161
Reset min./max. 1 to 4 (Parameter) 187
Reset min./max. temp. (Parameter) 162
Result device check (Parameter) 171
Result self check (Parameter) 84

S
Safety distance (Parameter) 92
Safety settings (Submenu) 89, 90
Sample time 1 to 4 (Parameter) 182
Save reference curve (Parameter) 191

Secondary variable (SV) (Parameter) 140
Sensor (Submenu) 42, 43
Sensor diagnostics (Submenu) 83, 84
Sensor temperature (Parameter) 76
Separator (Parameter) 29
Serial number (Parameter) 152
Signal quality (Parameter) 75
Simulation (Submenu) 165, 166
Software revision (Parameter) 133
Start device check (Parameter) 171
Start self check (Parameter) 84
Start-up current (Parameter) 116
Start-up mode (Parameter) 115
Submenu
Administration 38, 39
Advanced diagnostics 1 to 2 181
Advanced diagnostics 1 to 4 180
Burst configuration 1 to 3 134
Communication 125
Configuration 127, 128
Configuration backup display 34, 35
Current output 1 to 2 . . . . . 109, 110
Data logging 155, 156
Device check 170, 171
Device information 151, 152
Diagnostic configuration 126
Diagnostic list 146, 147
Diagnostics 142, 143, 144
Display 24, 25
Distance 78, 79
Echo tracking 106
Envelope diagnostics 190, 191
Event logbook 148, 149
Information 74, 75, 130, 131
Level 52, 53
Linearization 65, 66
Mapping 98, 99, 100
Medium 48, 49
Min/max values 159, 160
Output 108, 138, 139
Safety settings 89, 90
Sensor 42, 43
Sensor diagnostics 83, 84
Simulation 165, 166
Switch output 118, 119
System 23
Tank bottom evaluation 104
Switch output (Submenu) 118, 119
Switch output function (Parameter) 119
Switch output simulation (Parameter) 167
Switch status (Parameter) 124, 168
Switch-off delay (Parameter) 123
Switch-off value (Parameter) 122
Switch-on delay (Parameter) 122
Switch-on value (Parameter) 120
System (Submenu) 23

T

Table mode (Parameter) 70
Table number (Parameter) 71
Tank bottom echo amplitude (Parameter) 75
Tank bottom evaluation (Submenu) 104
Tank bottom range (Parameter) 104
Tank type (Parameter) 43
Tank/silo height (Parameter) 55
Temperature unit (Parameter) 43
Terminal voltage 1 (Parameter) 117
Tertiary variable (TV) (Parameter) 141
Time max. electronics temperature (Parameter) 162
Time max. level (Parameter) 160
Time min. electronics temperature (Parameter) 162
Time min. level (Parameter) 160
Time reference curve (Parameter) 191
Timestamp (Parameter) 144, 145, 147
Turn down (Parameter) 113

U

Unit after linearization (Parameter) 68
Upper limit 1 to 4 (Parameter) 185
Used calculation (Parameter) 76

V

Value (Parameter) 186
Value 1 display (Parameter) 27
Value current output 1 to 2 (Parameter) 167
Value echo lost (Parameter) 90

W

Wizard
Define access code 41

www.addresses.endress.com

Endress+Hauser

People for Process Automation