Description of Device Parameters

**Levelflex FMP5x**

**Modbus**

Guided wave radar
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1  Important document information

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

1.2  Symbols

1.2.1  Safety symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="DANGER" /></td>
<td>DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.</td>
</tr>
<tr>
<td><img src="" alt="WARNING" /></td>
<td>WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.</td>
</tr>
<tr>
<td><img src="" alt="CAUTION" /></td>
<td>CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.</td>
</tr>
<tr>
<td><img src="" alt="NOTE" /></td>
<td>NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.</td>
</tr>
</tbody>
</table>

1.2.2  Electrical symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="Direct current" /></td>
<td>Direct current</td>
</tr>
<tr>
<td><img src="" alt="Alternating current" /></td>
<td>Alternating current</td>
</tr>
<tr>
<td><img src="" alt="Direct current and alternating current" /></td>
<td>Direct current and alternating current</td>
</tr>
<tr>
<td><img src="" alt="Ground connection" /></td>
<td>Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.</td>
</tr>
<tr>
<td><img src="" alt="Protective Earth (PE)" /></td>
<td>Protective Earth (PE) A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device:  - Inner ground terminal: Connects the protective earth to the mains supply.  - Outer ground terminal: Connects the device to the plant grounding system.</td>
</tr>
</tbody>
</table>

1.2.3  Tool symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="Torx screwdriver" /></td>
<td>Torx screwdriver</td>
</tr>
<tr>
<td><img src="" alt="Flat blade screwdriver" /></td>
<td>Flat blade screwdriver</td>
</tr>
</tbody>
</table>
## Symbols for certain types of information

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Tip" /></td>
<td>Tip Indicates additional information.</td>
</tr>
<tr>
<td><img src="image2" alt="Reference to documentation" /></td>
<td>Reference to documentation.</td>
</tr>
<tr>
<td><img src="image3" alt="Reference to page" /></td>
<td>Reference to page.</td>
</tr>
<tr>
<td><img src="image4" alt="Reference to graphic" /></td>
<td>Reference to graphic.</td>
</tr>
<tr>
<td><img src="image5" alt="Operation via local display" /></td>
<td>Operation via local display.</td>
</tr>
<tr>
<td><img src="image6" alt="Operation via operating tool" /></td>
<td>Operation via operating tool.</td>
</tr>
<tr>
<td><img src="image7" alt="Write-protected parameter" /></td>
<td>Write-protected parameter.</td>
</tr>
</tbody>
</table>

## Symbols in graphics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3 ...</td>
<td>Item numbers</td>
</tr>
<tr>
<td>A, B, C, ...</td>
<td>Views</td>
</tr>
<tr>
<td>A-A, B-B, C-C, ...</td>
<td>Sections</td>
</tr>
</tbody>
</table>

## Symbols at the device

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Safety instructions</td>
</tr>
<tr>
<td>⚠️</td>
<td>Observe the safety instructions contained in the associated Operating Instructions.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Temperature resistance of the connection cables</td>
</tr>
<tr>
<td>⚠️</td>
<td>Specifies the minimum value of the temperature resistance of the connection cables.</td>
</tr>
</tbody>
</table>
## 1.3 Supplementary documentation

<table>
<thead>
<tr>
<th>Document</th>
<th>Purpose and content of the document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Information TI01454F (FMP51, Modbus)</td>
<td>Planning aid for your device&lt;br&gt;The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.</td>
</tr>
<tr>
<td>Brief Operating Instructions KA01421F (FMP51, Modbus)</td>
<td>Guide that takes you quickly to the 1st measured value&lt;br&gt;The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.</td>
</tr>
<tr>
<td>Description of Device Parameters GP01140F (FMP51, Modbus)</td>
<td>Reference for your parameters&lt;br&gt;The document provides a detailed explanation of each individual parameter in the operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.</td>
</tr>
</tbody>
</table>
## 1.4 Terms and abbreviations

<table>
<thead>
<tr>
<th>Term/abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>Document type &quot;Operating Instructions&quot;</td>
</tr>
<tr>
<td>KA</td>
<td>Document type &quot;Brief Operating Instructions&quot;</td>
</tr>
<tr>
<td>TI</td>
<td>Document type &quot;Technical Information&quot;</td>
</tr>
<tr>
<td>SD</td>
<td>Document type &quot;Special Documentation&quot;</td>
</tr>
<tr>
<td>XA</td>
<td>Document type &quot;Safety Instructions&quot;</td>
</tr>
<tr>
<td>PN</td>
<td>Nominal pressure</td>
</tr>
</tbody>
</table>
| MWP               | Maximum Working Pressure  
The MWP can also be found on the nameplate. |
| ToF               | Time of Flight |
| \( \varepsilon_r \) (DC value) | Relative dielectric constant |
| BD                | Blocking Distance; no signals are analyzed within the BD. |
| PLC               | Programmable Logic Controller |
| CDI               | Common Data Interface |
1.5 Registered trademarks

- Modbus®
  Registered trademark of SCHNEIDER AUTOMATION, INC.

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

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

- TRI CLAMP®
  Registered trademark of Alfa Laval Inc., Kenosha, USA

- NORD-LOCK®
  Registered trademark of Nord-Lock International AB

- FISHER®
  Registered trademark of Fisher Controls International LLC, Marshalltown, USA

- MASONEILAN®
  Registered trademark of Dresser, Inc., Addison, USA
2 Basic principles

2.1 Time-of-Flight principle

The Levelflex uses the guided propagation and reflection of electromagnetic pulses in order to determine the distance to a target object. The time that passes between emitting and receiving the pulses is a measurement for the distance to the object. Since the pulses have to travel to the object and back, the distance \( D \) is the result of half of the product of the duration \( t \) and the velocity of propagation \( c \):

\[ D = \Delta t \times c / 2 \]

From \( D \), the level is then calculated with the help of the calibration parameters.

![Diagram](image.png)

1 Calibration parameters for the time-of-flight principle

- **LN**: Length of the probe
- **D**: Distance
- **L**: Level
- **R**: Reference point of the measurement
- **E**: Empty calibration (= zero)
- **F**: Full calibration (= span)
2.2 Interface measurement

Interface measurement is possible with FMP51, FMP52, FMP54 and FMP55. It can be activated via the **Operating mode** parameter (→ 50).

When the high-frequency pulses hit the surface of the medium, only a percentage of the transmission pulse is reflected. In the case of media with a low dielectric constant $\text{DC}_1$, in particular, the other part penetrates the medium. The pulse is reflected once more at the interface point to a second medium with a higher dielectric constant, $\text{DC}_2$. The distance to the interface layer can now also be determined taking into account the delayed time-of-flight of the pulse through the upper medium.

![Diagram of Interface measurement with the guided radar](image)

### Preconditions for an interface measurement

- The dielectric constant (DC) of the upper medium must be known and constant.
- The DC of the upper medium may not be greater than 10.
- The DC difference between the upper medium and lower medium must be > 10.
- The upper medium must have a minimum thickness of 60 mm (2.4 in).

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)
2.3 Envelope curve

The Levelflex emits individual pulses in quick succession and scans their reflection again with a fluctuating delay. The amounts of energy received are arranged according to their time of flight. The graphic representation of this sequence is called "envelope curve". The following diagram shows a sketch of a typical envelope curve:

![Envelope curve diagram]

- **3 Important features of the envelope curve**
  1. Env. curve offset
  2. Ref. echo ampl.
  3. Electr. zero dist
  4. Cable zero dist.
  5. Ant. zero dist.
  6. Thres. f. z-dist
  7. Fzdist.win.left
  8. Fzdist.win.right
  10. Physical length of the probe (LN)
  11. Ref. echoposition
### 2.4 Mapping and subtracted curve

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

After a mapping, the signal evaluation does not use the envelope curve but the **subtracted curve**, instead:

\[
\text{Subtracted curve} = \text{Envelope curve} - \text{Mapping curve}
\]

![Diagram showing mapping and subtracted curve](image)

#### Table: 4  Mapping and subtracted curve

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interference echo</td>
</tr>
<tr>
<td>2</td>
<td>Level echo</td>
</tr>
<tr>
<td>3</td>
<td>End-of-probe echo</td>
</tr>
<tr>
<td>4</td>
<td>Envelope curve</td>
</tr>
<tr>
<td>5</td>
<td>Mapping curve</td>
</tr>
<tr>
<td>6</td>
<td>Subtracted curve</td>
</tr>
<tr>
<td>A</td>
<td>Internal area (Z distances)</td>
</tr>
<tr>
<td>B</td>
<td>Level area</td>
</tr>
<tr>
<td>C</td>
<td>End-of-probe area (EOP)</td>
</tr>
</tbody>
</table>

### 2.5 Echo tracking

Levelflex uses an echo tracking algorithm. This means, echoes in subsequent envelope curves are not evaluated independently but are considered to be a sequence of moving echoes. To do so, each echo is surrounded by a window of a certain width and the echo is searched for within this window in the next envelope curve. If an echo of this type is found, it is allocated to the ‘track’ of the previous echo. Each track can be assigned a specific meaning (level echo track, interface echo track, end-of-probe echo track, multiple echo track).

For a given installation, these tracks are in a well-defined relationship to each other. This relationship is recorded during the measurement such that later on reliable measuring values can be obtained even if the echo is temporarily lost or if the device is temporarily switched off.

For details on the echo tracking refer to: → 136.
3 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

---

**Expert**

- Direct access (0106) → 26
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---

**System**

---

**Display**

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- Format display (0098) → 31
- Value 1 to 4 display (0107–1 to 4) → 33
- Decimal places 1 to 4 (0095–1 to 4) → 33
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# Overview of the operating menu

## Levelflex FMP5x Modbus

<table>
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<tbody>
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<td>Contrast display (0105)</td>
<td>37</td>
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<td>Backlight (0111)</td>
<td>37</td>
</tr>
<tr>
<td>Access stat.disp (0091)</td>
<td>38</td>
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<tr>
<td><strong>Conf.backup disp</strong></td>
<td>40</td>
</tr>
<tr>
<td>Operating time (0652)</td>
<td>41</td>
</tr>
<tr>
<td>Last backup (0102)</td>
<td>41</td>
</tr>
<tr>
<td>Config. managem. (0100)</td>
<td>41</td>
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<tr>
<td>Backup state (0121)</td>
<td>42</td>
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<tr>
<td>Compar. result (0103)</td>
<td>43</td>
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<tr>
<td><strong>Administration</strong></td>
<td>44</td>
</tr>
<tr>
<td>Def. access code (0093)</td>
<td>45</td>
</tr>
<tr>
<td>Confirm code</td>
<td>47</td>
</tr>
<tr>
<td>Activate SW opt. (0029)</td>
<td>45</td>
</tr>
<tr>
<td>Device reset (0000)</td>
<td>46</td>
</tr>
<tr>
<td><strong>Sensor</strong></td>
<td>48</td>
</tr>
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<td>Distance unit (0551)</td>
<td>50</td>
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<tr>
<td>Temperature unit (0557)</td>
<td>50</td>
</tr>
<tr>
<td>Operating mode (1046)</td>
<td>50</td>
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<tr>
<td>Tank type (1175)</td>
<td>51</td>
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<tr>
<td>Tube diameter (1117)</td>
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<td>Process property (1081)</td>
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<td>54</td>
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## Overview of the operating menu

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### Overview of the operating menu

#### Levelflex FMP5x Modbus

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<tbody>
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<td>Level linearized</td>
<td>77</td>
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<td>Interf. lineariz</td>
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<td>78</td>
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<td>78</td>
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<td>Intermed. height</td>
<td>79</td>
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<tr>
<td>Table mode</td>
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<td>Table number</td>
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<tr>
<td>Level</td>
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</tr>
<tr>
<td>Level</td>
<td>81</td>
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<tr>
<td>Customer value</td>
<td>81</td>
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<td>Activate table</td>
<td>81</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td></td>
</tr>
<tr>
<td>Signal quality</td>
<td>84</td>
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<tr>
<td>Abs. echo ampl.</td>
<td>84</td>
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<tr>
<td>Relat.echo ampl.</td>
<td>85</td>
</tr>
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<td>Rel.interf.ampl.</td>
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<td>Tank trace state</td>
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<td>Measurm. freq.</td>
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</table>
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- Const.GPC factor (1217) → 106

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- Start self check (1133) → 110
- Result selfcheck (1134) → 110
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- Output echo lost (2307) → 116
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<th>Page</th>
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<td>118</td>
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<td>Delay echo lost (1193)</td>
<td>118</td>
</tr>
<tr>
<td>Safety distance (1093)</td>
<td>119</td>
</tr>
<tr>
<td>In safety dist. (1018)</td>
<td>119</td>
</tr>
<tr>
<td>Acknowl. alarm (1130)</td>
<td>119</td>
</tr>
<tr>
<td>Env. curve</td>
<td>122</td>
</tr>
<tr>
<td>Env. curve (1207)</td>
<td>122</td>
</tr>
<tr>
<td>Mapping</td>
<td>126</td>
</tr>
<tr>
<td>Distance (1124)</td>
<td>96</td>
</tr>
<tr>
<td>Interface dist. (1067)</td>
<td>97</td>
</tr>
<tr>
<td>Confirm distance (1045)</td>
<td>128</td>
</tr>
<tr>
<td>Present mapping (1182)</td>
<td>129</td>
</tr>
<tr>
<td>Map. end point (1022)</td>
<td>129</td>
</tr>
<tr>
<td>Record map (1069)</td>
<td>130</td>
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4 "Expert" menu


4.1 Structure of the menu

Navigation

Expert

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<td>➤ Diagnostics</td>
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</table>
4.2 Description of parameters

Navigation

Direct access

Description
Enter the access code of a parameter in order to access this parameter directly (i.e. without navigation).

User entry
0 to 65535

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.

Locking status

Navigation

Description
Indicates the write protection with the highest priority that is currently active.

User interface
- Hardware locked
- SIL locked
- WHG locked
- Temp. locked
### Access stat.disp

**Navigation**  
Expert → Access stat.disp (0091)

**Prerequisite**  
The device has a local display.

**Description**  
Indicates access authorization to parameters via local display.

**User interface**  
- Operator
- Maintenance
- Service

**Additional information**  
- If a ⌐ symbol appears in front of a parameter, the parameter cannot be changed via the local display with the current access authorization.
- The access authorization can be changed via the Ent. access code parameter (→ 28).
- 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 (→ 26).

### Access stat.tool

**Navigation**  
Expert → Access stat.tool (0005)

**Description**  
Indicates access authorization to parameters via operating tool (e.g. FieldCare).

**User interface**  
- Operator
- Maintenance
- Service

---

**Meaning and priorities of the types of write protection**

- **Hardware locked (priority 1)**  
The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters.

- **SIL locked (priority 2)**  
The SIL mode is activated. Writing access to the relevant parameters is denied.

- **WHG locked (priority 3)**  
The WHG mode is activated. Writing access to the relevant parameters is denied.

- **Temp. locked (priority 4)**  
Write access to the parameters is temporarily locked on account of internal processes in progress in the device (e.g. data upload/download, reset etc.). The parameters can be modified as soon as the processes are complete.

On the display module, the ⌐-symbol appears in front of parameters that cannot be modified since they are write-protected.
Additional information

The access authorization can be changed via the **Ent. access code** parameter (→ 28).

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 (→ 26).

---

**Ent. access code**

**Navigation**

Expert → Ent. access code (0003)

**Description**
Enter access code to disable write protec..

**User entry**

0 to 9999

**Additional information**

- For local operation, the customer-specific access code, which has been defined in the **Def. access code** parameter (→ 45), 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.

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<th>Operator</th>
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<tr>
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<td>Maintenance</td>
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4.3 "System" submenu

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

4.3.1 Structure of the submenu

Navigation  ➔ ➔ Expert → System

```
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</table>
```
4.3.2 "Display" submenu

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

![Info icon] This submenu is only visible if a display module is connected to the device.

Structure of the submenu

**Navigation**

Expert → System → Display

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Structure of the submenu

Navigation

Language

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

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<tbody>
<tr>
<td>Write access</td>
<td>Operator</td>
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</table>

Format display

Navigation

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

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

Factory setting
1 value, max.
Additional information

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

6. "Format display" = "Bargr. + 1 value"

7. "Format display" = "2 values"

8. "Format display" = "Val. large+2val."

9. "Format display" = "4 values"

- The Value 1 to 4 display →  33 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 (→  34).

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<tbody>
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<td>Operator</td>
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</tbody>
</table>
**Value 1 to 4 display**

**Navigation**

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

**Description**

Select measured value that is shown on the display.

**Selection**

- Level linearized
- Distance
- Interf. lineariz
- Interface dist.
- Thickn. upp. layer
- Curr. output 1
- Measur. curr.
- Curr. output 2
- Terminal volt.
- Electronic temp.
- Measur. cap.
- Analog out. AD 1
- Analog out. AD 2

**Factory setting**

**For level measurements**

- Value 1 display: Level linearized
- Value 2 display: Distance
- Value 3 display: Current output 1
- Value 4 display: None

**For interface measurements and one current output**

- Value 1 display: Interface linearized
- Value 2 display: Level linearized
- Value 3 display: Thickness upper layer
- Value 4 display: Current output 1

**For interface measurements and two current outputs**

- Value 1 display: Interface linearized
- Value 2 display: Level linearized
- Value 3 display: Current output 1
- Value 4 display: Current output 2

**Additional information**

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<th>Operator</th>
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**Decimal places 1 to 4**

**Navigation**

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

**Description**

Select number of decimal places for display value.
Expert menu

Levelflex FMP5x Modbus

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.

<table>
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<tr>
<th>Read access</th>
<th>Operator</th>
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<td>Write access</td>
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Display interval

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

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Operator</td>
</tr>
</tbody>
</table>

Display damping

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

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
**Header**

**Navigation**
- Expert → System → Display → Header (0097)
- 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 (→ 162)
- **Free text**
  Is defined in the Header text parameter (→ 35)

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

**Header text**

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

**Prerequisite**
Header (→ 35) = Free text

**Description**
Enter display header text.

**Factory setting**

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

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
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</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

Endress+Hauser
Separator

**Navigation**
- Expert → System → Display → Separator (0101)
- 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)
- 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)
- 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
- .xx
- .xxx
- .xxxx
**Factory setting**

x.xxxx

**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 → 33 parameters.
- The setting does not affect the accuracy of the measurement or the calculations.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
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</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

**Contrast display**

**Navigation**

- Expert → System → Display → Contrast display (0105)
- 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 buttons simultaneously.
  - Brighter: press the buttons simultaneously.

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<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
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</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Operator</td>
</tr>
</tbody>
</table>

**Backlight**

**Navigation**

- Expert → System → Display → Backlight (0111)
- 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.

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<tr>
<td>Write access</td>
<td>Operator</td>
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</tbody>
</table>

**Access stat.disp**

**Navigation**
- Expert → System → Display → Access stat.disp (0091)
- 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 (→ 28).
- 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 (→ 26).

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
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<tbody>
<tr>
<td>Write access</td>
<td>-</td>
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</tbody>
</table>
4.3.3 "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 (→ 41). 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.

For FMP51, FMP52, FMP54, FMP55: Configurations can only be exchanged between devices which are in the same operating mode (see the Operating mode parameter (→ 50)).

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 menu]

- **Conf.backup disp**

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<th>Item</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td>Operating time</td>
<td>41</td>
</tr>
<tr>
<td>Last backup</td>
<td>41</td>
</tr>
<tr>
<td>Config. managem.</td>
<td>41</td>
</tr>
<tr>
<td>Backup state</td>
<td>42</td>
</tr>
<tr>
<td>Compar. result</td>
<td>43</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>

Last backup

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

Description  Indicates when last backup was saved to display.

Additional information

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
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</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
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</tbody>
</table>

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 (→ 43).

- **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.*

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

---

**Backup state**

**Navigation**

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

**Description**

Displays which backup action is currently in progress.

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>
Compar. result

Navigation

- Expert → System → Conf.backup disp → Compar. result (0103)
- 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. (→ 41) = Compare.**

If the transmitter configuration has been duplicated from a different device by **Config. managem. (→ 41) = 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.**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>
4.3.4 "Administration" submenu

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

Structure of the submenu on the local display

Navigation  

Expert → System → Administration

```
[Expert]  

[Administration]

[Def. access code]  

Def. access code  

Confirm code  

Activate SW opt.

Device reset
```

Structure of the submenu in an operating tool

Navigation  

Expert → System → Administration

```
[Expert]  

[Administration]

Def. access code  

Activate SW opt.

Device reset
```
Description of parameters

Navigation  

Def. access code

Description

Define release code for write access to parameters.

User entry

0 to 9999

Factory setting

0

Additional information

1. 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.

2. 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.

3. 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 (→ 28).

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

5. For display operation: The new access code is only valid after it has been confirmed in the Confirm code parameter (→ 47).

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

Activate SW opt.

Navigation

Description

Enter code to unlock specific software options.

User entry

Positive integer

Factory setting

0

Additional information

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

Endress+Hauser
Device reset

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

Selection
- Cancel
- To bus defaults
- 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 measurement-related parameter is reset to its factory setting. Service parameters and communication-related parameters, however, remain unchanged.
- **Restart device**
  The restart resets every parameter which is stored in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
"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  
→  45

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

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
### 4.4 "Sensor" submenu

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

**Navigation**

![Expert → Sensor](expert_sensor)

### 4.4.1 Structure of the submenu

**Navigation**

![Expert → Sensor](expert_sensor)

<table>
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</thead>
<tbody>
<tr>
<td>Distance unit</td>
<td>→ 50</td>
<td></td>
<td></td>
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<tr>
<td>Temperature unit</td>
<td>→ 50</td>
<td></td>
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<tr>
<td>Operating mode</td>
<td>→ 50</td>
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<tr>
<td>Tank type</td>
<td>→ 51</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Tube diameter</td>
<td>→ 51</td>
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<tr>
<td>Bin type</td>
<td>→ 51</td>
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<tr>
<td>Process property</td>
<td>→ 52</td>
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<tr>
<td>Adv. conditions</td>
<td>→ 53</td>
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<tr>
<td>Applicat. param.</td>
<td>→ 54</td>
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<tr>
<td>▶️ Medium</td>
<td>→ 55</td>
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<tr>
<td>▶️ Level</td>
<td>→ 61</td>
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<tr>
<td>▶️ Linearization</td>
<td>→ 73</td>
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<tr>
<td>▶️ Information</td>
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<td>▶️ Sensor prop.</td>
<td>→ 91</td>
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<tr>
<td>▶️ Distance</td>
<td>→ 95</td>
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<td>▶️ Gas phase comp.</td>
<td>→ 104</td>
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<td>▶️ Sensor diag.</td>
<td>→ 109</td>
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<tr>
<td>▶️ Safety sett.</td>
<td>→ 116</td>
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<tr>
<td>Menu</td>
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<td>Env. curve</td>
<td>122</td>
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<tr>
<td>EOP evaluation</td>
<td>132</td>
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<td>Echo tracking</td>
<td>139</td>
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<tr>
<td>Interface</td>
<td>145</td>
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<td></td>
</tr>
</tbody>
</table>
4.4.2 Description of parameters

Navigation  

Expert → Sensor → Distance unit (0551)

Description  
Select distance unit.

Selection  

**SI units**  
- mm  
- m

**US units**  
- ft  
- in

Factory setting  
m

---

**Temperature unit**

Navigation  

Expert → Sensor → Temperature unit (0557)

Description  
Select temperature unit.

Selection  

**SI units**  
- °C  
- K

**US units**  
- °F  
- °R

Factory setting  
°C

---

**Operating mode**

Navigation  

Expert → Sensor → Operating mode (1046)

Prerequisite  
The device has the "interface measurement" application package (available for FMP51, FMP52, FMP54) 1).

Description  
Select operating mode.

Selection  
- Level  
- Interf.+capacit.  
- Interface

Factory setting  
FMP51/FMP52/FMP54: Level

---

1) Product structure: Feature 540 "Application Package", Option EB "Interface measurement"
Tank type

Navigation
- Expert → Sensor → Tank type (1175)

Prerequisite
- Medium type (→ 56) = Liquid

Description
Select tank type.

Selection
- Metallic
- Bypass / pipe
- Non metallic
- Mounted outside
- Coaxial

Factory setting
Depending on the probe

Additional information
- Depending on the probe some of the options mentioned above may not be available or there may be additional options.
- For coax probes and probes with metallic center washer Tank type parameter corresponds to the type of probe and cannot be changed.

Tube diameter

Navigation
- Expert → Sensor → Tube diameter (1117)

Prerequisite
- Tank type (→ 51) = Bypass / pipe

Description
Specify diameter of bypass or stilling well.

User entry
0 to 9.999 m

Factory setting
0.0384 m

Bin type

Navigation
- Expert → Sensor → Bin type (1176)

Prerequisite
- Medium type (→ 56) = Solid

Description
Specify bin type.

Selection
- Concrete
- Plastic wood
- Metallic
- Aluminium
- Buffer silo fast
- Bin/ Pile
"Expert" menu

- Crusher / belt
- Silo
- Workbench test

Factory setting
Metallic

Process property

Navigation
Expert → Sensor → Process property (1081)

Description
Specify typical rate of level change.

Selection
For "Medium type" = "Liquid"
- Very fast > 10 m (400 in)/min
- Fast > 1 m (40 in)/min
- Standard < 1 m (40 in) /min
- Medium < 10 cm (4 in) /min
- Slow < 1 cm (0.4 in) /min
- No filter / test

For "Medium type" = "Solid"
- Very fast > 100 m (333 ft) /h
- Fast > 10 m (33 ft) /h
- Standard < 10 m (33 ft) /h
- Medium < 1 m (3 ft) /h
- Slow < 0.1 m (0.3 ft) /h
- No filter / test

Factory setting
Std.<1m 40''/min

Additional information
The device adjusts the signal evaluation filters and the damping of the output signal to the
typical rate of level change defined in this parameter:

For "Operating mode" = "Level" and "Medium type" = "Liquid"

<table>
<thead>
<tr>
<th>Process property</th>
<th>Step response time / s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fst&gt;10m400''/min</td>
<td>5</td>
</tr>
<tr>
<td>Fast&gt;1m 40''/min</td>
<td>5</td>
</tr>
<tr>
<td>Std.&lt;1m 40''/min</td>
<td>14</td>
</tr>
<tr>
<td>Med&lt;10cm 4''/min</td>
<td>39</td>
</tr>
<tr>
<td>Sl.&lt;1cm .4''/min</td>
<td>76</td>
</tr>
<tr>
<td>No filter / test</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>

For "Operating mode" = "Level" and "Medium type" = "Solid"

<table>
<thead>
<tr>
<th>Process property</th>
<th>Step response time / s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast&gt;100m333'/h</td>
<td>37</td>
</tr>
<tr>
<td>Fast&gt;10m(33ft)/h</td>
<td>37</td>
</tr>
<tr>
<td>Std.&lt;10m(33ft)/h</td>
<td>74</td>
</tr>
<tr>
<td>Med &lt;1m (3ft) /h</td>
<td>146</td>
</tr>
</tbody>
</table>
### Leveflex FMP5x Modbus

#### "Expert" menu

<table>
<thead>
<tr>
<th>Process property</th>
<th>Step response time / s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow&lt;.1m (.3ft)/h</td>
<td>290</td>
</tr>
<tr>
<td>No filter / test</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>

For "Operating mode" = "Interface" or "Interf.+capacit."

<table>
<thead>
<tr>
<th>Process property</th>
<th>Step response time / s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast&gt;10m400'/min</td>
<td>5</td>
</tr>
<tr>
<td>Fast&gt;1m 40'/min</td>
<td>5</td>
</tr>
<tr>
<td>Std.&lt;1m 40'/min</td>
<td>23</td>
</tr>
<tr>
<td>Med&lt;10cm 4'/min</td>
<td>47</td>
</tr>
<tr>
<td>Sl.&lt;1cm .4'/min</td>
<td>81</td>
</tr>
<tr>
<td>No filter / test</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Other values of the step-response time (e.g. intermediate values) can be defined by the following parameters:

- **Dead time (→ 97)**
- **Integration time (→ 98)**

### Adv. conditions

#### Navigation

Expert → Sensor → Adv. conditions (1177)

#### Prerequisite

Operating mode (→ 50) = Level

#### Description

Specify additional process conditions (if required).

#### Selection

- None
- Oil/Watercondens  (only Medium type = Liquid)
- Probe near bott.
- Build up
- Foam >5cm/0,16ft

#### Factory setting

None

#### Additional information

- **Oil/Watercondens**  (only Medium type = Liquid)
  Makes sure that in the case of two-phase media only the total level is detected (example: oil/condensate application).

- **Probe near bott.**  (only for Medium type = Liquid)
  Improves the empty detection, especially if the probe is mounted close to the tank bottom.

- **Build up**
  Enables a safe empty-detection even if the end-of-probe signal has shifted due to build-up.

- **Foam >5cm/0,16ft**  (only for Medium type = Liquid)
  Optimizes the signal evaluation in applications with foam formation.
Applicat. param.

Navigation

Expert → Sensor → Applicat. param. (1126)
Expert → Sensor → Applicat. param. (1126)

Description

Indicates whether settings depending on the application parameters (e.g. Adv. conditions (→ 53), Tank type (→ 51) and Tube diameter (→ 51)) have been changed after the basic setup.

User interface

- Changed
- Not changed

Additional information

Meaning of the options

- Changed
Parameters have been changed. The device is no longer in the state defined by the application parameters.

- Not changed
There have been no changes. The device is still in the state defined by the application parameters.
4.4.3 "Medium" submenu

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

The dielectric constant is used to calculate the threshold for the level echo and (if applicable) the interface echo.

For FMP51/FMP52/FMP54/FMP55: The Operating mode parameter (→ 50) determines which parameters this submenu contains.

Structure of the submenu

**Navigation**  
Expert → Sensor → Medium

<table>
<thead>
<tr>
<th>Medium</th>
<th>→</th>
<th>56</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium property</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC lower medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calc. DC value</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Description of parameters

**Navigation**

- Expert → Sensor → Medium

**Medium group**

**Navigation**

- Expert → Sensor → Medium → Medium group (1208)

**Prerequisite**

- For FMP51/FMP52/FMP54/FMP55: Operating mode (→ 50) = Level
- Medium type (→ 56) = 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 (→ 57).

The **Medium group** parameter presets the **Medium property** parameter (→ 57) as follows:

<table>
<thead>
<tr>
<th>Medium group</th>
<th>Medium property (→ 57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>Unknown</td>
</tr>
<tr>
<td>Water based DC&gt;4</td>
<td>DC 4 ... ?</td>
</tr>
</tbody>
</table>

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

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

**Medium type**

**Navigation**

- Expert → Sensor → Medium → Medium type (1049)

**Description**

Specify type of medium.

**User interface**

- Liquid
- Solid

**Factory setting**

FMP50, FMP51, FMP52, FMP53, FMP54, FMP55: Liquid

**Additional information**

The **Solid** option is only available for Operating mode (→ 50) = Level

This parameter determines the value of several other parameters and strongly influences the complete signal evaluation. Therefore, it is strongly recommended not to change the factory setting.
Medium property

Navigation

Expert → Sensor → Medium → Medium property (1165)

Prerequisite

- Operating mode (→ 50) = Level
- EOP level eval. = Fix DC

Description

Specify relative dielectric constant \( \varepsilon_r \) of the medium.

Selection

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

Factory setting

Dependent on Medium type (→ 56) and Medium group (→ 56).

Additional information

Dependency on 'Medium type' and 'Medium group'

<table>
<thead>
<tr>
<th>Medium type (→ 56)</th>
<th>Medium group (→ 56)</th>
<th>Medium property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Liquid</td>
<td>Water based DC&gt;4</td>
<td>DC 4 ... 7</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

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)

For EOP level eval. = Fix DC, the exact dielectric constant has to be entered into the DC value parameter. Therefore, the Medium property parameter is not available in this case.

DC lower medium

Navigation

Expert → Sensor → Medium → DC lower medium (1154)

Prerequisite

Operating mode (→ 50) = Interface or Interf.+capacit.

Description

Specify the relative dielectric constant \( \varepsilon \) of the lower medium.

User entry

1 to 100

Factory setting

80.0
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)

The factory setting, $\varepsilon_r = 80$, is valid for water at 20 °C (68 °F).

### DC value

#### Navigation
- Expert → Sensor → Medium → DC value (1201)

#### Description
- For level measurements:
  - Specify dielectric constant $\varepsilon_r$.
- For interface measurements:
  - Specify dielectric constant $\varepsilon_i$ of the upper medium.

#### User entry
- Signed floating-point number

#### Factory setting
- Dependent on the following parameters:
  - Operating mode (→ 50)
  - Medium property (→ 57)
  - Medium type (→ 56)
  - Bin type (→ 51) or Tank type (→ 51)

#### Additional information
- Dependence of the factory settings on other parameters

For "Operating mode" = "Level"

<table>
<thead>
<tr>
<th>Medium property (→ 57)</th>
<th>Medium type (→ 56)</th>
<th>Bin type (→ 51) or Tank type (→ 51)</th>
<th>DC value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>Solid</td>
<td>Bin type (→ 51)</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aluminium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Plastic wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquid</td>
<td>Bin type (→ 51)</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Concrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Metallic</td>
<td></td>
</tr>
<tr>
<td>DC 1.4 ... 1.6</td>
<td>Solid</td>
<td>Liquid</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tank type (→ 51)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coaxial</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any other tank type</td>
<td>1.9</td>
</tr>
<tr>
<td>DC 1.6 ... 1.9</td>
<td>Solid</td>
<td>Bin type (→ 51)</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Concrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aluminium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Plastic wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquid</td>
<td>Bin type (→ 51)</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Metallic</td>
<td></td>
</tr>
<tr>
<td>DC 1.9 ... 2.5</td>
<td>Liquid</td>
<td>Tank type (→ 51)</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Non metallic</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mounted outside</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any other tank type</td>
<td>1.4</td>
</tr>
<tr>
<td>DC 2.5 ... 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Calc. DC value

<table>
<thead>
<tr>
<th>Medium property</th>
<th>Medium type</th>
<th>Bin type or Tank type</th>
<th>DC value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 4 ... 7</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>DC 7 ... 15</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>DC &gt; 15</td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

For "Operating mode" = "Interf.+capacit." or "Interface":
DC value = 1.9

As the value defines the echo threshold, it may not exceed the actual DC of the medium. Dielectric constants above DC = 15 have only a very limited influence on the echo threshold.

Navigation

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

Prerequisite

EOP level eval. = Automatic DC

Description

- For Operating mode = Level:
  Displays the dielectric constant calculated from the level and end-of-probe signals.
- For Operating mode = Interface or Interf.+capacit.:
  - For Interface prop. = Special: auto DC:
    Displays the dielectric constant of the upper medium which has been calculated from the level and interface signal.
  - Else:
    Identical to DC value.

User interface

1.0 to 100.0
4.4.4 "Level" submenu

The Level submenu (→ 61) is used to configure the calculation of the level from the measured distance.

10 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

<table>
<thead>
<tr>
<th>► Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance offset → 62</td>
</tr>
<tr>
<td>Empty calibr. → 63</td>
</tr>
<tr>
<td>Full calibr. → 64</td>
</tr>
<tr>
<td>Level unit → 65</td>
</tr>
<tr>
<td>Level limit mode → 65</td>
</tr>
<tr>
<td>High limit → 66</td>
</tr>
<tr>
<td>Low limit → 66</td>
</tr>
<tr>
<td>Level correction → 67</td>
</tr>
<tr>
<td>Output mode → 67</td>
</tr>
<tr>
<td>Level → 68</td>
</tr>
<tr>
<td>Level linearized → 69</td>
</tr>
<tr>
<td>Interface → 69</td>
</tr>
<tr>
<td>Interf. lineariz → 70</td>
</tr>
<tr>
<td>Thickn. upper layer → 70</td>
</tr>
</tbody>
</table>
Description of parameters

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.

The value entered in this parameter changes the distance input into the level block and thus influences the measured level. This change, however, is not taken into account in the displayed distance.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
Empty calibr.

Navigation

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

Description
Distance process connection to min. level.

User entry
Depending on the probe

Factory setting
Depending on the probe

Additional information

![Diagram: Empty calibr. (E) for level measurements in liquids](image1)

12 Empty calibr. (E) for level measurements in liquids

![Diagram: Empty calibr. (E) for interface measurements](image2)

13 Empty calibr. (E) for interface measurements

In the case of interface measurements the **Empty calibr.** parameter is valid for both, the total and the interface level.

<table>
<thead>
<tr>
<th>Access</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read access</td>
<td>Operator</td>
</tr>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
Full calibr.

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

Description
Span: max. level - min level.

User entry
Depending on the probe

Factory setting
Depending on the probe

Additional information

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

15 Full calibr. (F) for interface measurements

In the case of interface measurements the Full calibr. parameter is valid for both, the total and the interface level.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>
**Level unit**

**Navigation**
- Expert → Sensor → Level → Level unit (0576)
- Expert → Sensor → Level → Level unit (0576)

**Description**
Select level unit.

**Selection**

<table>
<thead>
<tr>
<th>SI units</th>
<th>US units</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>ft</td>
</tr>
<tr>
<td>m</td>
<td>in</td>
</tr>
<tr>
<td>mm</td>
<td></td>
</tr>
</tbody>
</table>

**Factory setting**
%

**Additional information**
The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 50):
- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibr.** (→ 63) and **Full calibr.** (→ 64)).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

**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** (→ 66) und **Low limit** (→ 66) parameters.
"Expert" menu

**High limit**

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

**Prerequisite**
- Level limit mode (→ 65) = High limit or 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).

---

**Low limit**

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

**Prerequisite**
- Level limit mode (→ 65) = Low limit or 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).

---

**Level correction**

**Navigation**
Expert → Sensor → Level → Level correction (2325)

**Description**
Specify level correction (if required).

**User entry**
–200 000.0 to 200 000.0 %

**Factory setting**
0.0 %

**Additional information**
The value specified in this parameter is added to the measured level (before linearization).

---

**Output mode**

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

**Description**
Select output mode.

**Selection**
- 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).
"Expert" menu

**Levelflex FMP5x Modbus**

---

**17 Definition of the "Output mode (→ 67)" parameter**

- **A** Level linearized
- **B** Ullage

---

The **Ullage** option is not available for **Lineariz. type (→ 75) = Table.**

---

**Level**

**Navigation**

- Expert → Sensor → Level → Level (2319)
- Expert → Sensor → Level → Level (2319)

**Description**

Displays measured level \( L \) (before linearization).

**Additional information**

---

**18 Level in case of liquid measurements**
The unit is defined in the **Level unit** parameter (→ 65).

- In case of interface measurements, this parameter always refers to the total level.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>-</td>
</tr>
</tbody>
</table>

**Level linearized**

**Navigation**

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

**Description**

Displays linearized level.

**Additional information**

- The unit is defined by the **Unit lineariz.** parameter (→ 76).
- For interface measurements, this parameter always refers to the total level.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>-</td>
</tr>
</tbody>
</table>

**Interface**

**Navigation**

- Expert → Sensor → Level → Interface (2352)

**Prerequisite**

Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**

Displays the measured interface level L_I (before linearization).
Additional information

The unit is defined in the **Level unit** parameter (→ 65).

---

**Interf. lineariz**

**Navigation**

Expert → Sensor → Level → Interf. lineariz (2382)

**Prerequisite**

Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**

Displays the linearized interface height.

**Additional information**

The unit is defined in the **Unit lineariz.** parameter → 76.

---

**Thickn.upp.layer**

**Navigation**

Expert → Sensor → Level → Thickn.upp.layer (2330)

**Prerequisite**

Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**

Displays the upper interface thickness (UP).
Additional information

The unit is defined by the **Unit lineariz.** parameter → 76.
4.4.5  "Linearization" submenu

Linearization: Transformation of the level and (if relevant) the interface height 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 (→ 75) = None
   B. Lineariz. type (→ 75) = Linear
   C. Lineariz. type (→ 75) = Table
   D. Lineariz. type (→ 75) = Pyramid bottom
   E. Lineariz. type (→ 75) = Conical bottom
   F. Lineariz. type (→ 75) = Angled bottom
   G. Lineariz. type (→ 75) = Horizontal cyl.
   H. Lineariz. type (→ 75) = Sphere

1. For "Operating mode (→ 50)" = "Interface" or "Interf. + capacit.": Interface before linearization (measured in distance units)

1'. For "Operating mode (→ 50)" = "Interface" or "Interf. + capacit.": Interface after linearization (corresponds to volume or weight)

L. Level before linearization (measured in distance units)
L'. Level linearized (→ 69) (corresponds to volume or weight)
M. Maximum value (→ 78)
d. Diameter (→ 78)
h. Interm. height (→ 79)
Structure of the submenu on the local display

*Navigation*  
Expert → Sensor → Linearization

![Structure of the submenu on the local display](image)

- Linearization
  - Lineariz. type
  - Unit lineariz.
  - Free text
  - Maximum value
  - Diameter
  - Intermed. height
  - Table mode
  - Activate table

→ 75
→ 76
→ 77
→ 78
→ 78
→ 79
→ 79
→ 81
Structure of the submenu in an operating tool (e.g. FieldCare)

*Navigation*

- Expert → Sensor → Linearization

<table>
<thead>
<tr>
<th>Linearization</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lineariz. type</td>
<td>75</td>
</tr>
<tr>
<td>Unit lineariz.</td>
<td>76</td>
</tr>
<tr>
<td>Free text</td>
<td>77</td>
</tr>
<tr>
<td>Level linearized</td>
<td>77</td>
</tr>
<tr>
<td>Interf. lineariz</td>
<td>78</td>
</tr>
<tr>
<td>Maximum value</td>
<td>78</td>
</tr>
<tr>
<td>Diameter</td>
<td>78</td>
</tr>
<tr>
<td>Intermed. height</td>
<td>79</td>
</tr>
<tr>
<td>Table mode</td>
<td>79</td>
</tr>
<tr>
<td>Table number</td>
<td>80</td>
</tr>
<tr>
<td>Level</td>
<td>81</td>
</tr>
<tr>
<td>Level</td>
<td>81</td>
</tr>
<tr>
<td>Level</td>
<td>81</td>
</tr>
<tr>
<td>Customer value</td>
<td>81</td>
</tr>
<tr>
<td>Activate table</td>
<td>81</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/D</td>
<td>E</td>
</tr>
<tr>
<td>F/G</td>
<td></td>
</tr>
</tbody>
</table>

A0021476

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.** (→ 76)
  - **Maximum value** (→ 78): 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.** (→ 76)
  - **Table mode** (→ 79)
  - For each table point: **Level** (→ 81)
  - For each table point: **Customer value** (→ 81)
  - **Activate table** (→ 81)

- **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.** (→ 76)
  - **Maximum value** (→ 78): Maximum volume or weight
  - **Intermed. height** (→ 79): 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.** (→ 76)
  - **Maximum value** (→ 78): Maximum volume or weight
  - **Intermed. height** (→ 79): 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.** (→ 76)
  - **Maximum value** (→ 78): Maximum volume or weight
  - **Intermed. height** (→ 79): 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.** (→ 76)
  - **Maximum value** (→ 78): Maximum volume or weight
  - **Diameter** (→ 78)

- **Sphere**
  The output value corresponds to the volume or weight in a spherical tank. The following additional parameters have to be specified:
  - **Unit lineariz.** (→ 76)
  - **Maximum value** (→ 78): Maximum volume or weight
  - **Diameter** (→ 78)
### Selection

- **SI units**
  - STon
  - t
  - kg
  - cm³
  - dm³
  - m³
  - hl
  - l
  - %

- **US units**
  - lb
  - UsGal
  - ft³

- **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 **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 (→  77).

---

### Free text

- Description: Enter unit symbol.
- User entry: Up to 32 alphanumerical characters (letters, numbers, special characters)
- Factory setting: Free text

---

### Level linearized

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

- **Description**
  - Displays linearized level.

- **Additional information**
  - The unit is defined by the **Unit lineariz.** parameter →  76.
  - For interface measurements, this parameter always refers to the total level.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>

---
"Expert" menu

Interf. lineariz

Navigation  
Expert → Sensor → Linearization → Interf. lineariz (2382)

Prerequisite  
Operating mode (→ 50) = Interface or Interf.+capacit.

Description  
Displays the linearized interface height.

Additional information  
The unit is defined in the Unit lineariz. parameter → 76.

Maximum value

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

Prerequisite  
Lineariz. type (→ 75) has one of the following values:  
- Linear  
- Pyramid bottom  
- Conical bottom  
- Angled bottom  
- Horizontal cyl.  
- Sphere

Description  
Specify the maximum content of the vessel (100%) measured in the units after linearization.

User entry  
-50000.0 to 50000.0 %

Factory setting  
100.0 %

Diameter

Navigation  
Expert → Sensor → Linearization → Diameter (2342)

Prerequisite  
Lineariz. type (→ 75) has one of the following values:  
- Horizontal cyl.  
- Sphere

Description  
Specify tank diameter.

User entry  
0 to 9999.999 m

Factory setting  
2 m

Additional information  
The unit is defined in the Distance unit parameter (→ 50).
Intermed. height

Navigation  

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

Prerequisite  

Lineariz. type (→ 75) has one of the following values:
- Pyramid bottom
- Conical bottom
- Angled bottom

Description  

Specify intermediate height H.

User entry  

0 to 200 m

Factory setting  

0 m

Additional information

The unit is defined in the Distance unit parameter (→ 50).

Table mode

Navigation  

Expert → Sensor → Linearization → Table mode (2303)

Prerequisite  

Lineariz. type (→ 75) = Table

Description  

Select editing mode of the linearization table.

Selection  

- Manual
- Semiautomatic
- Clear table
- Sort table

Factory setting  

Manual
**Addition information**

**Meaning of the options**

- **Manual**  
The level and the associated linearized value are entered manually for each linearization point.

- **Semiautomatic**  
The level is measured by the device for each linearization point. The associated linearized value is entered manually.

- **Clear table**  
Deletes the existing linearization table.

- **Sort table**  
Rearranges the linearization points into an ascending order.

**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.** (→ 63) and **Full calibr.** (→ 64) 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** (→ 79) = Clear table). Then enter a new table.

**How to enter the table**

- **Via FieldCare**  
The table points can be entered via the **Table number** (→ 80), **Level** (→ 81) and **Customer value** (→ 81) 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 (→ 65) beforehand.

---

**Table number**

**Navigation**

Expert → Sensor → Linearization → Table number (2370)

**Prerequisite**

Lineariz. type (→ 75) = Table

**Description**

Select table point you are going to enter or change.

**User entry**

1 to 32

**Factory setting**

1
**Level (Manual)**

**Navigation**
Expert → Sensor → Linearization → Level (2383)

**Prerequisite**
- Lineariz. type (→ 75) = Table
- Table mode (→ 79) = Manual

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

**User entry**
Signed floating-point number

**Factory setting**
0 %

**Level (Semiautomatic)**

**Navigation**
Expert → Sensor → Linearization → Level (2389)

**Prerequisite**
- Lineariz. type (→ 75) = Table
- Table mode (→ 79) = Semiautomatic

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

**Customer value**

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

**Prerequisite**
Lineariz. type (→ 75) = Table

**Description**
Enter linearized value for the table point.

**User entry**
Signed floating-point number

**Factory setting**
0 %

**Activate table**

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

**Prerequisite**
Lineariz. type (→ 75) = 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 (→ 75) = Table at the same time, the device issues error message F435.

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

ℹ️ 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.
4.4.6 "Information" submenu

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

Structure of the submenu

Navigation: Expert → Sensor → Information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal quality</td>
<td>84</td>
</tr>
<tr>
<td>Abs. echo ampl.</td>
<td>84</td>
</tr>
<tr>
<td>Relat. echo ampl.</td>
<td>85</td>
</tr>
<tr>
<td>Abs.interf.ampl.</td>
<td>86</td>
</tr>
<tr>
<td>Rel.interf.ampl.</td>
<td>86</td>
</tr>
<tr>
<td>Abs. EOP ampl.</td>
<td>87</td>
</tr>
<tr>
<td>Found echoes</td>
<td>87</td>
</tr>
<tr>
<td>Used calculation</td>
<td>88</td>
</tr>
<tr>
<td>Tank trace state</td>
<td>89</td>
</tr>
<tr>
<td>Measurn. freq.</td>
<td>89</td>
</tr>
<tr>
<td>Electronic temp.</td>
<td>89</td>
</tr>
</tbody>
</table>
Description of parameters

**Navigation**

🛠 Expert → Sensor → Information

---

**Signal quality**

**Navigation**

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

**Description**

Displays the signal quality of the evaluated echo.

**Additional information**

**Meaning of the display options**

- **Strong**
  The evaluated echo exceeds the threshold by at least 10 mV.
- **Medium**
  The evaluated echo exceeds the threshold by at least 5 mV.
- **Weak**
  The evaluated echo exceeds the threshold by less than 5 mV.
- **No signal**
  The device does not find a usable echo.

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

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

- F941, for **Output echo lost** (→ 🛠 117) = Alarm.
- S941, if another option has been selected in **Output echo lost** (→ 🛠 117).

---

**Abs. echo ampl.**

**Navigation**

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

**Description**

Displays the absolute amplitude of the level echo in the subtracted curve.

---

**Note:** Of these two echoes the one with the lower quality is indicated.
Additional information

1  Absolute echo amplitude in the envelope curve as measured from the 0mV line

Relat.echo ampl.

Navigation  
Expert ➔ Sensor ➔ Information ➔ Relat.echo ampl. (1089)

Description  
Displays the relative amplitude of the level echo in the subtracted curve. The relative amplitude is the difference between the level echo and the echo threshold.
Additional information

The relative echo amplitude is the difference between the amplitude in the envelope curve (blue) and the echo threshold (green).

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

Abs.interf.ampl.

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Sensor → Information → Abs.interf.ampl. (1129)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite</td>
<td>Operating mode (→ 50) = Interface or Interf.+capacit.</td>
</tr>
<tr>
<td>Description</td>
<td>Displays the absolute amplitude of the interface echo in the subtracted curve.</td>
</tr>
</tbody>
</table>

Rel.interf.ampl.

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Sensor → Information → Rel.interf.ampl. (1090)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite</td>
<td>Operating mode (→ 50) = Interface or Interf.+capacit.</td>
</tr>
<tr>
<td>Description</td>
<td>Displays the relative amplitude of the interface echo in the subtracted curve.</td>
</tr>
</tbody>
</table>
Abs. EOP ampl.

**Navigation**

Expert → Sensor → Information → Abs. EOP ampl. (1128)

**Description**

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

**Additional information**

1. **Absolute EOP amplitude (example for an insulated end-of-probe)**

**Polarity of the end-of-probe signal**

- For probe ends which are freely suspended in the medium or insulated against the tank, the end-of-probe signal is negative.
- For probe ends which are grounded to the tank potential, the end-of-probe signal is positive.

To ensure correct evaluation of the end-of-probe signal, its polarity must be specified in the EOP search mode parameter (→ 133).

---

**Found echoes**

**Navigation**

Expert → Sensor → Information → Found echoes (1068)

**Description**

Indicates which echoes have been found.
User interface

- None
- Level
- Interface
- EOP
- Level + interf.
- Level and EOP
- Interf. and EOP
- Level+interf+EOP
- EOP (TT)
- Multip. echo(TT)
- EOP (LN)
- EOP
- Level and EOP
- Level+interf(C)
- Level(C)+interf

Used calculation

Navigation

Expert → Sensor → Information → Used calculation (1115)

Description

Indicates which echoes are used for the calculation of the measured value.

Additional information

**Meaning of the options**

- **None**
  The measured value is not calculated (e.g. due to a lost echo)

- **Level**
  The level is calculated from the direct level echo.

- **EOP**
  The level is calculated from the end-of-probe signal (EOP).

- **EOP (TT)**
  The level is calculated from the end-of-probe signal (EOP) taking into account the tank table (TT).

- **Multip. echo(TT)**
  The level is calculated from the multiple echo, taking into account the tank table (TT).

- **EOP (LN)**
  An empty tank is detected from the end-of-probe signal (EOP) in the interface mode.

- **Level and EOP**
  The level is calculated from the direct level echo. Its plausibility is checked by the end-of-probe signal (EOP). This situation may occur if the device is in the interface mode and the tank contains only one medium.

- **Interface**
  The interface height is calculated from the direct interface echo. This situation may occur if **Tank level (→ 146) = Fully flooded.**

- **Level + interf.**
  The level is calculated from the direct level echo. The interface height is calculated from the direct interface echo.
Tank trace state

**Navigation**

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

**Description**

Indicates the current state of the tank trace.

**Additional information**

**Meaning of the options**

- **Not active**
  
  A valid tank trace is not available.

- **EOP (TT)**
  
  A valid EOP tank trace is available.

- **Multip. echo(TT)**
  
  A valid multiple echo tank trace is available.

- **EOP+Multipleecho**
  
  A valid EOP and multiple echo tank trace are available.

Measurm. freq.

**Navigation**

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

**Description**

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

**Additional information**

The measurement frequency is dependent on the length of the probe. Refer to the Technical Information (TI) of the respective device for details.

Electronic temp.

**Navigation**

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

**Description**

Displays the current temperature of the electronics.

**Additional information**

The unit is defined in the **Temperature unit** parameter (→ 50).
4.4.7 "Sensor prop." submenu

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

Probe length correction

For the signal evaluation it is essential that the Levelflex allocates the end-of-probe signal correctly. To ensure this one can manually enter the actual length of the probe or one can perform a probe length correction several times until the displayed length of the probe matches the actual length of the probe (LN). To do so one needs the following parameters:

- Pres. length (→ 92)
- Confirm length (→ 92)

When operating via the local display module, the Confirm length (→ 92) and Pres. length (→ 92) parameters are comprised in the Prob.length corr sequence.
### Structure of the submenu

**Navigation**


<table>
<thead>
<tr>
<th>Select</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor prop.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✔️</td>
<td>Probe grounded</td>
<td>92</td>
</tr>
<tr>
<td>✔️</td>
<td>Pres. length</td>
<td>92</td>
</tr>
<tr>
<td>✔️</td>
<td>Confirm length</td>
<td>92</td>
</tr>
<tr>
<td>✔️</td>
<td>Sensor module</td>
<td>93</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation  

---

**Probe grounded**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite</td>
<td>Operating mode (→ 50) = Level</td>
</tr>
<tr>
<td>Description</td>
<td>Specify whether the probe is grounded.</td>
</tr>
<tr>
<td>Selection</td>
<td>• No  • Yes</td>
</tr>
<tr>
<td>Factory setting</td>
<td>No</td>
</tr>
</tbody>
</table>

---

**Pres. length**

| Description |  • In most cases: Displays the length of the probe according to the currently measured end-of-probe signal.  • For Confirm length (→ 92) = Manual input: Enter actual length of probe. |
| User entry | 0 to 200 m |
| Factory setting | 4 m |

---

**Confirm length**

| Description | Select, whether the value displayed in the Pres. length parameter (→ 92) matches the actual length of the probe. Based on this input, the device performs a probe length correction. |
| Selection |  • Probe length OK  • Length too small  • Length too big  • Probe covered  • Manual input  • Length unknown |
| Factory setting | Probe length OK |
Additional information

<table>
<thead>
<tr>
<th>Meaning of the options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probe length OK</strong></td>
<td>To be selected if the indicated length is correct. An adjustment is not required. The device quits the sequence.</td>
</tr>
<tr>
<td><strong>Length too small</strong></td>
<td>To be selected if the displayed length is smaller than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is displayed in the Pres. length parameter → 92. This procedure has to be repeated until the displayed value matches the actual length of the probe.</td>
</tr>
<tr>
<td><strong>Length too big</strong></td>
<td>To be selected if the displayed length is bigger than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is indicated in the Pres. length parameter → 92. This procedure has to be repeated until the displayed value matches the actual length of the probe.</td>
</tr>
<tr>
<td><strong>Probe covered</strong></td>
<td>To be selected if the probe is (partially or completely) covered. A probe length correction is impossible in this case. The device quits the sequence.</td>
</tr>
<tr>
<td><strong>Manual input</strong></td>
<td>To be selected if no automatic probe length correction is to be performed. Instead, the actual length of the probe must be entered manually into the Pres. length parameter → 92.</td>
</tr>
<tr>
<td><strong>Length unknown</strong></td>
<td>To be selected if the actual length of the probe is unknown. A probe length correction is impossible in this case and the device quits the sequence.</td>
</tr>
</tbody>
</table>

Sensor module

**Navigation**

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

**Description**

Displays the type of sensor module.

---

3) When operated via FieldCare, the Manual input option needs not to be selected explicitly. In FieldCare the length of the probe can always be edited.
4.4.8 "Distance" submenu

The Distance submenu contains all parameters which control the filtering of the raw distance \( D_1 \). The resulting distance \( D_0 \) is used for the subsequent calculation of the level.

![Diagram of distance filtering](image)

- **22** The configurable distance filters
  - 1. Dead time (→ 97)
  - 2. Integration time (→ 98) (low pass filter)

**Low pass filter**

The low pass filter dampens the distance signal with a user defined integration time \( \tau \) (Integration time parameter (→ 98)). After a sudden change of the level, it takes about \( 5 \times \tau \), until the new measured value is obtained.

![Diagram of low pass filter](image)

- **23** Low pass filter
  - 1. Signal before the low pass filter
  - 2. Signal after the low pass filter
  - \( \tau \) Integration time (→ 98)
Structure of the submenu

**Navigation**

Expert → Sensor → Distance

<table>
<thead>
<tr>
<th>Distance</th>
<th>→ 96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface dist.</td>
<td>→ 97</td>
</tr>
<tr>
<td>Dead time</td>
<td>→ 97</td>
</tr>
<tr>
<td>Integration time</td>
<td>→ 98</td>
</tr>
<tr>
<td>Blocking dist.</td>
<td>→ 99</td>
</tr>
</tbody>
</table>
Description of parameters

**Navigation**

Expert → Sensor → Distance

**Description**

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

**Additional information**

- **24** Distance for liquid measurements
- **25** Distance for interface measurements

The unit is defined in the **Distance unit** parameter (→ 50).
Interface dist.

Navigation

Expert → Sensor → Distance → Interface dist. (1067)

Prerequisite

Operating mode (→ 50) = Interface or Interf.+capacit.

Description

Displays the measured distance $D_I$ between the reference point (lower edge of flange or threaded connection) and the interface.

Additional information

The unit is defined in the Distance unit parameter (→ 50).

Dead time

Navigation

Expert → Sensor → Distance → Dead time (1199)

Description

Define the dead time (in seconds).

User entry

0 to 60 s

Factory setting

Dependent on the following parameters:
- Medium type (→ 56)
- Process property (→ 52)

Additional information

Factory setting for level measurements with 'Medium type' = 'Liquid'

<table>
<thead>
<tr>
<th>Process property (→ 52)</th>
<th>Dead time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast&gt;1m 40'/min</td>
<td>0 s</td>
</tr>
<tr>
<td>Std.&lt;1m 40'/min</td>
<td>1 s</td>
</tr>
<tr>
<td>Med&lt;10cm 4'/min</td>
<td>3 s</td>
</tr>
<tr>
<td>Sl.&lt;1cm .4'/min</td>
<td>6 s</td>
</tr>
<tr>
<td>No filter / test</td>
<td>0 s</td>
</tr>
</tbody>
</table>
"Expert" menu

**Factory setting for level measurements with 'Medium type' = "Solid"**

<table>
<thead>
<tr>
<th>Process property (→ 52)</th>
<th>Dead time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast &gt; 10m (33ft)/h</td>
<td>1 s</td>
</tr>
<tr>
<td>Std. &lt; 10m (33ft)/h</td>
<td>3 s</td>
</tr>
<tr>
<td>Med &lt; 1m (3ft)/h</td>
<td>5 s</td>
</tr>
<tr>
<td>Slow &lt; 1m (3ft)/h</td>
<td>10 s</td>
</tr>
<tr>
<td>No filter / test</td>
<td>0 s</td>
</tr>
</tbody>
</table>

**Factory setting for interface measurements**

<table>
<thead>
<tr>
<th>Process property (→ 52)</th>
<th>Dead time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast &gt; 1m 40'/min</td>
<td>0 s</td>
</tr>
<tr>
<td>Std. &lt; 1m 40'/min</td>
<td>10 s</td>
</tr>
<tr>
<td>Med &lt; 10cm 4'/min</td>
<td>10 s</td>
</tr>
<tr>
<td>Sl. &lt; 1cm 4'/min</td>
<td>10 s</td>
</tr>
<tr>
<td>No filter / test</td>
<td>0 s</td>
</tr>
</tbody>
</table>

**Application**

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

![Diagram showing the effect of dead time](image)

**Disadvantages**

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

**Integration time**

**Navigation**  
Expert → Sensor → Distance → Integration time (1092)

**Description**  
Define the integration time (in seconds).

**User entry**  
0.0 to 200000.0 s
Factory setting

Dependent on the following parameters:
- Medium type (→ 56)
- Process property (→ 52)

Additional information

Factory setting for "Medium type" = "Liquid"

<table>
<thead>
<tr>
<th>Process property (→ 52)</th>
<th>Integration time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast&gt;1m 40'/min</td>
<td>1 s</td>
</tr>
<tr>
<td>Std.&lt;1m 40'/min</td>
<td>5 s</td>
</tr>
<tr>
<td>Med&lt;10cm 4'/min</td>
<td>15 s</td>
</tr>
<tr>
<td>Sl.&lt;1cm 4'/min</td>
<td>30 s</td>
</tr>
</tbody>
</table>

Factory setting for "Medium type" = "Solid"

<table>
<thead>
<tr>
<th>Process property (→ 52)</th>
<th>Integration time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast&gt;10m(33ft)/h</td>
<td>37 s</td>
</tr>
<tr>
<td>Std.&lt;10m(33ft)/h</td>
<td>74 s</td>
</tr>
<tr>
<td>Med&lt;1m (3ft) /h</td>
<td>145 s</td>
</tr>
<tr>
<td>Slow&lt;.1m(.3ft)/h</td>
<td>290 s</td>
</tr>
</tbody>
</table>

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

Blocking dist.

Navigation

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

Description

Specify upper blocking distance UB.

User entry

0 to 200 m

Factory setting

- For coax probes: 0 mm (0 in)
- For rod and rope probes up to 8 m (26 ft): 200 mm (8 in)
- For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge

For FMP51/FMP52/FMP54 with the Interface measurement application package 4) and for FMP55:
100 mm (3.9 in) for all antenna types

Additional information

Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance

---

4) Ordering feature 540 "Application Package", option EB "Interface measurement"
due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are ignored.

This behavior is only valid if the following two conditions are met:
- Expert → Sensor → Echo tracking → Evaluation mode (1112) = **Short time hist.** or **Long time hist.**
- Expert → Sensor → Gas phase comp. → GPC mode (1034) = **On**, **Without correct.** or **External correct**

If one of these conditions is not met, signals in the blocking distance will always be ignored.

If required, a different behavior for signals in the blocking distance can be defined by the Endress+Hauser service.
4.4.9  "Gas phase comp." submenu

For FMP51, FMP52 and FMP54: The Gas phase comp. submenu (→ 104) is only available if Operating mode (→ 50) = Level.
**Gas phase compensation with reference signal**

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

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

![Diagram showing gas phase compensation with a constant correction factor F](image)

28  *Gas phase compensation with a constant correction factor F*

- **A**  Position of the level echo in the original envelope curve
- **B**  Position of the level echo in the corrected envelope curve.
### Structure of the submenu

**Navigation**

````
Expert → Sensor → Gas phase comp.
````

<table>
<thead>
<tr>
<th>Item</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPC mode</td>
<td>105</td>
</tr>
<tr>
<td>Pres. ref. dist.</td>
<td>105</td>
</tr>
<tr>
<td>Reference dist.</td>
<td>105</td>
</tr>
<tr>
<td>Ref. echo thresh</td>
<td>106</td>
</tr>
<tr>
<td>Const. GPC factor</td>
<td>106</td>
</tr>
</tbody>
</table>
Description of parameters


### GPC mode

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Sensor → Gas phase comp. → GPC mode (1034)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Select gas phase compensation mode.</td>
</tr>
<tr>
<td>Selection</td>
<td>• Off</td>
</tr>
<tr>
<td></td>
<td>• On</td>
</tr>
<tr>
<td></td>
<td>• Without correct.</td>
</tr>
<tr>
<td></td>
<td>• External correct</td>
</tr>
<tr>
<td></td>
<td>• Const.GPC factor</td>
</tr>
<tr>
<td>Factory setting</td>
<td>Off</td>
</tr>
<tr>
<td>Additional information</td>
<td>Meaning of the options</td>
</tr>
<tr>
<td></td>
<td>• Off</td>
</tr>
<tr>
<td></td>
<td>The gas phase compensation is deactivated.</td>
</tr>
<tr>
<td></td>
<td>• On</td>
</tr>
<tr>
<td></td>
<td>This option can only be selected for probes with reference echo. The gas phase compensation is calculated from the position of this reference echo. In FieldCare, the displayed envelope curve does already contain the correction.</td>
</tr>
<tr>
<td></td>
<td>• Without correct.</td>
</tr>
<tr>
<td></td>
<td>The correction factor is calculated from the reference echo but not applied to the measurement. In FieldCare, the envelope curve is displayed without the correction. This option is only used for diagnostic purposes and should not be selected in normal applications.</td>
</tr>
<tr>
<td></td>
<td>• Const.GPC factor</td>
</tr>
<tr>
<td></td>
<td>The correction factor is a constant defined by the user. A reference echo is not needed. In FieldCare, the displayed envelope curve does already contain the correction.</td>
</tr>
</tbody>
</table>

### Pres. ref. dist.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite</td>
<td>GPC mode (→ 105) = On or Without correct.</td>
</tr>
<tr>
<td>Description</td>
<td>Displays the currently measured distance of the reference echo.</td>
</tr>
</tbody>
</table>

### Reference dist.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite</td>
<td>GPC mode (→ 105) = On or Without correct.</td>
</tr>
</tbody>
</table>
**Description**
Enter actual distance of the reference echo.

**User entry**
0 to 200 m

**Factory setting**
According to the probe

---

**Ref. echo thresh**

**Navigation**
Expert → Sensor → Gas phase comp. → Ref. echo thresh (1168)

**Prerequisite**
GPC mode (→ 105) = On or Without correct.

**Description**
Define threshold for the reference echo.

**User entry**
–999.0 to 999.0 mV

**Factory setting**
–80 mV

**Additional information**
- Only echoes exceeding the defined threshold are accepted as reference echo.
- Positive reference echoes are not suited for Levelflex as they might be mistaken for the level echo.

---

**Const.GPC factor**

**Navigation**
Expert → Sensor → Gas phase comp. → Const.GPC factor (1217)

**Prerequisite**
GPC mode (→ 105) = Const.GPC factor

**Description**
Specify constant correction factor for the measured distance.

**User entry**
0.5 to 1.5

**Factory setting**
1
4.4.10 "Sensor diag." submenu

The Sensor diag. submenu comprises all parameters which contain information about the state of the probe and the HF cable.

Broken probe detection

In the case of a broken probe caused by mechanical wear, a negative echo arises at the breaking point. If the broken probe detection is active, the device looks for a signal of this type and creates an error message if required.

The broken probe detection can only be used if an interference echo suppression (map) has been correctly recorded.
Self check

The **Start self check** (→ 110) and **Result selfcheck** (→ 110) parameters are used for the proof-test which is required for SIL applications in regular intervals. For details refer to the description of the test procedure C in the Functional Safety Manual SD00326F.

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 (→ 110).
Structure of the submenu

**Navigation**  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor diag.</td>
<td></td>
</tr>
<tr>
<td>Brok.probe detec</td>
<td>→ 110</td>
</tr>
<tr>
<td>Start self check</td>
<td>→ 110</td>
</tr>
<tr>
<td>Result selfcheck</td>
<td>→ 110</td>
</tr>
<tr>
<td>Noise of signal</td>
<td>→ 111</td>
</tr>
</tbody>
</table>
Description of parameters

**Navigation**

[Expert → Sensor → Sensor diag.]

---

**Brok.probe detec**

**Navigation**

[Expert → Sensor → Sensor diag. → Brok.probe detec (1032)]

[Expert → Sensor → Sensor diag. → Brok.probe detec (1032)]

**Description**

Switch the broken probe detection on or off.

**Selection**

- Off
- On

**Factory setting**

Off

**Additional information**

If the broken probe detection is switched on: As soon as a broken probe is detected, the device generates an alarm and the diagnostic message **Br.probe detect.**

---

**Start self check**

**Navigation**

[Expert → Sensor → Sensor diag. → Start self check (1133)]

**Description**

Start a self check of the device.

**Selection**

- No
- Yes

**Factory setting**

No

**Additional information**

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 (→ **110**).

The self check is used for the proof-test which is required for SIL applications in regular intervals. For details refer to the description of the test procedure C in the Functional Safety Manual SD00326F.

---

**Result selfcheck**

**Navigation**

[Expert → Sensor → Sensor diag. → Result selfcheck (1134)]

**Description**

Displays the result of the self check.
Additional information

Meaning of the options

- **Ok**
  The self check has been passed.

- **Not ok**
  The self check failed.

- **Check not done**
  A self check has not been performed.

### Noise of signal

**Navigation**


**Description**

Displays the noise of signal in the envelope curve
4.4.11 "Safety sett." submenu

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

Behavior in the case of an echo loss

The behavior in case of an echo loss is defined in the Output echo lost parameter (→ 117). Depending on the selected option, suitable values must be selected in a number of additional parameters:

<table>
<thead>
<tr>
<th>Option selected in &quot;Output echo lost (→ 117)&quot;</th>
<th>Required additional parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last valid value</td>
<td>Delay echo lost (→ 118)</td>
</tr>
<tr>
<td>Ramp echo lost</td>
<td>Ramp echo lost (→ 118)</td>
</tr>
<tr>
<td>Value echo lost</td>
<td>Value echo lost (→ 117)</td>
</tr>
<tr>
<td>Alarm</td>
<td>1)</td>
</tr>
</tbody>
</table>

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

"Output echo lost (→ 117)" = "Last valid value"

1  Echo loss
2  Delay echo lost (→ 118)
3  The last valid measured value is held.
30  "Output echo lost (→ 117)" = "Ramp echo lost"

1  Echo loss
2  "Delay echo lost (→ 118)"
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'.

31  "Output echo lost (→ 117)" = "Value echo lost"

1  Echo loss
2  Delay echo lost (→ 118)
3  Value echo lost (→ 117)
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 (→ 119).

Definition of the safety distance

1. Blocking dist. (→ 99)
2. Safety distance (→ 119)

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

- In safety dist. (→ 119)
- Acknowl. alarm (→ 119)

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

1. Safety distance (→ 119)
2. Value defined in "Failure mode"
34. "In safety dist." = "Warning": If the safety distance is undershot, the device continues measuring but nevertheless generates a warning.

1. Safety distance (→ 119)

35. "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 (→ 119)
2. Value defined in "Failure mode"
3. Acknow. alarm (→ 119)
# Structure of the submenu

**Navigation**  
Expert → Sensor → Safety sett.

<table>
<thead>
<tr>
<th>Item</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output echo lost</td>
<td>117</td>
</tr>
<tr>
<td>Value echo lost</td>
<td>117</td>
</tr>
<tr>
<td>Ramp echo lost</td>
<td>118</td>
</tr>
<tr>
<td>Delay echo lost</td>
<td>118</td>
</tr>
<tr>
<td>Safety distance</td>
<td>119</td>
</tr>
<tr>
<td>In safety dist.</td>
<td>119</td>
</tr>
<tr>
<td>Acknowl. alarm</td>
<td>119</td>
</tr>
</tbody>
</table>
**Description of parameters**

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

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

**Selection**  
- Last valid value
- Ramp 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**  
In the case of a lost echo the output value is continuously shifted towards 0% or 100%. The slope of the ramp is defined in the *Ramp echo lost* parameter (→ 118).
- **Value echo lost**  
In the case of a lost echo the output assumes the value defined in the *Value echo lost* parameter (→ 117).
- **Alarm**  
In the case of a lost echo the device generates an alarm; see the *Failure mode* parameter.

---

**Value echo lost**

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

**Prerequisite**  
Output echo lost (→ 117) = Value echo lost

**Description**  
Define output value in case of a lost echo.

**User entry**  
0 to 200 000.0 %

**Factory setting**  
0.0 %

**Additional information**  
Use the unit which has been defined for the measured value output:
- without linearization: *Level unit* (→ 65)
- with linearization: *Unit lineariz.* (→ 76)
Ramp echo lost

**Navigation**

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

**Prerequisite**

Output echo lost (→ 117) = Ramp echo lost

**Description**

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

**User entry**

Signed floating-point number

**Factory setting**

0.0 %/min

**Additional information**

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

![Diagram showing the ramp echo lost with points A, B, and C.

A = Delay echo lost (→ 118)
B = Ramp echo lost (→ 118) (positive value)
C = Ramp echo lost (→ 118) (negative value)

After an echo loss, the device waits for the time specified in this parameter before reacting as specified in the Output echo lost parameter (→ 117). This helps to avoid interruptions of the measurement by short-term interferences.

Delay echo lost

**Navigation**

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

**Description**

Define the delay in the case of an echo loss.

**User entry**

0 to 99 999.9 s

**Factory setting**

60.0 s

**Additional information**

After an echo loss, the device waits for the time specified in this parameter before reacting as specified in the Output echo lost parameter (→ 117). This helps to avoid interruptions of the measurement by short-term interferences.
Safety distance

**Navigation**

Expert → Sensor → Safety sett. → Safety distance (1093)

**Description**

Define safety distance.

**User entry**

-200 to 200 m

**Factory setting**

0 m

**Additional information**

The safety distance is measured from the reference point of the measurement (lower edge of the flange or threaded connection). The safety distance can be used to generate a warning before the level rises into the blocking distance. The **In safety dist.** parameter (→ 119) defines the reaction of the device if the level rises into the safety distance.

In safety dist.

**Navigation**


**Description**

Define reaction if the level rises into the safety distance.

**Selection**

- Off
- Alarm
- Warning
- Self holding

**Factory setting**

Warning

**Additional information**

**Meaning of the options**

- **Off**
  No reaction if the level rises into the safety distance
- **Alarm**
  The device assumes the alarm state and generates the diagnostic message **In safety dist.**.
- **Warning**
  The device assumes the warning state and generates the diagnostic message **In safety dist.**.
- **Self holding**
  The device assumes the defined alarm state. Additionally, the diagnostic message **In safety dist.** is generated. If the level drops out of the safety distance, the alarm remains active. The measurement is continued only after a reset of the self holding via the **Acknowl. alarm** parameter (→ 119).

Acknowl. alarm

**Navigation**

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

**Prerequisite**

In safety dist. (→ 119) = Self holding
Description

Reset the self holding alarm of the device.

Selection

- No
- Yes

Factory setting

No

Additional information

**Meaning of the options**

- **No**
  
  The alarm is **not** rest.

- **Yes**
  
  The alarm is reset. The measurement is resumed.
4.4.12  "Env. curve" submenu

The Env. curve submenu (→ 122) is only available on the display module (not in FieldCare). It is used to display the envelope curve on the display module. When operating via FieldCare, the envelope curve can be displayed in the envelope curve editor (Device Operation → Device Functions → Additional Functions → Envelope Curve).
**Description of parameters**

**Navigation**

Expert → Sensor → Env. curve

---

**Env. curve**

**Navigation**

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

**Description**

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

**Selection**

- Env. curve
- Envelope + Map
- Subtr. + Thres.
- Envelope + Ref.

**Factory setting**

Env. curve

**Additional information**

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

![Env. curve Display](image)

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

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

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

Mapping curve and subtracted curve

After a mapping, the signal evaluation does not use the envelope curve but the subtracted curve, instead:

\[
\text{Subtracted curve} = \text{Envelope curve} - \text{Mapping curve}
\]

Static map

The static map is typically used for rod and coax probes. It is recorded during the commissioning. It is essential that the probe is completely uncovered when recording the map.

When recording a new static envelope curve, the previous curve is deleted.

Dynamic map

The dynamic map is, for example, used for probes with a reference signal for gas phase compensation. In the case of a static map this reference signal would be suppressed and would no longer be visible in the subtracted curve.

Before the dynamic mapping curve can be used, a static map - if present - must be deleted.

The dynamic map continuously adjusts itself to the changing conditions within the vessel. An averaging width of 1 500 mm (60 in) is used for this. This prevents the dynamic map from suppressing the actual level echo.

Combined map

If it is not possible to record the map with the probe being completely uncovered (e.g. because the vessel cannot be completely emptied during the commissioning procedure), a combined map can be used instead. In this case, a static map is only recorded for the upper part of the probe (defined by the Map. end point parameter (→ 129)). In the lower
part, a dynamic map is used. Both curves are connected by an interpolation area to ensure a smooth transition.

The initial map

An initial map is stored in the device. This map is active under the following conditions:
- if no static map has been recorded,
- if the static map has been deactivated,
- if the static map has been deleted.

The form of the initial map depends on a number of settings of the basic calibration and is designed to suppress typical interferences in the upper part of the probe. It can not be changed by the user.
Structure of the submenu on the local display

Navigation ➤ Expert → Sensor → Mapping

```
<table>
<thead>
<tr>
<th>▶ Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Mapping</td>
</tr>
<tr>
<td>Confirm distance</td>
</tr>
<tr>
<td>Map. end point</td>
</tr>
<tr>
<td>Record map</td>
</tr>
<tr>
<td>Distance</td>
</tr>
</tbody>
</table>
```
Structure of the submenu in an operating tool

*Navigation* 
Expert → Sensor → Mapping

*“Mapping” submenu*

<table>
<thead>
<tr>
<th>Function</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>127</td>
</tr>
<tr>
<td>Interface dist.</td>
<td>128</td>
</tr>
<tr>
<td>Confirm distance</td>
<td>128</td>
</tr>
<tr>
<td>Present mapping</td>
<td>129</td>
</tr>
<tr>
<td>Map. end point</td>
<td>129</td>
</tr>
<tr>
<td>Record map</td>
<td>130</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation

Expert → Sensor → Mapping → Distance (1124)

Description

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

Additional information

The unit is defined in the Distance unit parameter (→ 50).
**Interface dist.**

**Navigation**

Expert → Sensor → Mapping → Interface dist. (1067)

**Prerequisite**

Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**

Displays the measured distance $D_I$ between the reference point (lower edge of flange or threaded connection) and the interface.

**Additional information**

The unit is defined in the Distance unit parameter (→ 50).

---

**Confirm distance**

**Navigation**

Expert → Sensor → Mapping → Confirm distance (1045)

**Description**

Specify, whether the measured distance matches the real distance.

Depending on the selection the device automatically sets the range of mapping.

**Selection**

- Manual map
- Distance ok
- Distance unknown
- Dist. too small
- Distance too big
- Tank empty
- Delete map

**Factory setting**

Distance unknown
Additional information

<table>
<thead>
<tr>
<th>Meaning of the options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual map</strong></td>
</tr>
<tr>
<td>To be selected if the range of mapping is to be defined manually in the Map. end point parameter (→ 129). In this case it is not necessary to confirm the distance.</td>
</tr>
<tr>
<td><strong>Distance ok</strong></td>
</tr>
<tr>
<td>To be selected if the measured distance matches the actual distance. The device performs a mapping.</td>
</tr>
<tr>
<td><strong>Distance unknown</strong></td>
</tr>
<tr>
<td>To be selected if the actual distance is unknown. A mapping can not be performed in this case.</td>
</tr>
<tr>
<td><strong>Dist. too small</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Distance too big</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Tank empty</strong></td>
</tr>
<tr>
<td>To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range.</td>
</tr>
<tr>
<td><strong>Factory map</strong></td>
</tr>
<tr>
<td>To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the Confirm distance parameter and a new mapping can be recorded.</td>
</tr>
</tbody>
</table>

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

For interface measurements the distance always refers to the total level (not the interface level).

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

---

Present mapping

**Navigation**

- Expert → Sensor → Mapping → Present mapping (1182)

**Description**

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

---

**Map. end point**

**Navigation**

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

**Prerequisite**

Confirm distance (→ 128) = Manual map or Dist. too small

---

5) Only available for "Expert → Sensor → Echo tracking → Evaluation mode parameter (→ 140)" = "Short time hist." or "Long time hist."
Description Specify new end of the mapping.

User entry 0 to 200.000.0 m

Factory setting 0.1 m

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

For reference purposes the Present mapping parameter (→ 129) is displayed together with this parameter. It indicates up to which distance a mapping has already been recorded.

Record map

Navigation Expert → Sensor → Mapping → Record map (1069)

Prerequisite Confirm distance (→ 128) = Manual map or Dist. too small

Description Start recording of the map.

Selection • No
• Record map
• Delete map

Factory setting No

Additional information Meaning of the options
• No
The map is not recorded.
• Record map
The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing ✔.
• Delete map
The mapping (if one exists) is deleted and the device displays the recalculated measured distance and the mapping range. When operating via the local display, these values must be confirmed by pressing ✔.
4.4.14 "EOP evaluation" submenu

As an alternative to evaluating the direct level signal, Levelflex can calculate the level via the shift of the end-of-probe signal (EOP). Details on the EOP evaluation are configured in the EOP evaluation submenu.

### Shift of the end-of-probe signal (EOP)

When evaluating the end-of-probe signal, you make use of the fact that electromagnetic pulses propagate more slowly in a medium than in air. As a consequence the end-of-probe signal moves downwards when the level is increased. By inverting this relationship one can calculate the level $L$ from the end-of-probe shift $A$:

$$L = A / (\sqrt{DK} - 1)$$

Where $DC$ is the dielectric constant of the medium.

If both, the level signal and the end-of-probe signal are known, the dielectric constant $DC$ can be calculated:

$$DK = (A/L + 1)^2$$

The calculated DC value is displayed in the **Calc. DC value** parameter (→ 59).
Structure of the submenu

**Navigation**  
Expert → Sensor → EOP evaluation

- EOP search mode  
  → 133
- EOP shift  
  → 133
- DC value  
  → 134
- Calc. DC value  
  → 135
**Description of parameters**

*Navigation*  
Expert → Sensor → EOP evaluation

---

**EOP search mode**

**Navigation**
- Expert → Sensor → EOP evaluation → EOP search mode (1026)
- Expert → Sensor → EOP evaluation → EOP search mode (1026)

**Prerequisite**
- **Operating mode** parameter (→ 50) = **Level**

**Description**
Select method for the detection of the end-of-probe signal.

**Selection**
- Empty recog. only
- Negative EOP
- Positive EOP
- Neg. EOP high

**Factory setting**
Negative EOP

**Additional information**

**Meaning of the options**
- **Empty recog. only**
  Positive and negative end-of-probe signals are searched for. However, the level is not calculated from the end-of-probe signal.
  - If no level signal is present and if the end-of-probe signal is within the range defined in the EOP range up area parameter, the level is set to 0%, which means an empty tank or silo is assumed.
  - If no level signal is present and if the end-of-probe signal is beyond the range defined in the EOP range up area parameter, an echo loss is reported.
- **Negative EOP**
  Only negative end-of-probe signals are searched for. This is the correct option if the probe end is insulated.
- **Positive EOP**
  Only positive end-of-probe signals are searched for. This is the correct option if the end of the probe is connected to ground.
- **Neg. EOP high**
  The resolution at the end of the probe is improved by a deconvolution algorithm. This is only possible if the end-of-probe position in the case of an empty tank has been stored by selecting the **Tank empty** option in the **Confirm distance** parameter (→ 128).

---

**EOP shift**

**Navigation**
- Expert → Sensor → EOP evaluation → EOP shift (1027)
- Expert → Sensor → EOP evaluation → EOP shift (1027)

**Prerequisite**
- EOP level eval. ≠ Off

**Description**
Displays the current shift of the end-of-probe signal as compared to the empty vessel.
"Expert" menu

Levelflex FMP5x Modbus

DC value

Navigation

Expert → Sensor → EOP evaluation → DC value (1201)

Description

- For level measurements:
  Specify dielectric constant $\varepsilon_r$.
- For interface measurements:
  Specify dielectric constant $\varepsilon_r$ of the upper medium.

User entry

Signed floating-point number

Factory setting

Dependent on the following parameters:

- Operating mode (→ 50)
- Medium property (→ 57)
- Medium type (→ 56)
- Bin type (→ 51) or Tank type (→ 51)

Additional information

Dependence of the factory settings on other parameters

For "Operating mode" = "Level"

<table>
<thead>
<tr>
<th>Medium property (→ 57)</th>
<th>Medium type (→ 56)</th>
<th>Bin type (→ 51) or Tank type (→ 51)</th>
<th>DC value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>Solid</td>
<td>Bin type (→ 51)</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Aluminium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Plastic wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bin type (→ 51)</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Concrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Metallic</td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
<td>Tank type (→ 51)</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coaxial</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any other tank type</td>
<td>1.9</td>
</tr>
<tr>
<td>DC 1.4 ... 1.6</td>
<td>Solid</td>
<td>Bin type (→ 51)</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Concrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Aluminium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Plastic wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bin type (→ 51)</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Metallic</td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
<td>Tank type (→ 51)</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Non metallic</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Mounted outside</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any other tank type</td>
<td>1.4</td>
</tr>
<tr>
<td>DC 1.6 ... 1.9</td>
<td></td>
<td></td>
<td>1.6</td>
</tr>
<tr>
<td>DC 1.9 ... 2.5</td>
<td></td>
<td></td>
<td>1.9</td>
</tr>
<tr>
<td>DC 2.5 ... 4</td>
<td></td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>DC 4 ... 7</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>DC 7 ... 15</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>DC &gt; 15</td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

For "Operating mode" = "Interf.+capacit." or "Interface":

DC value = 1.9

As the value defines the echo threshold, it may not exceed the actual DC of the medium. Dielectric constants above DC = 15 have only a very limited influence on the echo threshold.
Calc. DC value

Navigation
- Expert → Sensor → EOP evaluation → Calc. DC value (1118)
- Expert → Sensor → EOP evaluation → Calc. DC value (1118)

Prerequisite
EOP level eval. = Automatic DC

Description
- For level measurements:
  Displays calculated dielectric constant $\varepsilon_r$.
- For interface measurements:
  Displays calculated dielectric constant $\varepsilon_r$ or the upper medium.

Additional information
The exact meaning of this parameter is dependent on further settings:
- Operating mode (→ 50) = Level:
  Displays the dielectric constant which is calculated from the end-of-probe signal and the level.
- Operating mode (→ 50) = Interface or Interf.+capacit.:
  - For Interface prop. (→ 146) = Special: auto DC:
    Automatically calculated DC of the upper medium
  - In any other case:
    Identical to the DC value parameter (→ 58)

6) The correct calculation of the dielectric constant is only possible for media with a small dielectric constant and weak signal damping, for which the level signal and the end-of-probe signal can be evaluated simultaneously. Among these media are for example oil, solvents and synthetic granules.
4.4.15  "Echo tracking" submenu

The echo tracking algorithm takes into account the change in time of the individual echoes when evaluating the envelope curve. This improves the allocation of the echoes to the level or interface signal. Different types of echo tracking can be selected in the **Evaluation mode** parameter (→ 140). A number of further parameters is used to configure the echo tracking more precisely.

"Evaluation mode" = "History off"

The envelope curve is evaluated statically.

"Evaluation mode" = "Short time hist."

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

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

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.

In this evaluation mode it is possible to activate the moving track recognition (**Mov.track recog.** parameter).

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

If the moving track recognition is switched on, this distinction is used as an additional criterion to identify the level echo.
"Evaluation mode" = "Long time hist."

The Long time hist. option is not available for interface measurements.

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

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

Schematic exmaples

42 Example 1: Tank history with interference echo and end of probe echo (small DC values)

- D0 Actual level distance
- D1 Distance of the signal in the envelope curve
- 1 Level echo
- 2 Interference echo
- 3 End-of-probe echo
- 4 Track "End-of-probe echo" (stored in the tank history)
- 5 Track "Level echo" (stored in the tank history)
- 6 Track "Interference echo" (stored in the tank history)
43  Example 2: Tank history with a multiple echo (large DC values)

D0  Actual level distance
D1  Distance of the signal in the envelope curve
1   Level echo
2   Multiple echo
3   Track 'Multiple echo' (stored in the tank history)
4   Track 'Level echo' (stored in the tank history)
### Structure of the submenu

**Navigation**  

- **Expert → Sensor → Echo tracking**

<table>
<thead>
<tr>
<th>▶ Echo tracking</th>
<th>→ 140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation mode</td>
<td></td>
</tr>
<tr>
<td>History reset</td>
<td></td>
</tr>
</tbody>
</table>
Description of parameters

**Navigation**  
Expert → Sensor → Echo tracking → Evaluation mode (1112)

**Description**  
Select evaluation mode for echo tracking.

**Selection**  
- History off
- Short time hist.
- Long time hist.

**Factory setting**  
- For level measurements:  
  Long time history
- For interface measurements:  
  Short time history
- Exceptions:
  - For FMP54 and any FMP5x with center washer:  
    Short time history
  - For Tank type (→ 51) = Bypass / pipe:  
    Short time history
  - If the gas phase compensation is active, i.e. GPC mode (→ 105) ≠ Off:  
    History off
  - For Process property (→ 52) = Very fast > 100 m (333 ft) /h or No filter / test:  
    History off

**Additional information**  
**Meaning of the options**
- History off  
The envelope curve is evaluated only statically.
- Short time hist.  
In addition to the static algorithms a dynamic echo trace is continuously created.
- Long time hist.  
(Only available for level measurements)  
In addition to the static algorithms and the dynamic echo trace a tank trace is continuously generated. Using the tank trace the device can determine the level even if the level echo ist lost temporarily.

- The Long time hist. option is not available for interface measurements.
- The Long time hist. option is not recommended if there are substantial changes of the medium or process conditions within a short period of time (e.g. in the case of changing dielectric constants or boiling media).

**History reset**  

**Navigation**  
Expert → Sensor → Echo tracking → History reset (1145)

**Description**  
Reset 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.
### 4.4.16 "Interface" submenu

<table>
<thead>
<tr>
<th>Operating mode (→ 50)</th>
<th>Evaluated signals</th>
<th>available for</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>Signal of the guided radar</td>
<td>FMP51</td>
<td>→ 143</td>
</tr>
</tbody>
</table>
Interface measurement with guided radar (without capacitance measurement)

Basic principles

When the high-frequency pulses hit the surface of the medium, only a percentage of the transmission pulse is reflected. In the case of media A with a low dielectric constant $\epsilon_A$, in particular, the other part penetrates the medium. The pulse is reflected once more at the interface point to a second medium, B, with a higher dielectric constant $\epsilon_B$. Thus, the envelope curve contains a level echo $D_1$ as well as an interface echo $D_2$.

When evaluating the interface echo, Levelflex must take into account the fact that electromagnetic pulses propagate slower in a medium than in air. Therefore, the interface echo appears shifted into the direction of larger distances. Using the dielectric constant of the upper medium, Levelflex can automatically compensate for this shift:

$$D_2 = D_1 + (D_2 - D_1) / \sqrt{\epsilon_A}$$

If an interface measurement is activated, Evaluation mode (→ 140) = Short time hist. is the only option. The Long time hist. option can not be used in combination with an interface measurement.

Prerequisites for an interface measurement

- The dielectric constant of the upper medium must be constant and known.
- Dielectric constant of the upper medium: $\epsilon_A \leq 10$
- Dielectric constant of the lower medium: $\epsilon_B \geq \epsilon_A + 10$
Tank level

For interface measurements it is important whether the container is partially filled or fully flooded. This must be specified by the user in the Tank level parameter (→ 146):

- **Tank level (→ 146) = Partially filled**
  In this case the device looks for two signals: the interface echo and the level echo; if required, the end-of-probe signal is used for signal evaluation, too → 131.

- **Tank level (→ 146) = Fully flooded**
  This is typically used for bypass applications. In this case, the device searches for the interface echo only; if required, the end-of-probe signal is used for signal evaluation, too → 131. If this option is selected, the total level must always be within the upper blocking distance (UB) in order to avoid that it is mistaken for the interface signal.
Structure of the submenu

*Navigation*  

![Diagram of the submenu structure](image)

<table>
<thead>
<tr>
<th>Interface</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank level</td>
<td></td>
<td>146</td>
</tr>
<tr>
<td>Interface prop.</td>
<td></td>
<td>146</td>
</tr>
<tr>
<td>Int. criterion</td>
<td></td>
<td>148</td>
</tr>
<tr>
<td>Measur. cap.</td>
<td></td>
<td>148</td>
</tr>
<tr>
<td>Build-up ratio</td>
<td></td>
<td>148</td>
</tr>
<tr>
<td>Build-up thres.</td>
<td></td>
<td>148</td>
</tr>
<tr>
<td>Empty capacit.</td>
<td></td>
<td>149</td>
</tr>
</tbody>
</table>
Description of parameters

**Navigation**

Expert → Sensor → Interface

---

**Tank level**

**Navigation**

Expert → Sensor → Interface → Tank level (1111)

**Prerequisite**

Operating mode (→ 50) = Interface

**Description**

Specify whether the tank or bypass is completely flooded or not.

**Selection**

- Partially filled
- Fully flooded

**Factory setting**

Partially filled

**Additional information**

**Meaning of the options**

- **Partially filled**
  
  The device searches for 2 echo signals, one for the interface and one for the total level.

- **Fully flooded**
  
  The device searches for the interface level only. With this setting it is essential that the upper level signal always is within the upper blocking distance (UB) in order to avoid that it is evaluated by mistake.

---

**Interface prop.**

**Navigation**

Expert → Sensor → Interface → Interface prop. (1107)

**Prerequisite**

Operating mode (→ 50) = Interf.+capac.
**Description**

Select interface property.

The interface property determines how the Guided Radar and the Capacitance Measurement interact.

**Selection**

- Special: auto DC
- Build up
- Standard
- Oil/Watercondens

**Factory setting**

Standard

**Additional information**

**Meaning of the options**

**Special: auto DC**

- Condition:
  
The specific capacitance (pF/m) is known. \(^7\)

- Signal evaluation:
  
As long as a clear interface is detected, both the total and the interface level are determined via the Guided Radar. The dielectric constant of the upper medium is continuously adjusted. If an emulsion layer is present, the total level is determined via the Guided Radar whereas the interface level is determined via the Capacitance Measurement.

**Build up**

- Condition:
  
The dielectric constant of the upper medium and the specific capacitance (pF/m) are known. \(^7\)

- Signal evaluation:
  
As long as a clear interface is detected, the interface level is determined via the Guided Radar as well as via the Capacitance Measurement. If these two values start to diverge from each other due to build-up formation, an error message is generated. If an emulsion layer is present, the total level is determined via the Guided Radar whereas the interface level is determined via the Capacitance Measurement.

**Standard**

- Condition:
  
The dielectric constant of the upper medium is known.

- Signal evaluation:
  
As long as a clear interface is detected, the specific capacitance (pF/m) is continuously adjusted. Therefore build-up has only little influence on the measurement. If an emulsion layer is present, the total level is determined via the Guided Radar whereas the interface level is determined via the Capacitance Measurement.

**Oil/Watercondens**

- Condition:
  
The dielectric constant of the upper medium and the specific capacitance (pF/m) are known. \(^7\)

- Signal evaluation:
  
The total level is always determined via the Guided Radar. The interface level is always determined via the Capacitance Measurement.

---

7) The specific capacitance of the media depends on the DC value and the geometry of the probe, which may differ noticeably. For rod probes < 2 m, the probe geometry is measured after production and the resulting specific capacitance for conductive media is preset on delivery.
**“Expert” menu**

**Int. criterion**

**Navigation**
- Expert → Sensor → Interface → Int. criterion (1184)
- Expert → Sensor → Interface → Int. criterion (1184)

**Prerequisite** Operating mode (→ 50) = Interface or Interf.+capacit.

**Description** Displays the threshold (in mV) for the recognition of the interface signal.

**Measur. cap.**

**Navigation**
- Expert → Sensor → Interface → Measur. cap. (1066)
- Expert → Sensor → Interface → Measur. cap. (1066)

**Prerequisite** Operating mode (→ 50) = Interf.+capacit.

**Description** Displays the measured capacitance (pF).

**Build-up ratio**

**Navigation**
- Expert → Sensor → Interface → Build-up ratio (1210)
- Expert → Sensor → Interface → Build-up ratio (1210)

**Prerequisite** Interface prop. (→ 146) = Build up

**Description** Indicates the relative deviation between the interface distance measured by the radar and the capacitance, respectively.

**Additional information** Formula by which this value is calculated:

\[ \frac{|(D_{Radar} - D_{Capa})|}{D_{Radar}} \]

If this ratio exceeds the value defined in the **Build-up thres.** parameter (→ 148), an error message is generated.

**Build-up thres.**

**Navigation**
- Expert → Sensor → Interface → Build-up thres. (1211)
- Expert → Sensor → Interface → Build-up thres. (1211)

**Prerequisite** Interface prop. (→ 146) = Build up

**Description** Define threshold for build-up detection.

**User entry** Signed floating-point number


**Empty capacitance.**

**Navigation**

- Expert → Sensor → Interface → Empty capacitance. (1122)
- Expert → Sensor → Interface → Empty capacitance. (1122)

**Prerequisite**

Operating mode (→  50) = Interf.+capacit.

**Description**

Specify capacitance for the empty tank.

**User entry**

0.0 to 10 000.0 pF

**Factory setting**

0.0 pF

**Additional information**

Normally, the device determines the empty capacitance automatically if during commissioning Confirm distance (→  128) = Tank empty is selected. In exceptional cases - if emptying the tank during commissioning is impossible - a calculated value can be entered manually.

**Calculation of the empty capacitance**

1. Read the empty capacitance per meter from the diagram.
2. Multiply the read value by the length of the probe.
3. Add the result to the basic capacitance of the device according to the following table:

<table>
<thead>
<tr>
<th>Device version</th>
<th>Basic capacitance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact device</td>
<td>29.5 pF</td>
</tr>
<tr>
<td>Feature 600 &quot;Probe Design&quot;, option model MB &quot;Sensor remote, 3m/9ft cable, detachable +mounting bracket&quot;</td>
<td>278.4 pF</td>
</tr>
</tbody>
</table>

**Factory setting**

0.1

**Additional information**

If the **Build-up ratio** parameter (→  148) exceeds the value specified in this parameter, the corresponding error message is generated.
45 Empty capacitance per meter according to bypass or stilling well diameter

\( D \)  Bypass or stilling well diameter

\( K \)  Capacitance per meter
4.5 "Output" submenu

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

4.5.1 Structure of the submenu

Navigation: Expert → Output

Diagram:

- Output
  - Switch output

→ 152
**4.5.2 "Switch output" submenu**

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

**Structure of the submenu**

*Navigation*  
Expert → Output → Switch output

- Switch out funct
- Assign diag. beh
- Assign limit
- Switch-on value
- Switch-off value
- Assign status
- Switch-on delay
- Switch-off delay
- Failure mode
- Switch status
- Invert outp.sig.
Description of parameters

Navigation  

Expert → Output → Switch output → Switch out funct

Switch out funct

Navigation  

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

Description

Select function for switch output.

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 (→ 153) 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 (→ 154)
  - Switch-on value (→ 154)
  - Switch-off value (→ 155)
- 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 (→ 156).

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

Assign diag. beh

Navigation  

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

Prerequisite

Switch out funct (→ 153) = Diag. behavior

Description

Select diagnostic behavior for switch output.

Selection

- Alarm
- Alarm or warning
- Warning
**"Expert" menu**

**Expert** menu

**Levelflex FMP5x Modbus**

---

**Factory setting**

**Alarm**

---

**Assign limit**

---

**Navigation**

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

**Prerequisite**

- **Switch out funct** (→ 153) = Limit

**Description**

Select process variable for limit monitoring.

**Selection**

- Off
- Level linearized
- Distance
- Interf. lineariz
- Interface dist.
- Thckn.upp.layer
- Terminal volt.
- Electronic temp.
- Measur. cap.
- Relat.echo ampl.
- Rel.interf.ampl.
- Abs. echo ampl.
- Abs.interf.ampl.

**Factory setting**

- Off

---

**Switch-on value**

---

**Navigation**

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

**Prerequisite**

- **Switch out funct** (→ 153) = Limit

**Description**

Enter measured value for the switch-on point.

**User entry**

- Signed floating-point number

**Factory setting**

- 0

**Additional information**

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

- **Switch-on value > Switch-off value**
  - The output is closed if the measured value is larger than Switch-on value.
  - The output is opened if the measured value is smaller than Switch-off value.
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.
**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 (→ 154).

---

**Assign status**

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

**Prerequisite**
Switch out funct (→ 153) = Digital Output

**Description**
Select device status for switch output.

**Selection**
- Off
- Digital out AD 1
- Digital out AD 2

**Factory setting**
Off

**Additional information**
The Digital out AD 1 and Digital out AD 2 options refer to the Advanced Diagnostic Blocks → 206. A switch signal generated in these blocks can be transmitted via the switch output.

---

**Switch-on delay**

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

**Prerequisite**
- Switch out funct (→ 153) = Limit
- Assign limit (→ 154) ≠ Off

**Description**
Define switch-on delay.

**User entry**
0.0 to 100.0 s

**Factory setting**
0.0 s

---

**Switch-off delay**

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

**Prerequisite**
- Switch out funct (→ 153) = Limit
- Assign limit (→ 154) ≠ Off
**Description**  Define switch-off delay.

**User entry**  0.0 to 100.0 s

**Factory setting**  0.0 s

---

**Failure mode**

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

**Description**  Define output behavior in alarm condition.

**Selection**
- Actual status
- Open
- Closed

**Factory setting**  Open

---

**Switch status**

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

**Description**  Displays the current state of the switch output.

---

**Invert outp.sig.**

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

**Description**  Specify whether the output signal is to be inverted.

**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.
4.6 "Communication" submenu

Communication submenu (→ 158) enthält alle Parameter zur Steuerung der HART-Schnittstelle.

Configuration of the Modbus communication, see separate documentation:
BA01957F (Operating Instructions FMP51, Modbus)

4.6.1 Structure of the submenu

Navigation  Expert → Communication

<table>
<thead>
<tr>
<th>▶ Communication</th>
<th>→ 159</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Diag. config.</td>
<td></td>
</tr>
<tr>
<td>▶ Configuration</td>
<td>→ 161</td>
</tr>
<tr>
<td>▶ Information</td>
<td>→ 164</td>
</tr>
<tr>
<td>▶ Burst config. 1 to 3</td>
<td>→ 168</td>
</tr>
<tr>
<td>▶ Output</td>
<td>→ 171</td>
</tr>
</tbody>
</table>
4.6.2 "Diagnostic configuration" submenu

In diesem Untermenü kann einzelnen Fehlermeldungen ein Status nach der NAMUR-Empfehlung NE107 zugeordnet werden. Dies betrifft folgende Fehlermeldungen:

- In safety dist.
- Echo lost
- AD occured (falls eine Erweiterte Diagnose aktiviert wurde)

**Navigation**

Expert → Communication → Diag. config.

Configuration via local display

1. ☰/../Communication
   - Diag. config.
   - Configuration
   - Information

Go to the Diag. config. submenu.

2. ☰/../Diag. config. 65535-1
   - Diag. safety dist
   - Out of spec. (S)
   - Diagn. echo lost
   - Stat. AD event1

Select an error message.

3. ☰/../Diag. safety dis. 65535-1
   - Mainten. reg. (M)
   - Funct. check (C)
   - Out of spec. (S)
   - No effect (N)

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.
4.6.3 "Configuration" submenu

Structure of the submenu

Navigation  Expert → Communication → Configuration

<table>
<thead>
<tr>
<th>Configuration</th>
<th>→ 162</th>
</tr>
</thead>
<tbody>
<tr>
<td>HART short tag</td>
<td>→ 162</td>
</tr>
<tr>
<td>Device tag</td>
<td>→ 162</td>
</tr>
<tr>
<td>HART address</td>
<td>→ 162</td>
</tr>
<tr>
<td>No. of preambles</td>
<td>→ 162</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation  Expert → Communication → Configuration

HART short tag

Navigation  Expert → Communication → Configuration → HART short tag (0220)
Description  Define short tag for the measuring point.
Factory setting  SHORTTAG

Device tag

Navigation  Expert → Communication → Configuration → Device tag (0215)
Description  Enter tag for measuring point.
Factory setting  FMP5x

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.

No. of preambles

Navigation  Expert → Communication → Configuration → No. of preambles (0217)
Description  Define number of preambles within the HART telegram.
User entry  2 to 20
| Factory setting | 5  |

4.6.4 "Information" submenu

Structure of the submenu

*Navigation*  
Expert → Communication → Information

<table>
<thead>
<tr>
<th>Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Device revision</td>
<td>→ 165</td>
</tr>
<tr>
<td>Device ID</td>
<td>→ 165</td>
</tr>
<tr>
<td>Device type</td>
<td>→ 165</td>
</tr>
<tr>
<td>Manufacturer ID</td>
<td>→ 165</td>
</tr>
<tr>
<td>HART revision</td>
<td>→ 166</td>
</tr>
<tr>
<td>HART descriptor</td>
<td>→ 166</td>
</tr>
<tr>
<td>HART message</td>
<td>→ 166</td>
</tr>
<tr>
<td>Hardware rev.</td>
<td>→ 166</td>
</tr>
<tr>
<td>Software rev.</td>
<td>→ 166</td>
</tr>
<tr>
<td>HART date code</td>
<td>→ 166</td>
</tr>
</tbody>
</table>
Description of parameters

*Navigation*  
Expert → Communication → Information

---

**Device revision**

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

*Description*  
Displays the device revision registered for this device at the HART Communication Foundation.

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

---

**Device ID**

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

*Description*  
Displays Device ID.

*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.

---

**Device type**

*Navigation*  
Expert → Communication → Information → Device type (0222)

*Description*  
Displays the device type with which the device is registered with the HART Communication Foundation.

*Additional information*  
The device type is needed to allocate the correct Device Description file (DD) to the device.

---

**Manufacturer ID**

*Navigation*  
Expert → Communication → Information → Manufacturer ID (0223)

*Description*  
Displays the manufactured ID with which the device is registered with the HART Communication Foundation.
### HART revision

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Communication → Information → HART revision (0205)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Indicates HART revision of the device.</td>
</tr>
</tbody>
</table>

### HART descriptor

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Communication → Information → HART descriptor (0212)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Enter descriptor for the measuring point.</td>
</tr>
<tr>
<td>Factory setting</td>
<td>FMP5x</td>
</tr>
</tbody>
</table>

### HART message

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Communication → Information → HART message (0216)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Define HART message which is sent via the HART protocol if requested by the master.</td>
</tr>
<tr>
<td>Factory setting</td>
<td>FMP5x</td>
</tr>
</tbody>
</table>

### Hardware rev.

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Communication → Information → Hardware rev. (0206)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Indicates hardware revision of the device.</td>
</tr>
</tbody>
</table>

### Software rev.

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Communication → Information → Software rev. (0224)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Indicates software revision of the device.</td>
</tr>
</tbody>
</table>

### HART date code

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Expert → Communication → Information → HART date code (0202)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Enter date of the last configuration change.</td>
</tr>
</tbody>
</table>
Additional information  Format: YYYY-MM-DD
4.6.5 "Burst config. 1 to 3" submenu

Structure of the submenu

Navigation


Expert → Communication → Burst config. 1 to 3

<table>
<thead>
<tr>
<th>Burst config. 1 to 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burst mode 1 to 3</td>
</tr>
<tr>
<td>Burst command 1 to 3</td>
</tr>
<tr>
<td>Burst variable 0...7</td>
</tr>
<tr>
<td>Trigger mode</td>
</tr>
<tr>
<td>Trigger level</td>
</tr>
<tr>
<td>Min. upd. per.</td>
</tr>
<tr>
<td>Max. upd. per.</td>
</tr>
</tbody>
</table>

Description of parameters

Navigation


Expert → Communication → Burst config. 1 to 3

Burst mode 1 to 3

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

Burst command 1 to 3

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.
Levelflex FMP5x Modbus

**“Expert” menu**

**Selection**
- Primary var (PV)
- Current/%Range
- DynamicVariables
- DV with status
- Device variables
- Add.device stat

**Factory setting**
Current/%Range

**Burst variable 0...7**

**Navigation**

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

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

**Selection**
- Level linearized
- Distance
- Unfiltered dist.
- Interface
- Interface dist.
- Unfilt. I. dist.
- Thicnk.upp.layer
- Terminal volt.
- Electronic temp.
- Measur. cap.
- Abs. echo ampl.
- Relat.echo ampl.
- Abs.interf.ampl.
- Rel.interf.ampl.
- Abs. EOP ampl.
- Noise of signal
- EOP shift
- Calc. DC value
- 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

* Visibility depends on order options or device settings
## 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

## Trigger level

Navigation  

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

Description  
Define point of time when burst message is sent.

User entry  
Signed floating-point number

Factory setting  
2.0E-38

## 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

## Max. upd. per.

Navigation  

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

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

User entry  
Positive integer

Factory setting  
2 000 ms
4.6.6 "Output" submenu

Structure of the submenu

*Navigation* Expert → Communication → Output

| Output | Assign PV | → | 172 |
|        | Primary var (PV) | → | 172 |
|        | Assign SV | → | 172 |
|        | Second var (SV) | → | 173 |
|        | Assign TV | → | 173 |
|        | Tertiary var (TV) | → | 174 |
|        | Assign QV | → | 174 |
|        | Quaterna var (QV) | → | 175 |
**Description of parameters**

*Navigation*  
Expert → Communication → Output

---

**Assign PV**

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

**Selection**  
- Level linearized
- Distance
- Interf. lineariz
- Interface dist.
- Thickn. upper layer
- Electronic temp.
- Measur. cap.
- Relat. echo ampl.
- Rel. interf. ampl.
- Analog out. AD 1
- Analog out. AD 2

**Factory setting**  
- For level measurements: **Level linearized**
- For interface measurements: **Interface linearized**

**Additional information**

<table>
<thead>
<tr>
<th>Access</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read access</td>
<td>Operator</td>
</tr>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

---

**Primary var (PV)**

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

**Description**  
Displays primary HART variable (PV).

---

**Assign SV**

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

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

**Selection**  
- None
- Level linearized
- Distance
- Unfiltered dist.
- Interf. lineariz
- Interface dist.
Unfilt. I. dist.
Thickn.upp.layer
Terminal volt.
Electronic temp.
Measur. cap.
Abs. echo ampl.
Relat.echo ampl.
Abs.interf.ampl.
Rel.interf.ampl.
Abs. EOP ampl.
Noise of signal
EOP shift
Calc. DC value
Sensor debug
Analog out. AD 1
Analog out. AD 2

Factory setting
- For level measurements: **Distance**
- For interface measurements: **Level linearized**

Additional information

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

**Second.var(SV)**

**Navigation**

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

**Description**

Displays secondary HART variable (SV).

**Assign TV**

**Navigation**

Expert → Communication → Output → Assign TV (0236)

Expert → Communication → Output → Assign TV (0236)

**Description**

Select measuring variable for third HART variable (TV).

**Selection**

- None
- Level linearized
- Distance
- Unfiltered dist.
- Interf. lineariz
- Interface dist.
- Unfilt. I. dist.
- Thickn.upp.layer
- Terminal volt.
- Electronic temp.
- Measur. cap.
- Abs. echo ampl.
- Relat.echo ampl.
- Abs.interf.ampl.
"Expert" menu

- Rel. interf. ampl.
- Abs. EOP ampl.
- Noise of signal
- EOP shift
- Calc. DC value
- Sensor debug
- Analog out. AD 1
- Analog out. AD 2

Factory setting
- For level measurements: Absolute echo amplitude
- For interface measurements: Thickness upper layer

Additional information

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

Tertiary var(TV)

Navigation

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

Description
Displays third HART variable (TV).

Assign QV

Navigation

Expert → Communication → Output → Assign QV (0237)

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

Selection
- None
- Level linearized
- Distance
- Unfiltered dist.
- Interf. lineariz
- Interface dist.
- Unfilt. I. dist.
- Thicken. upp. layer
- Terminal volt.
- Electronic temp.
- Measur. cap.
- Abs. echo ampl.
- Relat. echo ampl.
- Abs. interf. ampl.
- Rel. interf. ampl.
- Abs. EOP ampl.
- Noise of signal
- EOP shift
- Calc. DC value
- Sensor debug
- Analog out. AD 1
- Analog out. AD 2
**Factory setting**

- For level measurements: **Relative echo amplitude**
- For interface measurements: **Absolute interface amplitude**

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

**Quaterna.var(QV)**

**Navigation**

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

**Description**

Displays fourth HART variable (QV).
4.7 "Diagnostics" submenu

4.7.1 Structure of the submenu on the local display

Navigation  ➤ Expert → Diagnostics

<table>
<thead>
<tr>
<th>Diagnostics</th>
<th>→ 178</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual diagnos.</td>
<td></td>
</tr>
<tr>
<td>Prev.diagnostics</td>
<td></td>
</tr>
<tr>
<td>Time fr. restart</td>
<td></td>
</tr>
<tr>
<td>Operating time</td>
<td></td>
</tr>
<tr>
<td>Diagnostic list</td>
<td>→ 180</td>
</tr>
<tr>
<td>Event logbook</td>
<td>→ 182</td>
</tr>
<tr>
<td>Device info</td>
<td>→ 185</td>
</tr>
<tr>
<td>Data logging</td>
<td>→ 189</td>
</tr>
<tr>
<td>Min/max val.</td>
<td>→ 193</td>
</tr>
<tr>
<td>Simulation</td>
<td>→ 200</td>
</tr>
<tr>
<td>Device check</td>
<td>→ 203</td>
</tr>
<tr>
<td>Adv.diagn. 1 to 2</td>
<td>→ 213</td>
</tr>
<tr>
<td>Envelope diag.</td>
<td>→ 222</td>
</tr>
</tbody>
</table>
4.7.2 Structure of the submenu in an operating tool

**Navigation**

- **Expert** → **Diagnostics**

<table>
<thead>
<tr>
<th>Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual diagnos.</strong></td>
</tr>
<tr>
<td><strong>Timestamp</strong></td>
</tr>
<tr>
<td><strong>Prev.diagnostics</strong></td>
</tr>
<tr>
<td><strong>Timestamp</strong></td>
</tr>
<tr>
<td><strong>Time fr. restart</strong></td>
</tr>
<tr>
<td><strong>Operating time</strong></td>
</tr>
<tr>
<td><strong>Diagnostic list</strong></td>
</tr>
<tr>
<td><strong>Event logbook</strong></td>
</tr>
<tr>
<td><strong>Device info</strong></td>
</tr>
<tr>
<td><strong>Data logging</strong></td>
</tr>
<tr>
<td><strong>Min/max val.</strong></td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
</tr>
<tr>
<td><strong>Device check</strong></td>
</tr>
<tr>
<td><strong>Adv.diagn. 1 to 2</strong></td>
</tr>
<tr>
<td><strong>Envelope diag.</strong></td>
</tr>
</tbody>
</table>
4.7.3 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.

Timestamp

Navigation  

Expert → Diagnostics → Timestamp (0667)

Description
Displays timestamp for the Actual diagnos. parameter (→  178).

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

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.
**Timestamp**

**Navigation**

Expert → Diagnostics → Timestamp (0672)

**Description**

Displays timestamp for the **Prev.diagnostics** parameter (→ 178).

**User interface**

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

**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.

**User interface**

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

**Operating time**

**Navigation**

Expert → Diagnostics → Operating time (0652)

**Description**

Indicates how long device has been in operation.

**User interface**

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

**Additional information**

*Maximum time*

9 999 d (≈ 27 years)
4.7.4 "Diagnostic list" submenu

Structure of the submenu on the local display

*Navigation*

```
Expert → Diagnostics → Diagnostic list
```

![Diagram of the local display structure](image)

Structure of the submenu in an operating tool

*Navigation*

```
Expert → Diagnostics → Diagnostic list
```

![Diagram of the operating tool structure](image)
Description of parameters

**Navigation**  
Expert → Diagnostics → Diagnostic list

---

### Diagnostics 1 to 5

**Navigation**  
Expert → Diagnostics → Diagnostic list → Diagnostics 1 to 5 (0692–1 to 5)

**Description**  
Display the current diagnostics messages with the highest to fifth-highest priority.

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

---

### Timestamp 1 to 5

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

**Description**  
Displays timestamp for the **Diagnostics 1 to 5** parameter (→  181).

**User interface**  
Days (d), hours (h), minutes (m), seconds (s)
4.7.5 "Event logbook" submenu

Structure of the submenu on the local display

Navigation  

Expert → Diagnostics → Event logbook

- Event logbook
  - Filter options
  - Event list

Structure of the submenu in an operating tool

Navigation  

Expert → Diagnostics → Event logbook

- Event logbook
## Description of parameters

**Navigation**  
Expert → Diagnostics → Event logbook

### Filter options

<table>
<thead>
<tr>
<th>Description</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select category (status signal) whose event messages are displayed in the events list.</td>
<td>All, Failure (F), Funct. check (C), Out of spec. (S), Mainten. req. (M), Information (I)</td>
</tr>
</tbody>
</table>

### Factory setting

All

### Additional information

- This parameter is only used for operation via the local display.
- The status signals are categorized according to NAMUR NE 107.
"Event list" submenu

The Event list submenu 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.
4.7.6 "Device info" submenu

Structure of the submenu

*Navigation*  
Expert → Diagnostics → Device info

<table>
<thead>
<tr>
<th>Device info</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Device tag</td>
<td>→ 186</td>
</tr>
<tr>
<td>Serial number</td>
<td>→ 186</td>
</tr>
<tr>
<td>Firmware version</td>
<td>→ 186</td>
</tr>
<tr>
<td>Device name</td>
<td>→ 187</td>
</tr>
<tr>
<td>Order code</td>
<td>→ 187</td>
</tr>
<tr>
<td>Ext. order cd. 1 to 3</td>
<td>→ 187</td>
</tr>
<tr>
<td>ENP version</td>
<td>→ 187</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation

Expert → Diagnostics → Device info

Device tag

Navigation

Expert → Diagnostics → Device info → Device tag (0011)

Description

Enter tag for measuring point.

Factory setting

FMP5x

Additional information

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>

Serial number

Navigation

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

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.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>

Firmware version

Navigation

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

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.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>
Device name

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

Additional information

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Service</td>
</tr>
</tbody>
</table>

Order code

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

Additional information

The order code is generated from the extended order code, which defines all device features of the product structure. In contrast, the device features cannot be read directly from the order code.

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Service</td>
</tr>
</tbody>
</table>

Ext. order cd. 1 to 3

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

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Service</td>
</tr>
</tbody>
</table>

ENP version

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

User interface
xx.yy.zz
### Additional information

<table>
<thead>
<tr>
<th>Access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read access</td>
<td>Operator</td>
</tr>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>
4.7.7 "Data logging" submenu

Structure of the submenu on the local display

**Navigation**

[Expert → Diagnostics → Data logging]

<table>
<thead>
<tr>
<th>Data logging</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assign chan. 1 to 4</td>
<td>[190]</td>
</tr>
<tr>
<td>Logging interval</td>
<td>[191]</td>
</tr>
<tr>
<td>Clear logging</td>
<td>[191]</td>
</tr>
</tbody>
</table>

Structure of the submenu in an operating tool

**Navigation**

[Expert → Diagnostics → Data logging]

<table>
<thead>
<tr>
<th>Data logging</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assign chan. 1 to 4</td>
<td>[190]</td>
</tr>
<tr>
<td>Logging interval</td>
<td>[191]</td>
</tr>
<tr>
<td>Clear logging</td>
<td>[191]</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation

Expert → Diagnostics → Data logging

Assign chan. 1 to 4

Navigation

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

Description

Allocate a process variable to the respective data logging channel.

Selection

- Off
- Level linearized
- Distance
- Unfiltered dist.
- Interf. lineariz
- Interface dist.
- Unfilt. I. dist.
- Thckn.u.pp.layer
- Curr.output 1
- Measur. curr.
- Curr.output 2
- Terminal volt.
- Electronic temp.
- Measur. cap.
- Abs. echo ampl.
- Relat.echo ampl.
- Abs.interf.ampl.
- Rel.interf.ampl.
- Abs. EOP ampl.
- EOP shift
- Noise of signal
- Calc. DC value
- Analog out. AD 1
- Analog out. AD 2

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.
### Logging interval

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

**Description**  
Define logging interval $t_{\text{log}}$.

**User entry**  
1.0 to 3600.0 s

**Factory setting**  
30.0 s

**Additional information**  
This parameter defines the interval between the individual data points in the data log, and thus the maximum loggable process time $T_{\text{log}}$:  
- If 1 logging channel is used: $T_{\text{log}} = 1000 \cdot t_{\text{log}}$
- If 2 logging channels are used: $T_{\text{log}} = 500 \cdot t_{\text{log}}$
- If 3 logging channels are used: $T_{\text{log}} = 333 \cdot t_{\text{log}}$
- If 4 logging channels are used: $T_{\text{log}} = 250 \cdot t_{\text{log}}$

Once this time elapses, the oldest data points in the data log are cyclically overwritten such that a time of $T_{\text{log}}$ always remains in the memory (ring memory principle).

The logged data are deleted if this parameter is changed.

**Example**

**When using 1 logging channel**
- $T_{\text{log}} = 1000 \cdot 1 \text{ s} = 1000 \text{ s} = 16.5 \text{ min}$
- $T_{\text{log}} = 1000 \cdot 10 \text{ s} = 10000 \text{ s} = 2.75 \text{ h}$
- $T_{\text{log}} = 1000 \cdot 80 \text{ s} = 80000 \text{ s} = 22 \text{ h}$
- $T_{\text{log}} = 1000 \cdot 3600 \text{ s} = 3600000 \text{ s} = 41 \text{ d}$

### Clear logging

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

**Description**  
Initiate a deletion of the complete logging memory.

**Selection**  
- Cancel
- Clear data

**Factory setting**  
Cancel
"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.
## 4.7.8 "Min/max val." submenu

### Structure of the submenu

**Navigation**
Expert → Diagnostics → Min/max val.

<table>
<thead>
<tr>
<th>▶ Min/max val.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. level value</td>
<td>→ 194</td>
</tr>
<tr>
<td>Time max. level</td>
<td>→ 194</td>
</tr>
<tr>
<td>Min. level value</td>
<td>→ 194</td>
</tr>
<tr>
<td>Time min. level</td>
<td>→ 194</td>
</tr>
<tr>
<td>Max. drain. speed</td>
<td>→ 195</td>
</tr>
<tr>
<td>Max. fill. speed</td>
<td>→ 195</td>
</tr>
<tr>
<td>Reset min/max</td>
<td>→ 195</td>
</tr>
<tr>
<td>Max. interf. value</td>
<td>→ 196</td>
</tr>
<tr>
<td>Time max. interf</td>
<td>→ 196</td>
</tr>
<tr>
<td>Min. interf. value</td>
<td>→ 196</td>
</tr>
<tr>
<td>Time min. interf</td>
<td>→ 196</td>
</tr>
<tr>
<td>I max. draining</td>
<td>→ 197</td>
</tr>
<tr>
<td>I max. fill speed</td>
<td>→ 197</td>
</tr>
<tr>
<td>Max. electr. temp.</td>
<td>→ 197</td>
</tr>
<tr>
<td>Time max.el.temp</td>
<td>→ 197</td>
</tr>
<tr>
<td>Min. electr. temp.</td>
<td>→ 198</td>
</tr>
<tr>
<td>Time min.el.temp</td>
<td>→ 198</td>
</tr>
<tr>
<td>Res. min/max temp</td>
<td>→ 198</td>
</tr>
</tbody>
</table>
Description of parameters

*Navigation*  

**Max. level value**

**Navigation**  
- Expert → Diagnostics → Min/max val. → Max. level value (2357)  
- Expert → Diagnostics → Min/max val. → Max. level value (2357)

**Description**  
Displays maximum level measured in the past.

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Time max. level**

**Navigation**  
- Expert → Diagnostics → Min/max val. → Time max. level (2385)  
- Expert → Diagnostics → Min/max val. → Time max. level (2385)

**Description**  
Displays operating time at which the maximum level has been obtained.

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Min. level value**

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

**Description**  
Displays minimum level measured in the past.

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Time min. level**

**Navigation**  
- Expert → Diagnostics → Min/max val. → Time min. level (2386)  
- Expert → Diagnostics → Min/max val. → Time min. level (2386)

**Description**  
Displays operating time at which the minimum level has been obtained.
Levelflex FMP5x Modbus

“Expert” menu

### Max.drain.speed

| Navigation | Expert → Diagnostics → Min/max val. → Max.drain.speed (2320)  
|            | 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)  
|            | 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)  
|            | 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
- L drain/fill spd
- Interface
- Reset all

**Factory setting**
None

**Additional information**
- Read access: Operator
- Write access: Maintenance
Max.interf.value

**Navigation**
- Expert → Diagnostics → Min/max val. → Max.interf.value (2361)
- Expert → Diagnostics → Min/max val. → Max.interf.value (2361)

**Prerequisite**  
Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**  
Display minimum interface height measured in the past.

Time max. interf

**Navigation**
- Expert → Diagnostics → Min/max val. → Time max. interf (2388)
- Expert → Diagnostics → Min/max val. → Time max. interf (2388)

**Prerequisite**  
Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**  
Display operating time at which the maximum interface height has been obtained.

Min.interf.value

**Navigation**
- Expert → Diagnostics → Min/max val. → Min.interf.value (2362)
- Expert → Diagnostics → Min/max val. → Min.interf.value (2362)

**Prerequisite**  
Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**  
Display minimum interface height measured in the past.

Time min. interf

**Navigation**
- Expert → Diagnostics → Min/max val. → Time min. interf (2387)
- Expert → Diagnostics → Min/max val. → Time min. interf (2387)

**Prerequisite**  
Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**  
Display operating time at which the minimum interface height has been obtained.
### I max. draining

**Navigation**
- Expert → Diagnostics → Min/max val. → I max. draining (2363)
- Expert → Diagnostics → Min/max val. → I max. draining (2363)

**Prerequisite**
Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**
Displays maximum draining speed of the lower medium measured in the past.

### I max.fill speed

**Navigation**
- Expert → Diagnostics → Min/max val. → I max.fill speed (2359)
- Expert → Diagnostics → Min/max val. → I max.fill speed (2359)

**Prerequisite**
Operating mode (→ 50) = Interface or Interf.+capacit.

**Description**
Displays maximum filling speed of the lower medium measured in the past.

### Max.electr.temp.

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

**Description**
Displays maximum electronics temperature measured in the past.

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>-</td>
</tr>
</tbody>
</table>

### 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**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Write access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>-</td>
</tr>
</tbody>
</table>
**Min.electr.temp.**

**Navigation**

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

**Description**

Displays minimum electronics temperature measured in the past.

**Additional information**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>-</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Read access</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write access</td>
<td>Service</td>
</tr>
</tbody>
</table>
4.7.9 "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*

<table>
<thead>
<tr>
<th>Condition to be simulated</th>
<th>Associated parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific value of a process variable</td>
<td>• Assign meas.var. (→ 201)</td>
</tr>
<tr>
<td></td>
<td>• Value proc. var. (→ 201)</td>
</tr>
<tr>
<td>Specific state of the switch output</td>
<td>• Switch sim. (→ 201)</td>
</tr>
<tr>
<td></td>
<td>• Switch status (→ 202)</td>
</tr>
<tr>
<td>Existence of an alarm</td>
<td>Sim. alarm (→ 202)</td>
</tr>
</tbody>
</table>
Structure of the submenu

**Navigation**

Expert → Diagnostics → Simulation

<table>
<thead>
<tr>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assign meas.var. → 201</td>
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<tr>
<td>Value proc. var. → 201</td>
</tr>
<tr>
<td>Switch sim. → 201</td>
</tr>
<tr>
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</tr>
<tr>
<td>Sim. alarm → 202</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation Expert → Diagnostics → Simulation

Assign meas.var.

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

Description Select process variable to be simulated.

Selection

- Off
- Level
- Interface
- Level linearized
- Interf. lineariz
- Thicken.lineariz.

Factory setting Off

Additional information

- The value of the variable to be simulated is defined in the Value proc. var. parameter (→ 201).
- If Assign meas.var. ≠ Off, a simulation is active. This is indicated by a diagnostic message of the Function check (C) category.

Value proc. var.

Navigation Expert → Diagnostics → Simulation → Value proc. var. (2329)

Prerequisite Assign meas.var. (→ 201) ≠ Off

Description Specify value of the process value being simulated.

User entry Signed floating-point number

Factory setting 0

Additional information Downstream measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.

Switch sim.

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

Description Switch the simulation of the switch output on or off.

Selection

- Off
- On
### Switch status

<table>
<thead>
<tr>
<th>Factory setting</th>
<th>Off</th>
</tr>
</thead>
</table>

**Navigation**

Expert → Diagnostics → Simulation → Switch status (0463)

**Prerequisite**

Switch sim. (→ 201) = On

**Description**

Define the switch state to be simulated.

**Selection**

- Open
- Closed

**Factory setting**

Open

**Additional information**

The switch status assumes the value defined in this parameter. This helps to check correct operation of connected control units.

### Sim. alarm

<table>
<thead>
<tr>
<th>Factory setting</th>
<th>Off</th>
</tr>
</thead>
</table>

**Navigation**

Expert → Diagnostics → Simulation → Sim. alarm (0654)

**Description**

Switch alarm simulation on or off.

**Selection**

- Off
- On

**Factory setting**

Off

**Additional information**

When selecting the On option, the device generates an alarm. This helps to check the correct output behavior of the device in the case of an alarm.

An active simulation is indicated by the diagnostic message **C484 Sim. fail. mode**.
4.7.10 "Device check" submenu

Structure of the submenu

Navigation  
Expert → Diagnostics → Device check

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<tr>
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<tr>
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</tr>
<tr>
<td>Launch signal  →  205</td>
</tr>
<tr>
<td>Interface signal  →  205</td>
</tr>
</tbody>
</table>
Description of parameters

Navigation  

Expert → Diagnostics → Device check

Start dev. check

Navigation  

Expert → Diagnostics → Device check → Start dev. check (1013)

Description  

Start a device check.

Selection  

• No  

• Yes

Factory setting  

No

Additional information  

In the case of a lost echo a device check cannot be performed.

Result dev.check

Navigation  

Expert → Diagnostics → Device check → Result dev.check (1014)

Description  

Displays the result of the device check.

Additional information  

Meaning of the display options  

• Installation ok  
  Measurement possible without restrictions.

• Accuracy reduced  
  A measurement is possible. However, the measuring accuracy may be reduced due to the signal amplitudes.

• Meas.capab. red.  
  A measurement is currently possible. However, there is the risk of an echo loss. Check the mounting position of the device and the dielectric constant of the medium.

• Check not done  
  No device check has been performed.

Last check time

Navigation  

Expert → Diagnostics → Device check → Last check time (1203)

Description  

Displays the operating time at which the last device check has been performed.
**Level signal**

**Navigation**  
Expert → Diagnostics → Device check → Level signal (1016)

**Prerequisite**  
Device check has been performed.

**Description**  
Displays result of the device check for the level signal.

**User interface**  
- Check not done
- Check not OK
- Check OK

**Additional information**  
For **Level signal = Check not OK**: Check the mounting position of the device and the dielectric constant of the medium.

---

**Launch signal**

**Navigation**  
Expert → Diagnostics → Device check → Launch signal (1012)

**Prerequisite**  
Device check has been performed.

**Description**  
Displays result of the display check for the launch signal.

**User interface**  
- Check not done
- Check not OK
- Check OK

**Additional information**  
For **Launch signal = Check not OK**: Check the mounting position of the device. In non-metallic vessels use a metal plate or a metal flange.

---

**Interface signal**

**Navigation**  
Expert → Diagnostics → Device check → Interface signal (1015)

**Prerequisite**  
- Operating mode (→ 50) = Interface or Interf.+capacit.
- Device check has been performed.

**Description**  
Displays result of the device check for the interface signal.

**User interface**  
- Check not done
- Check not OK
- Check OK
4.7.11 "Adv. diagn. 1 to 2" submenu

Mode of operation

The Advanced Diagnostics offers additional options to monitor the process. The device contains two Advanced Diagnostic Blocks which can be used separately or in combination.

A measuring variable can be assigned to the input of each Advanced Diagnostic Block. Based on a freely configurable time interval, the variable can be submitted to a statistical function (e.g. maximum, minimum, mean, slope). Finally, a limit detection can be parametrized and its result can be transmitted to a digital output.

The result can be displayed and evaluated by a DCS or PLC. If required, it can also be linked to the second Advanced Diagnostic block and thus it is possible to combine the two results by the logical operators AND or OR.

46 Combined Advanced Diagnostic blocks

A  Advanced Diagnosotics 1
B  Advanced Diagnosotics 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

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<th>Associated parameters</th>
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<td>Assign signal (→ 214)</td>
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<td><img src="#" alt="List of parameters" /></td>
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</tr>
<tr>
<td>- Minimum</td>
<td><img src="#" alt="List of parameters" /></td>
</tr>
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<td>- Mean</td>
<td><img src="#" alt="List of parameters" /></td>
</tr>
<tr>
<td>- Std. deviation</td>
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<tr>
<td>Drag indicator for the calculated quantity</td>
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<tr>
<td>Limit check</td>
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</tr>
<tr>
<td>Reaction in case of a limit violation</td>
<td><img src="#" alt="List of parameters" /></td>
</tr>
</tbody>
</table>
Example 1: Draining/filling speed

Only one Advanced Diagnostic Block is needed for this application. In the example this is Adv. diagn. 1 (→ 213). However, Adv. diagn. 2 (→ 213) could be used just as well.

The level change rate (i.e. draining or filling speed) allows the customer to instantly realize whether or not the level is changing, and at which rate. The rate at which the level is changing must be observed as powerful pumps can create significant over and underpressure in a tank. Pressure relieve valves can only operate properly up to a certain level change rate. This is in particular valid for almost emptied tanks. The level change rate is also an intermediate result for calculating transfer estimates, such as time to fill, time to empty, time to target, etc.

Basic idea

The Advanced Diagnostics is used to calculate the draining or filling speed from the measured level. The result can be transmitted via the current output or the HART communication interface.

Configuration of the calculation

The calculation of the rate of level change is configured as follows:

1. Select Assign signal 1 = Level linearized.
2. Select Link AD 1 to = None (= factory setting)
3. Define Sample time 1 in accordance with the expected draining or filling speed.
4. Select Calc. type 1 = Slope.
5. 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 (→ 220)
- Evt behaviour (→ 220)
- Alarm delay (→ 220)

With this configuration, the Maximum value 1 and Minimum value 1 drag indicators display the maximum or minimum value the rate of level change has obtained. Positive values indicate filling (rising level), negative values indicate draining (falling level). If required, the drag indicators can be reset by the Reset min/max 1 parameter.
Allocation of the calculated rate of level change to the current output

1. Navigate to the following submenu: Expert → Output → Curr.output 1.
3. Select Turn down = On.
4. Enter maximum expected draining speed (negative value) in 4 mA value.
5. Enter maximum expected filling speed (positive value) in 20 mA value.

With this configuration, the rate of level change is transmitted via the current output. The relationship between the rate of level change and the output current is as follows:

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

Where:
- $\Delta L/\Delta t$: Rate of level change
- $W_4$: 4 mA value
- $W_{20}$: 20 mA value
- $I$: Output current

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

\[
I_c = 4 \text{ mA} - \frac{W_4}{W_{20} - W_4} 16 \text{ mA}
\]

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 ($\rightarrow$ 172) = Analog out. AD 1.

With this configuration, the Primary var (PV) parameter ($\rightarrow$ 172) 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.

8) Negative values: draining speed; Positive values: filling speed
Example 2: Foam detection

In this example, both Advance Diagnostic Blocks are used.

Preconditions

- The process runs at a fixed level (in the example: 80%)
- If foam occurs during the operation, the vessel should automatically be sprinkled with water from the top or an antifoam agent should be added to dissolve the foam.

Basic idea

The echo amplitude decreases in the case of foam formation. This can be used by the Advanced Diagnostics to detect the foam. The foam detection, however, should only be active as long as the level is between 75% and 85%.

Configuration of the level monitoring

In order to ensure that the level is within the correct range, configure the Adv.diag. 1 submenu as follows:

1. Navigate to the Adv.diag. 1 submenu
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.diag. 2 submenu as follows:

1. Select Assign signal 2 = Relat.echo ampl.
2. Use the **Minimum value** 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 (130 mV in the example).

3. Select **Calc. type** = **Mean**.

4. Enter **Sample time** = '60 s'.

5. Select **Check mode** = **Lower limit**.

6. Enter the amplitude limit determined in step 2 into the **Lower limit** parameter (130 mV in the example).

With these settings, the Advanced Diagnostic Block behaves as follows:
- If the amplitude is above 130 mV (i.e.: no foam), the block assumes the digital value '0' (INACTIVE).
- If the amplitude is below 130 mV (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.** submenu (→ 213):

1. Select **Link AD** to **Digital out AD 1**.

2. Select **Link. logic AD** = **AND**.

With this configuration the output of **Advanced Diagnostics** 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.** 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

Configuration of the Advanced Diagnostics for foam detection

- **L**: Level
- **A**: Amplitude

### Advanced diagnostics 1: Monitoring the level
1. **Assign signal 1** = "Relat.echo ampl."
2. **Check mode 1** = "Out of range"
3. **Upper limit 1** = 85 %
4. **Lower limit 1** = 75 %
5. Digital output of Advanced Diagnostics 1

### 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** = 130 mV
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 2`

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<td>➔</td>
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<tr>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>Sample time 1 to 2</td>
<td>➔ 215</td>
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</tr>
<tr>
<td>Alarm delay 1 to 2</td>
<td>➔ 220</td>
</tr>
</tbody>
</table>
Description of parameters

Assign signal 1 to 2

Navigation

Expert → Diagnostics → Adv.diagn. 1 to 2

Description

Allocate a measuring variable to the Advanced Diagnostic Block.

Selection

- None
- Level linearized
- Distance
- Unfiltered dist.
- Interf. lineariz
- Interface dist.
- Unfilt. I. dist.
- Thickn.upp.layer
- Electronic temp.
- Measur. cap.
- Relat.echo ampl.
- Abs. echo ampl.
- Abs.interf.ampl.
- Rel.interf.ampl.
- Abs. EOP ampl.
- EOP shift
- Noise of signal
- Measur. curr.
- Terminal volt.
- Calc. DC value
- Sensor debug

Factory setting

None

Link AD 1 to 2 to

Navigation

Expert → Diagnostics → Adv.diagn. 1 to 2 → Link AD 1 to 2

Description

Link the digital input (DI) of the Advanced Diagnostic Block to the digital output (DO) of the other Advanced Diagnostic Block.

Selection

- None
- Digital out AD 1
- Digital out AD 2

Factory setting

None
### Link. logic AD 1 to 2

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Link. logic AD 1 to 2 (11181–1 to 2)

**Prerequisite**

Link AD to (→ 214) = Digital out AD 1 oder Digital out AD 2

**Description**

Select linking logic between the two Advanced Diagnostic Blocks.

**Selection**

- AND
- OR

**Factory setting**

AND

---

### Sample time 1 to 2

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Sample time 1 to 2 (11187–1 to 2)

**Prerequisite**

Assign signal (→ 214) ≠ None

**Description**

Specify sampling interval for the calculation.

**User entry**

1 to 3600 s

**Factory setting**

10 s

---

### Calc. type 1 to 2

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Calc. type 1 to 2 (11174–1 to 2)

**Prerequisite**

Assign signal (→ 214) ≠ 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
"Expert" menu

Additional information

50  Options of the "Calc. type" parameter
a  Sample time (→ 215)
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 (→ 215).

Check mode 1 to 2

Navigation  Expert → Diagnostics → Adv.diagn. 1 to 2 → Check mode 1 to 2 (11175–1 to 2)

Prerequisite  Assign signal (→ 214) ≠ None

Description  Define check mode for limit monitoring.
**Selection**

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

**Factory setting**

Off

**Additional information**

![Diagram showing selection options](image)

- A: Status of digital output: 0 ("INACTIVE")
- B: Status of digital output: 1 ("ACTIVE")
- C: Upper limit (→  218)
- D: Lower limit (→  218)
- E: Hysteresis (→  219)
- F: "Check mode" = "Lower limit"
- G: "Check mode" = "Upper limit"
- H: "Check mode" = "In range"
- I: "Check mode" = "Out of range"

51 Limit monitoring in the Advanced Diagnostic Block

- 0  Status of digital output: 0 ("INACTIVE")
- 1  Status of digital output: 1 ("ACTIVE")
- a  Upper limit (→  218)
- b  Lower limit (→  218)
- c  Hysteresis (→  219)
- 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 (→  215), the check does not refer to the assigned measuring variable but to the quantity calculated from it.

---

**Calc. unit 1 to 2**

**Navigation**

Expert → Diagnostics → Adv.diaign. 1 to 2 → Calc. unit 1 to 2 (11188–1 to 2)

**Prerequisite**

Assign signal (→  214) → None

**Description**

Select unit for the calculation.

**Selection**

Dependent on the following parameters:

- Assign diagnostic signal (→  214)
- Calculation type (→  215)
Factory setting  
Dependent on the following parameters:
- Assign diagnostic signal (→ 214)
- Calculation type (→ 215)

Upper limit 1 to 2

Navigation  
Expert → Diagnostics → Adv.diagn. 1 to 2 → Upper limit 1 to 2 (11182–1 to 2)

Prerequisite  
Check mode parameter (→ 216) 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 (→ 214)
- Calculation type (→ 215)

Factory setting  
Dependent on the following parameters:
- Assign diagnostic signal (→ 214)
- Calculation type (→ 215)

Lower limit 1 to 2

Navigation  
Expert → Diagnostics → Adv.diagn. 1 to 2 → Lower limit 1 to 2 (11184–1 to 2)

Prerequisite  
Check mode parameter (→ 216) 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 (→ 214)
- Calculation type (→ 215)

Factory setting  
Dependent on the following parameters:
- Assign diagnostic signal (→ 214)
- Calculation type (→ 215)
**Hysteresis 1 to 2**

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Hysteresis 1 to 2 (11178–1 to 2)

**Prerequisite**

Check mode parameter (→ 216) 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 (→ 214)
- Calculation type (→ 215)

**Factory setting**

Dependent on the following parameters:
- Assign diagnostic signal (→ 214)
- Calculation type (→ 215)

---

**Maximum value 1 to 2**

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Maximum value 1 to 2 (11183–1 to 2)

**Prerequisite**

Assign signal (→ 214) ≠ None

**Description**

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

---

**Minimum value 1 to 2**

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Minimum value 1 to 2 (11185–1 to 2)

**Prerequisite**

Assign signal (→ 214) ≠ None

**Description**

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

---

**Reset min/max 1 to 2**

**Navigation**

Expert → Diagnostics → Adv.diagn. 1 to 2 → Reset min/max 1 to 2 (11186–1 to 2)

**Prerequisite**

Assign signal (→ 214) ≠ None

**Description**

Reset drag indicators (Maximum value (→ 219) and/or Minimum value (→ 219)).
"Expert" menu

**Expert** menu

**Levelflex FMP5x Modbus**

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

**Factory setting**
Off

---

**Stat. AD event 1 to 2**

**Navigation**
Expert → Diagnostics → Adv.diagn. 1 to 2 → Stat. AD event 1 to 2 (11176–1 to 2)

**Prerequisite**
Assign signal (→ 214) ≠ 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)

**Factory setting**
Mainten. req.(M)

---

**Evt behaviour 1 to 2**

**Navigation**
Expert → Diagnostics → Adv.diagn. 1 to 2 → Evt behaviour 1 to 2 (11177–1 to 2)

**Prerequisite**
Assign signal (→ 214) ≠ None

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

**Selection**
- Off
- Alarm
- Warning
- Logbook only

**Factory setting**
Warning

---

**Alarm delay 1 to 2**

**Navigation**
Expert → Diagnostics → Adv.diagn. 1 to 2 → Alarm delay 1 to 2 (11171–1 to 2)

**Prerequisite**
Assign signal (→ 214) ≠ None

**Description**
Define alarm delay for the Advanced Diagnostic Block.
<table>
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<th>0.0 to 3600.0 s</th>
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</thead>
<tbody>
<tr>
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<td>10.0 s</td>
</tr>
</tbody>
</table>

4.7.12  "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 (→ 223).

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.

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</tr>
</tbody>
</table>
Description of parameters

**Navigation**

Expert → Diagnostics → Envelope diag. → Save ref. curve (1218)

**Description**
Save current envelope curve as reference curve.

**Selection**
- No
- Yes

**Factory setting**
No

**Additional information**

**Meaning of the options**
- No
  - No action
- Yes
  - The current envelope curve is saved as reference curve.

---

**Time ref. curve**

**Navigation**

Expert → Diagnostics → Envelope diag. → Time ref. curve (1232)

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