Technical Information

**Liquicap M  FMI51, FMI52**

Capacitance level measurement
For continuous measurement in liquids

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**Application**

The Liquicap M FMI5x compact transmitter is used for the continuous level measurement of liquids.

Thanks to its robust and tried-and-tested construction, the probe can be used both in vacuums and in overpressure up to 100 bar. The materials used allow operating temperatures in the medium container of –80 °C to +200 °C.

Used in conjunction with Fieldgate (remote measured value interrogation via the Internet), Liquicap M provides an ideal solution for inventorying materials and optimizing logistics (inventory control).

**Your benefits**

- No adjustment necessary for media with a conductivity of 100 µS/cm and higher. The probes are adjusted to the ordered probe length on leaving the factory (0 % to 100 %). This makes easy and fast commissioning possible.
- Menu-guided local configuration via plain text display (optional)
- Universal application thanks to wide range of certificates and approvals
- Use also in safety systems requiring functional safety to SIL2 in accordance with IEC 61508
- Corrosion-resistant, FDA-listed materials in contact with the process
- Can be switched for media forming buildup
- Short reaction times
- No need for readjustment after replacing electronics
- Automatic monitoring of electronics and possible damage to insulation, as well as rod breaking or rope tearing
- Suitable for interface measurement

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Endress + Hauser
People for Process Automation
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<td><strong>Additional approvals</strong></td>
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Function and system design

Measuring principle

The principle of capacitance level measurement is based on the change in capacitance of the capacitor due to the change in the level. The probe and container wall (conductive material) form an electric capacitor. When the probe is in air (1), a certain low initial capacitance is measured. When the container is filled, the capacitance increases the more the probe is covered (2), (3). As of a conductivity of 100 μs/cm, the measurement is independent of the value for the dielectric constant (DK) of the liquid. As a result, fluctuations in the DK value do not affect the measured value display. Furthermore, the system also prevents the effect of medium buildup or condensate near the process connection for probes with an inactive length.

Note!
A ground tube is used as a counterelectrode for containers made of nonconductive materials.

Function

The selected electronic insert of the probe (e.g. FEI50H 4 to 20 mA HART) converts the measured change in capacitance of the liquid to a signal that is proportional to the level.

Phase-selective measurement

The evaluation of the container capacitance works along the principle of phase-selective measurement. In this process, the amount of alternating current and the phase shift between the voltage and current is measured. With these two characteristic quantities, the capacitance idle current can be calculated by the medium capacitor and the real current by the medium resistance. Conductive buildup stuck to the probe rod/rope acts like additional medium resistance and causes an error in measurement. As the size of the medium resistance can be determined with phase-selective measurement, the system compensates for the buildup on the probe.

\[ R: \text{Conductivity of the liquid} \]
\[ C: \text{Capacitance of the liquid} \]
\[ C_A: \text{Initial capacitance (probe not covered)} \]
\[ C_E: \text{Final capacitance (probe covered)} \]
\[ \Delta C: \text{Change in capacitance} \]
Interface measurement

A prior adjustment also ensures a certain and definite measured value even if the emulsion layer is of varying thickness. In this process, the average value of the emulsion film is always measured. The adjustment values for empty and full adjustment can be calculated with the FieldCare operating program from Endress+Hauser.

Measuring system

1.) Water, for example (the medium must be conductive ≥ 100 μS/cm)
2.) Emulsion
3.) Oil, for example (nonconductive medium <1 μS/cm)

PFM output (FEI57C)

The complete measuring system consists of:
- The capacitance Liquicap M FMI51 or FMI52 level probe
- The FEI57C electronic insert
- A transmitter power supply unit

Note!
- The twin-core feeder is also used for PFM signal transmission.
- In combination with a power supply unit the FEC57C will only run in a 1-channel-mode and without an automatic alignment correction.
4 to 20 mA output with HART protocol (FEI50H)

The complete measuring system consists of:

- The capacitance Liquicap M FMI51 or FMI52 level probe
- The FEI50H electronic insert
- A transmitter power supply unit (e.g. RN221N, RNS221, RMA421, RMA422)

Note!
DC voltage must be supplied to the electronic insert. The twin-core feeder is also used for HART protocol signal transmission.

![Diagram](image)

1 PLC (programmable logic controller)
2 VIATOR Bluetooth modem with connecting cable
3 Field Xpert
4 Computer with operating tool (e.g. FieldCare)
5 Commubox FXA291
6 ToF Adapter FXA291
7 Commubox FXA195 (USB)
8 Micropilot with display module
9 Field Communicator 475
10 FXA195 oder Field Communicator 475
11 Transmitter power supply unit RN221N (with communication resistor)

**Local operation**
- Standard - via keys and switches on the electronic insert
- Optional - via display and operating module

**Remote operation**
- With HART handheld terminal DXR375/475
- With a personal computer, Commubox FXA195 and the operating program FieldCare.

Note!
FieldCare is a graphic operating program and is used to support commissioning, data backup, signal analysis and documentation of the measuring point.
Vendor managed inventory

The remote interrogation of tank or silo levels via Fieldgate enables suppliers of raw materials to gather information about the current inventories of their regular customers at any time and, for example, take this into account in their own production planning. The Fieldgate monitors the configured level limits and automatically triggers the next order as required. Here, the range of possibilities ranges from simple requisitioning by e-mail through to fully automatic order processing by incorporating XML data into the planning systems on both sides.

Remote maintenance of measuring systems

Not only does Fieldgate transmit the current measured values, it also alerts the standby personnel responsible by e-mail or SMS as required. Service technicians can diagnose and configure the connected HART devices remotely in the event of an alarm or also for routine checks. All that is required for this is the appropriate HART operating software (e.g. FieldCare) for the connected device. Fieldgate forwards the information transparently. In this way, all options of the operating software in question are available remotely. By using remote diagnosis and remote configuration some onsite service operations can be avoided and all others can at least be planned and prepared better.
Operating conditions: Installation

**Installation instructions**

Liquicap M FMI51 (rod probe) can be installed vertically from above or below. Liquicap M FMI52 (rope probe) can be installed vertically from above.

**Note!**
- The probe may not come into contact with the container wall! Do not install probes in the area of the filling curtain!
- When using in agitating tanks, make sure you install at a safe distance from the agitator.
- If multiple probes are mounted next to each other, a minimum distance of 500 mm (19.7 in) between the probes must be observed.
- Rod probes with a ground tube should be used in the event of severe lateral load.
- When mounting, ensure there is a good electrically conductive connection between the process connection and the tank. Use an electrically conductive sealing band for example.

**For containers that conduct electricity e.g. steel tanks**

Dimensions mm (in)

**For containers that do not conduct electricity e.g. plastic tanks**

Probe with ground tube and grounding
With separate housing

Note!
- The maximum connection length between the probe and the separate housing is 6 m (L4). The desired length must be quoted when ordering a Liquicap M with a separate housing.
- The overall length L = L1 + L4 may not exceed 10 m.
- If the connecting cable is to be shortened or passed through a wall, it must be separated from the process connection.

Rod length L1 max. 4 m
Rope length L1 max. 9.7 m (the maximum total length of L1 + L4 should not exceed 10 m).

Extension heights

<table>
<thead>
<tr>
<th>Housing side: wall mounting</th>
<th>Housing side: pipe mounting</th>
<th>Sensor side</th>
</tr>
</thead>
<tbody>
<tr>
<td>-61 (2.4) B</td>
<td>-75 (2.95) B</td>
<td>r ≥100 (3.94)</td>
</tr>
<tr>
<td>H1</td>
<td>H1</td>
<td>D</td>
</tr>
<tr>
<td>r ≥100 (3.94)</td>
<td></td>
<td>H5</td>
</tr>
<tr>
<td>H1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensions mm (in)

Note!
- The cable has a bending radius of r ≥ 100 mm
- Connecting cable: ø10.5 mm
- Outer jacket: silicone, notch-resistant
### Wall holder unit

**Note!**
- The wall holder unit is part of the scope of supply for device versions with a separate housing.
- The wall holder unit first has to be screwed to the separate housing before you can use it as a drilling template. The distance between the holes is reduced by screwing it to the separate housing.

<table>
<thead>
<tr>
<th>Probes Ø10 mm rod</th>
<th>H5 (mm)</th>
<th>D (mm)</th>
</tr>
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<tr>
<td>Probes Ø16 mm rod or rope (without fully insulated inactive length)</td>
<td>66</td>
<td>38</td>
</tr>
<tr>
<td>Probes Ø22 mm rod or rope (with fully insulated inactive length)</td>
<td>89</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions mm (in)</th>
</tr>
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<tbody>
<tr>
<td>3 (0.12)</td>
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</table>

<table>
<thead>
<tr>
<th>Polyester housing (F16)</th>
<th>Stainless steel housing (F15)</th>
<th>Aluminum housing (F17)</th>
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<tr>
<td>B (mm)</td>
<td>76</td>
<td>64</td>
</tr>
<tr>
<td>H1 (mm)</td>
<td>172</td>
<td>166</td>
</tr>
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Operating conditions: Environment

**Ambient temperature range**
- –50 to +70 °C
- –40 to +70 °C (with F16 housing)
- Observe restrictions (derating) → 11
- If operating outdoors, use a protective cover! → 33

**Storage temperature**
-50 to +85 °C

**Climate class**
DIN EN 60068-2-38/IEC 68-2-38: test Z/AD

**Vibration resistance**
DIN EN 60068-2-64/IEC 68-2-64: 20 Hz–2000 Hz; 0.01 g²/Hz

**Shock resistance**
DIN EN 60068-2-27/IEC 68-2-27: 30 g acceleration

**Cleaning**

**Housing:**
When cleaning, make sure that the cleaning agent used does not attack or corrode the housing surface or seals.

**Probe:**
Depending on the application, buildup (contamination and soiling) can form on the probe rod. A high degree of material buildup can affect the measurement result. If the medium tends to create a high degree of buildup, regular cleaning is recommended. When cleaning, it is important to make sure that the insulation of the probe rod is not damaged.

**Degree of protection**

<table>
<thead>
<tr>
<th>Housing</th>
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<th>IP67*</th>
<th>IP68*</th>
<th>NEMA4X**</th>
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<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
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<td>Stainless steel housing F15</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Aluminum housing F17</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
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<td>Aluminum housing F13 with gas-tight process seal</td>
<td>X</td>
<td>-</td>
<td>X***</td>
<td>X</td>
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<tr>
<td>Stainless steel housing F27 with gas-tight process seal</td>
<td>X</td>
<td>X</td>
<td>X***</td>
<td>X</td>
</tr>
<tr>
<td>Aluminum housing T13 with gas-tight process seal and separate connection compartment (Ex d)</td>
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<td>-</td>
<td>X***</td>
<td>X</td>
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<tr>
<td>Separate housing</td>
<td>X</td>
<td>-</td>
<td>X***</td>
<td>X</td>
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</tbody>
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* as per EN60529
** as per NEMA 250
*** Only with M20 cable entry or G1/2 thread

**Electromagnetic compatibility (EMC)**
- Interference emission to EN 61326, Electrical Equipment Class B
- Interference immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)
- Error current in accordance with Namur NE43: FEI50H = 22mA
- A usual commercial instrument cable can be used.
Operating conditions: Process

Process temperature range

The following diagrams apply for:
- Rod and rope version
- Insulation: PTFE, PFA, FEP
- Standard applications outside hazardous areas

Note!
The temperature is restricted to $T_a \leq -40^\circ C$ if the polyester housing F16 is used or if additional option B is selected (free from paint-wetting impairment substances, only FMI51).

With compact housing

![Diagram 1]

$T_a$: Ambient temperature
$T_P$: Process temperature

With separate housing

![Diagram 2]

$T_a$: Ambient temperature
$T_P$: Process temperature

* The permitted ambient temperature at the separate housing is the same as indicated for the compact housing.
Influence of process temperature

Error in case of fully insulated probes typically 0.13%/K related to the full scale value.

Process pressure limits

**Probe ø10 mm (including insulation)**

-1 to 25 bar (observe dependencies: process temperature and process connection → 11 and 17).

**Probe ø16 mm (including insulation)**

- -1 to 100 bar (observe dependencies: process temperature and process connection → 11 and 17)
- In the event of an inactive length, the maximum permitted process pressure is 63 bar
- In the event of CRN approval and inactive length, the maximum permitted process pressure is 32 bar

**Probe ø22 mm (including insulation)**

- -1 to 50 bar (observe dependencies: process temperature and process connection → 11 and 17).

Refer to the following standards for the pressure values permitted at higher temperatures:

- EN 1092-1: 2005 Table, Appendix G2
  With regard to its resistance/temperature property, the material 1.4435 is identical to 1.4404 which is grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 1998 Tab. 2-2.2 F316
- ASME B 16.5a - 1998 Tab. 2.3.8 N10276
- JIS B 2220

In each case it applies to the lowest value from the derating curves of the device and the selected flange.

Pressure and temperature derating

For process connections ½", ¾", 1", flanges < DN50, < ANSI 2", < JIS 50A (10 mm rod)
For process connections ¾", 1", flanges < DN50, < ANSI 2", < JIS 50A (16 mm rod)

Rod insulation: PTFE, PFA
Rope insulation: FEP, PFA

**Note!**
See also “Process connections” → 17.
For process connections 1½", flanges ≥ DN50, ≥ ANSI 2", ≥ JIS 50A (16 mm rod)
Rod insulation: PTFE, PFA
Rope insulation: FEP, PFA

Note!
See also ‘Process connections’ → 17

\[ P_p: \text{Process pressure} \]
\[ T_p: \text{Process temperature} \]

* For probes with an inactive length.

With a fully insulated inactive length (22 mm rod):

\[ P_p: \text{Process pressure} \]
\[ T_p: \text{Process temperature} \]
Liquicap M operational range

The measuring accuracy is independent of the conductivity and DK value (dielectric constant).

- 0 %...100 % factory calibration

The measuring accuracy depends on the DC value and the conductivity of the medium. Measurement not recommendable. Select therefore different measurement principle.

- 0 % factory calibration

The measuring accuracy depends on the DC value.

<table>
<thead>
<tr>
<th>Conductivity [μS/cm]</th>
<th>10^4</th>
<th>10^3</th>
<th>10^2</th>
<th>10^1</th>
<th>10^-1</th>
<th>10^-2</th>
<th>10^-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Water-based liquids, aqueous solutions of salts, acids and alkalis, aqueous dispersions and emulsions, wastewater, electrolytes, beverages</td>
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<tr>
<td>e.g. Hydrocarbons with a higher water content, demineralised water</td>
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<tr>
<td>e.g. Hydrocarbons with a water content under 0.1%, petrols, oils, solvents</td>
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Note!
Further information and dielectric constants (DC values) in the Download Area of the Endress+Hauser web site:
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser “DC Values App” (available for Android and iOS)
**Mechanical construction**

*Note!*

The dimensions on the following pages are indicated in mm.
Housing

Note!
High cover for display (optional).

Polyester housing F16

Stainless steel housing F15

Aluminum housing F17

Aluminum housing F13
With gas-tight process seal

Stainless steel housing F27
with gas-tight process seal

Aluminum housing T13
With separate connection compartment and gas-tight process seal
### Extension height of housing with adapter

<table>
<thead>
<tr>
<th></th>
<th>Polyester housing F16</th>
<th>Stainless steel housing F15</th>
<th>Aluminum housing F17</th>
<th>Aluminum housing F13</th>
<th>Stainless steel housing F27</th>
<th>Aluminum housing T13</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Order code**

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 (without display)</td>
<td>143</td>
<td>141</td>
<td>150</td>
<td>194</td>
<td>194</td>
<td>210</td>
</tr>
<tr>
<td>H2 (with display)</td>
<td>162</td>
<td>179</td>
<td>179</td>
<td>223</td>
<td>223</td>
<td>223</td>
</tr>
</tbody>
</table>

### Process connections

<table>
<thead>
<tr>
<th></th>
<th>Thread G</th>
<th>Thread NPT</th>
<th>Threaded pipe joint</th>
<th>Tri-Clamp</th>
<th>Tri-Clamp clad</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
<td><img src="image13.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Rod probes Ø 10, rope probes**

- For pressures up to 25 bar
- Version / order code: G ½ / GCJ
- Dimensions: H3 = 38, H4 = 19, AF = 41
- Surface roughness: ≤ 0.8 µm
- Additional information: Seal: elastomer

**Rod probes Ø 16, rope probes**

- For pressures up to 25 bar
- Version / order code: G ¾ / GDJ
- Dimensions: H3 = 41, H4 = 25, AF = 55
- Surface roughness: ≤ 0.8 µm
- Additional information: Seal: elastomer, EHEDG*, 3A*  

**Rod probes Ø 22, rope probes**

- For pressures up to 50 bar
- Version / order code: G 1½ / GGJ
- Dimensions: H3 = 66, H2 = 66
- Surface roughness: ≤ 0.8 µm
- Additional information: Seal: elastomer, EHEDG*, 3A*
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Thread G</th>
<th>Thread NPT</th>
<th>Threaded pipe joint</th>
<th>Tri-Clamp</th>
<th>Tri-Clamp clad</th>
</tr>
</thead>
<tbody>
<tr>
<td>H3 = 85</td>
<td>H3 = 85</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>H4 = 25</td>
<td>H4 = 25</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>AF = 55</td>
<td>AF = 55</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Additional information</td>
<td>Seal: elastomer</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

* EHEDG, 3A: Certificate only applies for probes without an inactive length and with a fully insulated probe rod.  
** In the event of CRN approval, the maximum permitted process pressure is 11 bar.  
*** Not in conjunction with inactive length. 
**** Process connection: Tri-Clamp (47 mm) with seal (2 mm) and removable clamp (49 mm). 

---

### Flanges

<table>
<thead>
<tr>
<th>Flanges</th>
<th>Hygiene connection</th>
<th>Hygiene connection</th>
<th>Hygiene connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>{EN1092-1}</td>
<td>Thread with flush-mounted seal</td>
<td>Thread with flush-mounted seal</td>
<td>Adapter 44 mm with flush-mounted seal</td>
</tr>
<tr>
<td>{ANSI B 16.5}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>{JIS B2220}</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rod probes Ø10, rope probes

- **For pressures up to** Max. 25 bar (depends on flange)  
- **Version / order code**  
  - EN / B**  
  - ANSI / A**  
  - JIS / K**  
  - G3/4 / GQJ  
  - G1 / GWJ  
- **Dimensions**  
  - H3 = 57  
  - H3 = 31  
  - H3 = 30  
- **Additional information**  
  - Also clad (PTFE)  
  - Weld-in adapter see "Accessories" Page 33 EHEDG*, 3A*  
  - Weld-in adapter see "Accessories" Page 33 EHEDG*, 3A*  

### Rod probes Ø16, rope probes

- **For pressures up to** Max. 100 bar (depends on flange)  
- **Version / order code**  
  - EN / B**  
  - ANSI / A**  
  - JIS / K**  
  - Universal adapter / UPJ  
- **Standard dimensions:**  
  - Dimensions with inactive length:  
    - H3 = 66  
    - H3 = 56  
- **Additional information**  
  - Also clad (PTFE)  
  - Universal adapter see "Accessories" Page 33 EHEDG*, 3A*  

### Rod probes Ø22, rope probes

- **For pressures up to** Max. 50 bar (depends on flange)  
- **Version / order code**  
  - EN / B**  
  - ANSI / A**  
  - JIS / K**  
- **Dimensions**  
  - H3 = 111  
- **Additional information**  
  - Only clad (PTFE)  

* EHEDG, 3A: Certificate only applies for probes without an inactive length and with a fully insulated probe rod.
Rod probes FMI51

Note!

- The active probe rod is always fully insulated (dimension L1).
- Total length of probe from sealing surface: \( L = L_1 + L_3 \)
- Thickness of insulation for probe rod diameter: 10 mm = 1 mm; 16 mm = 2 mm; 22 mm = 2 mm
- The insulation is welded at the tip of the probe. Measurement cannot be performed in this area.
- Probe rod diameter 10 mm: approx. 10 mm
- Probe rod diameter 16 and 22 mm: approx. 15 mm
- For conductive liquids (>100 \( \mu \)S/cm), the probe is adjusted at the factory to the probe length ordered (0% to 100%). For nonconductive liquids (<1 \( \mu \)S/cm), 0% adjustment is performed at the factory.
- The 100% adjustment has to be carried out on site.
- Length tolerances \( L_1, L_3: <1 \text{ m}: 0 \text{ to } –5 \text{ mm}, 1 \text{ to } 3 \text{ m}: 0 \text{ to } –10 \text{ mm}, 3 \text{ to } 6 \text{ m}: 0 \text{ to } –20 \text{ mm} \)

<table>
<thead>
<tr>
<th>Rod probe</th>
<th>Rod probe with ground tube</th>
<th>Rod probe with inactive length</th>
<th>Rod probe with inactive length and ground tube</th>
<th>Rod probe with fully insulated inactive length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length (L)</td>
<td>100...4000</td>
<td>100...4000</td>
<td>200...6000</td>
<td>200...6000</td>
</tr>
<tr>
<td>Active rod length (L1)</td>
<td>100...4000</td>
<td>100...4000</td>
<td>100...4000</td>
<td>100...4000</td>
</tr>
<tr>
<td>Inactive rod length (L3)</td>
<td>–</td>
<td>–</td>
<td>100...2000</td>
<td>100...2000</td>
</tr>
<tr>
<td>Ø Probe rod</td>
<td>10</td>
<td>16</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Height of the cone at the end of the active rod length (L1), depending on the probe diameter</td>
<td>10</td>
<td>13</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Ø Ground tube with or without inactive length</td>
<td>–</td>
<td>–</td>
<td>22</td>
<td>43</td>
</tr>
<tr>
<td>Lateral loading capacity (Nm) at 20 °C</td>
<td>&lt;15</td>
<td>&lt;30</td>
<td>&lt;40</td>
<td>&lt;300</td>
</tr>
<tr>
<td>For use in agitating tanks</td>
<td>–</td>
<td>–</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>For conductive liquids &gt;100 ( \mu )S/cm</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>For nonconductive liquids &lt;1 ( \mu )S/cm</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>For aggressive liquids</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>For high-viscosity liquids</td>
<td>X</td>
<td>–</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>For use in plastic tanks</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>For use in mounting nozzles</td>
<td>–</td>
<td>–</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In the event of condensate on tank ceiling</td>
<td>–</td>
<td>–</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

* \( H_4 \) = Thread height (important for calculating the exact probe length for process connections with a thread.) → Ø 17
** Probe tube
Rod probes FMI51 for hygiene applications

Note!
- Total length of probe from sealing surface: \( L = L_1 \)
- Thickness of insulation with probe rod diameter 16 mm = 2 mm
- Length tolerances \( L_1 \): <1 m: 0 to –5 mm, 1 to 3 m: 0 to –10 mm, 3 to 6 m: 0 to –20 mm

<table>
<thead>
<tr>
<th>Rod probe with clad Tri-Clamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length (L)</td>
</tr>
<tr>
<td>Active rod length (L1)</td>
</tr>
<tr>
<td>Probe rod diameter</td>
</tr>
<tr>
<td>Ø Ground tube</td>
</tr>
<tr>
<td>Ø Inactive length</td>
</tr>
<tr>
<td>Lateral loading capacity (Nm) at 20 °C</td>
</tr>
<tr>
<td>For use in agitating tanks</td>
</tr>
<tr>
<td>For conductive liquids &gt;100 μS/cm</td>
</tr>
<tr>
<td>For high-viscosity conductive liquids</td>
</tr>
<tr>
<td>For nonconductive liquids &lt;1 μS/cm</td>
</tr>
<tr>
<td>For aggressive liquids</td>
</tr>
<tr>
<td>For high-viscosity liquids</td>
</tr>
<tr>
<td>For use in plastic tanks</td>
</tr>
<tr>
<td>For use in mounting nozzles</td>
</tr>
<tr>
<td>In the event of condensate on tank ceiling</td>
</tr>
</tbody>
</table>
**FM52 rope probes**

**Note!**
- The active probe length is always fully insulated (dimension L1).
- Total length of probe from sealing surface: L = L1 + L3
- All rope probes are prepared for tensioning in containers (tensioning weight / anchor hole)
  - In case of media < 1 mS/cm, appropriate measures must be taken, e.g. a metallic reference point or a metallic tank.
  - Back-and-forth swinging of the rope directly influences the switch point. The probe must therefore be tightened.
- For conductive liquids (>100 μS/cm), the probe is adjusted at the factory to the probe length ordered (0 % to 100 %). For nonconductive liquids (<1 μS/cm), 0% adjustment is performed at the factory. Only the 100% adjustment must be carried out on site.
- Not suitable for agitator tanks, high-viscosity liquids and plastic tanks.
- Thickness of rope insulation 0.75 mm
- In the range of the anchor weight the measurement is not linear.
- Length tolerances L1, L3: <1 m: 0 to –10 mm, 1 to 3 m: 0 to –20 mm, 3 to 6 m: 0 to –30 mm, 6 to 12 m: 0 to –40 mm

<table>
<thead>
<tr>
<th></th>
<th>Rope probe</th>
<th>Rope probe with clad Tri-Clamp</th>
<th>Rope probe with inactive length (uninsulated)</th>
<th>Rope probe with fully insulated inactive length</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total length (L)</strong></td>
<td>420...10000</td>
<td>570...10000</td>
<td>570...10000</td>
<td>570...10000</td>
</tr>
<tr>
<td><strong>Active rope length (L1)</strong></td>
<td>420...10000</td>
<td>420...9850</td>
<td>420...9850</td>
<td>420...9850</td>
</tr>
<tr>
<td><strong>Inactive length (L3)</strong></td>
<td>--</td>
<td>150...2000</td>
<td>150...1000</td>
<td>150...1000</td>
</tr>
<tr>
<td><strong>Ø Inactive length</strong></td>
<td>--</td>
<td>22/43*</td>
<td>22**</td>
<td>22**</td>
</tr>
<tr>
<td><strong>Ø Probe rope</strong></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Ø Anchor weight</strong></td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td><strong>Ø Anchor hole</strong></td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Tensile loading capacity (N) of probe rope at 20 °C</strong></td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td><strong>For aggressive liquids</strong></td>
<td>X</td>
<td>--</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
### Technical data: probe

#### Capacitance values of probe
- Basic capacitance: approx. 18 pF

#### Additional capacitance
- Mount the probe with a minimum distance of 50 mm from a conductive container wall:
  - Probe rod: approx. 1.3 pF/100 mm in air
  - Probe rope: approx. 1.0 pF/100 mm in air
- Fully insulated probe rod in water:
  - Approx. 38 pF/100 mm (16 mm rod)
  - Approx. 45 pF/100 mm (10 mm rod)
  - Approx. 50 pF/100 mm (22 mm rod)
- Insulated probe rope in water: approx. 19 pF/100 mm
- Rod probe with ground tube:
  - Insulated probe rod: in air approx. 6.4 pF/100 mm
  - Insulated probe rod: in water approx. 38 pF/100 mm (16 mm rod)
  - Insulated probe rod: in water approx. 45 pF/100 mm (10 mm rod)

#### Probe lengths for continuous measurement in conductive liquids
- Rod probe (range 0 to 2000 pF for ≤ 4000 mm)
- Rope probe < 6 m (range 0 to 2000 pF)
- Rope probe > 6 m (range 0 to 4000 pF)

### Weight

<table>
<thead>
<tr>
<th></th>
<th>Rope probe</th>
<th>Rope probe with clad Tri-Clamp</th>
<th>Rope probe with inactive length (uninsulated)</th>
<th>Rope probe with fully insulated inactive length</th>
</tr>
</thead>
<tbody>
<tr>
<td>For use in mounting nozzles</td>
<td>--</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>For conductive liquids &gt;100 μS/cm</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>For aggressive liquids</td>
<td>X</td>
<td></td>
<td>--</td>
<td>X</td>
</tr>
<tr>
<td>For high-viscosity liquids</td>
<td>--</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>For non-conductive liquids &lt;1 μS/cm</td>
<td>--</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In the event of condensate on tank ceiling</td>
<td>--</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*The Ø value of the inactive length depends on the process connection selected
Ø22: GDJ, GEJ, RDJ, REJ, TCJ, TJ; Flansche: ASME B16.5; NPS ≤ 1½”, EN1092-1: ≤ DN40, JIS: ≤ 10K40
Ø43: GGJ, RGJ, TDJ, MRJ; Flansche: ASME B16.5; NPS ≥ 2”, EN1092-1: ≥ DN50, JIS: ≥ 10K50
** Probe tube
**Material**

Material specifications as per AISI and DIN-EN.

**In contact with the process**

- Probe rod, ground tube, inactive length, tensioning weight for rope probe: 316L (1.4435)
- Probe rope: 316 (1.4401)
- Probe rod insulation
  - If PFA selected: PFA (FDA 21 CFR 177.1550)
  - If FEP selected: FEP, PTFE and PFA (FDA 21 CFR 177.1550)
- Probe rope insulation
  - If PFA selected: PFA (FDA 21 CFR 177.1550)
  - If FEP selected: FEP, PTFE and PFA (FDA 21 CFR 177.1550)
- Process connection: 316L (1.4435 or 1.4404)
- Flat seal for process connection G 4/₈ or G 1: elastomer fiber, asbestos-free
- Sealing ring for process connection G 4/₈, G ¾, G 1, G 1½: Elastomer fiber, asbestos-free, resistant to lubricants, solvents, steam, weak acids and alkalis; to 300 °C and to 100 bar

**Not in contact with the process**

- Ground terminals on housing (exterior): 304 (1.4301)
- Nameplate on housing (exterior): 304 (1.4301)
- Cable glands
  - Housing F13, F15, F16, F17, F27: polyamide (PA)
  - Housing T13: nickel-plated brass
  - Housing F16: PBT-FR with cover made of PBT-FR or with sight glass made of PA12,
    - Cover seal: EPDM
    - Adhesive nameplate: polyester foil (PET)
    - Pressure compensation filter: PBT-GF20
- Stainless steel housing F15: 316L (1.4404)
  - Cover seal: silicone
  - Cover clamp: 304 (1.4301)
  - Pressure compensation filter: PBT-GF20, PA
- Aluminum housing F17/F13/T13: EN-AC-AlSi10Mg, plastic-coated,
  - Cover seal: EPDM
  - Cover clamp: nickel-plated brass
  - Pressure compensation filter: silicone (not T13)
- Stainless steel housing F27: 316L (1.4435)
  - Cover seal: FVMQ (optional: EPDM seal available as spare part)
  - Cover clamp: 316L (1.4435)
Input

Measured variable
Continuous measurement of change in capacitance between probe rod and container wall or ground tube, depending on the level of a liquid.

Probe covered => high capacitance
Probe not covered => low capacitance

Measuring range
- Measuring frequency: 500 kHz
- Span: $\Delta C = 25$ to 4000 pF recommended (2 to 4000 pF possible)
- Final capacitance: $C_e = \text{max. } 4000$ pF
- Adjustable initial capacitance:
  - $C_A = 0$ to 2000 pF (<6 m probe length)
  - $C_A = 0$ to 4000 pF (>6 m probe length)

Measuring condition
- Measuring range L1 possible from the tip of the probe to the process connection.
- Particularly suited for small containers.

Output

Output signal
FEI50H (4 to 20mA/HART Version 5.0)
3.8 to 20.5 mA with HART protocol

FEI57C (PFM)
The transmitter superimposes current pulses (PFM signal 60 to 2800 Hz) with a pulse width of approx. 100 $\mu$s and a current strength of approx. 8 mA on the supply current (approx. 8 mA).

Signal on alarm
FEI50H
Fault diagnosis can be called up as follows:
- Via the local display: Red LED
- Via the local display showing:
  - Error symbol
  - Plain text display
- Via the current output: 22 mA (in accordance with NE43)
- Via the digital interface (HART status error message)

FEI57C
Fault diagnosis can be called up as follows:
- Via the local display: Red LED
- Local display at switching unit
**Linearization**

**FEI50H**

The Liquicap M linearization function enables conversion of the measured value into any desired length or volume units. Linearization tables for volume calculation of horizontal cylindrical tanks and spherical tanks are pre-programmed. Any other tables with up to 32 value pairs can be input manually or semi-automatically.

**FEI57C**

With FEI57C, linearization takes place in the switching units.

---

**Power supply**

**Electrical connection**

**Connection compartment**

Six housings with the following protection classes are available:

<table>
<thead>
<tr>
<th>Housing</th>
<th>Standard</th>
<th>Ex ia</th>
<th>Ex d</th>
<th>Gas-tight process seal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester housing F16</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stainless steel housing F15</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Aluminum housing F17</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Aluminum housing F13</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stainless steel housing F27</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aluminum housing T13 (with separate connection compartment)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**M12 connector**

For the version with an M12 connector, the housing does not have to be opened to connect the signal line.

**PIN assignment for M12 connector**

<table>
<thead>
<tr>
<th>PIN</th>
<th>2-wire electronic inserts: FEI50H, FEI57C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Not assigned</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
</tr>
</tbody>
</table>
Terminal assignment

2-wire, 4 to 20 mA with HART
The twin-core connecting cable is connected to the screw terminals (conductor cross-section 0.5 to 2.5 mm) in the connection compartment at the electronic insert. If the superimposed communication signal (HART) is used, a shielded cable must be used and the shielding connected at the sensor and power supply. Protective circuits against reverse polarity, HF-influences and overvoltage peaks are integrated (see TI00241F ’EMC test procedures’).

2-wire, PFM
The twin-core, shielded connecting cable with a cable resistance of max. 25 Ω per core is connected to the screw terminals (conductor cross-section 0.5 to 2.5 mm) in the connection compartment. The shielding must be connected at the sensor and power supply. Protective circuits against reverse polarity, HF-influences and overvoltage peaks are integrated (see TI00241F ’EMC test procedures’).

Supply voltage

All of the following voltages are terminal voltages directly at the device:

FEI50H:
- 12.0 to 36 VDC (in the non-hazardous area)
- 12.0 to 30 VDC (in hazardous areas EEx ia)
- 14.4 to 30 VDC (in hazardous areas EEx d)

FEI57C:
14.8 VDC from associated supply unit.

Note!
Both electronic inserts have integrated reverse polarity protection.

Cable entry

- Cable gland: M20x1.5 (for EEx d only cable entry)
  Two cable glands are included in scope of delivery.
- Cable entry: G ½ or ½ NPT

Power consumption

FEI50H
Min. 40 mW, max. 800 mW
FEI57C
Max. 250 mW

Current consumption

FEI50H (4 to 20 mA/HART)
- Current consumption: 3.8 to 22 mA
- HART multidrop operation: 4 mA
- Residual ripple HART: 47 to 125 Hz; Uss = 200 mV (with 500 Ω)
- Noise HART (FEI50H): 500 Hz to 10 kHz; Ueff <2.2 mV (with 500 Ω)

FEI57C

![Graph showing current consumption](image)

Frequency: 60 to 2800 Hz

Performance characteristics

Reference operating conditions
- Room temperature: +20 °C ±5 °C
  - Span: ΔC = 25 to 4000 pF recommended (2 to 4000 pF possible)

Maximum measured error
- Non-repeatability (reproducibility) as per DIN 61298-2: max. ±0.1 %
- Non-linearity for limit point setting (linearity) as per DIN 61298-2: max. ±0.5 %

Influence of ambient temperature
Electronic insert
<0.06 % / 10 K related to the full scale value

Separate housing
Change in capacitance of connecting cable 0.015 pF/m per K

Influence of process pressure
In the case of fully insulated probes in conductive liquids: <10.0 % related to the full scale value

Switch-on behavior
FEI50H
14 s (stable measured value after switch-on procedure). Start-up in safe state (22 mA).

FEI57C
1.5 s (stable measured value after switch-on procedure). Start-up in safe state (22 mA).

Measured value reaction time
FEI50H
\[ t_1 \leq 0.3 \, \text{s} \]
\[ t_1 \leq 0.5 \, \text{s} \] for operating mode SIL

FEI57C
\[ t_1 = 0.3 \, \text{s} \]
Note!
Observe integration time of switching unit

[Diagram showing measurement times]

\[ \tau = \text{Integration time} \]
\[ t_1 = \text{Dead time} \]
Integration time

**FEI50H**

\[ \tau = 1 \text{ s (factory setting)} \]

0 to 60 s can be set.

The integration time affects the speed at which the display and the current output react to changes in the level.

### Accuracy of factory adjustment

<table>
<thead>
<tr>
<th></th>
<th>Probe length &lt;2 m</th>
<th>Probe length &gt;2 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty adjustment (0 %)</td>
<td>( \leq 5 \text{ mm} )</td>
<td>Approx. 2 %</td>
</tr>
<tr>
<td>Full adjustment (100 %)</td>
<td>( \leq 5 \text{ mm} )</td>
<td>Approx. 2 %</td>
</tr>
</tbody>
</table>

Medium conductivity \( \geq 100 \mu\text{S/cm} \)

Minimum distance to container wall = 250 mm

Note!

In an installed state, readjustment is only necessary if:

- The 0 % or the 100 % value have to be adjusted specifically for the customer.
- The liquid is not conductive.
- The distance from probe to tank wall is <250 mm

Resolution

**FEI50H**

- Analog in % (4 to 20 mA)
  - FMI51, FMI52: 11 bit/2048 steps, 8 \( \mu \text{A} \)
  - The resolution of the electronics can be directly converted to units of length of the probe FMI51 or FMI52. e.g. active probe rod 1000 mm
    
    Resolution = \( \frac{1000 \text{ mm}}{2048} = 0.48 \text{ mm} \)

**FEI57C**

- Zero frequency \( f_0 \) 60 Hz:
  - Sensitivity of the electronic insert = 0.685 Hz/pF
  - Entry in switching unit FMC671 under V3H5 and V3H6 or V7H5 and V7H6
**Human interface**

**Electronic inserts**

**FEI50H**
- Green LED ( Operational status )
- Red LED ( Fault message )
- Key (-)
- Key (+)
- Mode switch
  - 1: Operation
  - 2: Empty adjustment
  - 3: Full adjustment
  - 4: Measuring modes (buildup)
  - 5: Measuring range
  - 6: Self-test
  - 7: Reset (factory settings)
  - 8: Upload sensor EEPROM
- 4 to 20 mA current pick-off, e.g. for full/empty adjustment with multimeter.
- Display connection

**FEI57C**
- Green LED ( Operational status )
- Red LED ( Fault message )
- DIP switch, buildup (YES/NO)
- DIP switch, probe length ( probe length >6 m/ ≤6 m )

**Local operation with display**

The optional display can be used to configure via 3 keys directly at the device. All device functions can be set via menu operation. The menu consists of function groups and functions. Application parameters can be read or set in the functions.

The menu guidance with integrated help texts ensures quick and safe commissioning. For accessing the display, the cover of the electronics compartment can also be opened in hazardous areas (EEEx ia).
Remote operation with handheld terminal

The handheld terminals FieldXpert or Field Communicator DXR375/475 can be used to set all device functions via menu operation.
Remote operation via FieldCare Device Setup

FieldCare is a graphic operating program and is used to support commissioning, data backup, signal analysis and documentation of the devices. The following operating systems are supported: Windows 2000, Windows XP, Windows Vista and Windows 7.

FieldCare supports the following functions:
- Configuration of transmitters in online operation
- Tank linearization
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Menu guided commissioning

Connection options

- HART with Commubox FXA195

Note!
The latest version of FieldCare is available at: www.de.endress.com ® Search for: FieldCare.
## Certificates and approvals

### CE mark

The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

### RoHS

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

### RCM-Tick marking

The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM-Tick marking on the name plate.

### Ex approval

- ATEX
- IECEx
- CSA
- FM
- NEPSI
- INMETRO
- EAC

See 'Ordering information' from → 33

### EAC conformity

The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.

### Other standards and guidelines

<table>
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<tr>
<th>Standard</th>
<th>Description</th>
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<tr>
<td>EN 60529</td>
<td>Degrees of protection by housing (IP code)</td>
</tr>
<tr>
<td>EN 61010</td>
<td>Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures</td>
</tr>
<tr>
<td>EN 61326</td>
<td>Interference emission (Class B equipment), interference immunity (Annex A - Industrial)</td>
</tr>
<tr>
<td>NAMUR</td>
<td>Association for Standards for Control and Regulation in the Chemical Industry</td>
</tr>
<tr>
<td>IEC 61508</td>
<td>Functional safety</td>
</tr>
</tbody>
</table>

### CRN approval

Versions with a CRN approval (Canadian Registration Number) are listed in the corresponding registration documents. CRN-approved devices are labeled with registration number CRN 0F1988.7C on the nameplate. You can find further details on the maximum pressure values in the Download Area of the Endress+Hauser website.

### Additional approvals

- See also Certificates → 34
- TSE Certificate of Suitability (FMI51)
  - The following applies to wetted device components:
    - They do not contain any materials derived from animals.
    - No additives or operating materials derived from animals are used in production or processing.
  
  Note!
  The wetted device components are listed in the "Mechanical construction" (→ 15 ff) and "Ordering information" (→ 33) sections.
- AD2000
  The wetted material (316L) corresponds to AD2000 – W0/W2
Druckgeräterichtlinie 2014/68/EU (DGRL)

Pressure equipment with allowable pressure $\leq 200$ bar (2900 psi)
Pressure instruments with a flange and threaded boss that do not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure.

Reasons:
According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings". If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.

Ordering information

Ordering information
Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser web site: www.endress.com → Choose your country → Products → Select measuring technology, software or components → Select product (picklists: measurement method, product family etc.) → Device support (right-hand column): Configure the selected product → The Product Configurator for the selected product is opened.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Protective cover
For F13, F17 and F27 housing (without display)
Order number: 71040497

For F16 housing
Order number: 71127760

Shortening kit for FMI52
Once the rope is shortened, the device loses its hygiene approval: EHEDG, 3A.
Order number: 942901-0001

Commubox FXA195 HART
For intrinsically safe HART communication with FieldCare via a USB port.

Overvoltage protection HAW56x
Surge arrester for limiting overvoltage in signal lines and components.

Note!
For detailed information about overvoltage protection please refer to the following documents:
- TI01012K: HAW562 Overvoltage protective for installation on housing M20x1,5
- TI01013K: HAW569 Overvoltage protective for installation on housing in cabinet

Weld-in adapter
All the weld-in adapters available are described in the document TI00426F.
This is available in the Download Area of the Endress+Hauser web site: www.endress.com → Download
Documentation

Note!
The following document types are also available in the Download Area of the Endress+Hauser web site: www.endress.com → Download

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<tr>
<th>Technical Information</th>
<th>Operating Instructions</th>
<th>Certificates</th>
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<td>- Fieldgate FXA320, FXA520 TI00369F/00/EN</td>
<td>- Liquicap M FMI51, FMI52 (PFM) BA00297F/00/en</td>
<td>- ATEX safety instructions</td>
</tr>
<tr>
<td></td>
<td>- Liquicap M FMI51, FMI52 (HART) BA00298F/00/en</td>
<td>- Liquicap M FMI51, FMI52</td>
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<tr>
<td></td>
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<td>ATEX II 1/2 G Ex ia IIC/IIB T3...T6, II 1/2 D IP65 T90 °C XA00327F/00/A3</td>
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<tr>
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<td>ATEX II 1/2 G Ex d [ia] IIC/IIB T3...T6, Ex de [ia Ga] IIC/IIB T3...T6 Ga/Gb, Ex iaD 20 Txx°C/Ex tD A21 IP6x Txx°C XA00328F/00/A3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liquicap M FMI51, FMI52 Ga/Gb Ex ia IIC T6...T3; Ex ia D 20 / Ex tD A21 IP65 T90°C XA00423F/00/A3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liquicap M FMI51, FMI52 II 3 G Ex nA/nC IIC T6; Ex tc IIIC T100 °C Da/Db IP65 XA00346F/00/A3</td>
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<tr>
<td></td>
<td></td>
<td>INMETRO safety instructions</td>
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<tr>
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<td></td>
<td>- Liquicap M FMI51, FMI52 Ex d [ia Ga] IIC/IIB T3...T6 Ga/Gb; Ex de [ia Ga] IIC T3...T6 Ga/Gb XA00417F/00/A3</td>
</tr>
<tr>
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<td>- Liquicap M FMI51, FMI52 Ex ia IIC/IIB T3...T6 Ga/Gb; Ex ia IIC T90°C Da/Db IP65 XA01172F/00/A3</td>
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<tr>
<td></td>
<td></td>
<td>NEPSI safety instructions</td>
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<td></td>
<td></td>
<td>- Liquicap M FMI51, FMI52 Ex ia IIC/IIB T3...T6 Ga/Gb XA00417F/00/A3</td>
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<tr>
<td></td>
<td></td>
<td>- Liquicap M FMI51, FMI52 Ex d [ia] IIC/IIB T3/T4/T6 Ga/Gb, Ex de ia IIC/IIB T3/T4/T6 XA00418F/00/A3</td>
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<tr>
<td></td>
<td></td>
<td>- Liquicap M FMI51, FMI52 Ex nA IIC T3...T6 Gc, Ex nC IIC T3...T6 Gc XA00430F/00/A3</td>
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<tr>
<td></td>
<td></td>
<td>Overfill protection DIBt (WHG)</td>
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<tr>
<td></td>
<td></td>
<td>- Liquicap M FMI51, FMI52 ZE00265F/00/de</td>
</tr>
<tr>
<td>Functional safety (SIL2)</td>
<td></td>
<td>- Liquicap M FMI51, FMI52 SD00198F/00/en</td>
</tr>
</tbody>
</table>
Control Drawings (CSA and FM)

- Liquicap M FMI51, FMI52
  FM IS
  ZD00220F/00/en

- Liquicap M FMI51, FMI52
  CSA IS
  ZD00221F/00/en

- Liquicap M FMI51, FMI52
  CSA XP
  ZD00233F/00/en