Operating Instructions
Liquipoint FTW33
Conductive and capacitance point level measurement
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1  About this document

1.1  Document function
These Operating Instructions provide all of the information that is required in various phases of the life cycle of the device including:
- Product identification
- Incoming acceptance
- Storage
- Installation
- Connection
- Operation
- Commissioning
- Troubleshooting
- Maintenance
- Disposal

1.2  Symbols used

1.2.1  Safety symbols

⚠️ CAUTION
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

⚠️ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠️ NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

⚠️ WARNING
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

1.2.2  Tool symbols

🔧 Open-ended wrench

1.2.3  Symbols for certain types of information and graphics

🟢 Permitted
Procedures, processes or actions that are permitted

✅Preferred
Procedures, processes or actions that are preferred

❌Forbidden
Procedures, processes or actions that are forbidden
1.3  Documentation

The following documentation types are available in the Downloads area of the Endress + Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
- W@M Device Viewer (www.endress.com/deviceviewer): Enter the serial number from nameplate
- Endress+Hauser Operations App: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

1.3.1  Technical Information (TI)

Planning aid
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.

1.3.2  Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.3.3  Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.
1.4 Registered trademarks

Io-Link®

Is a registered trademark. It may only be used in conjunction with products and services by members of the IO-Link Community or by non-members who hold an appropriate license. For more detailed information on the use of IO-Link, please refer to the rules of the IO-Link Community at: www.io.link.com.
2 Basic safety instructions

2.1 Requirements for the personnel
The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

‣ Trained, qualified specialists must have a relevant qualification for this specific function and task.
‣ Are authorized by the plant owner/operator.
‣ Are familiar with federal/national regulations.
‣ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
‣ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

‣ Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
‣ Follow the instructions in this manual.

2.2 Designated use

Application and media
The device described in these instructions may only be used as a point level switch for liquids and foams.

To ensure that the measuring device remains in proper condition for the operating time:

‣ Use the device only for media to which the process-wetted materials are sufficiently resistant.
‣ Observe the limit values in "Technical data".

Incorrect use
The manufacturer is not liable for damage caused by improper or non-designated use.

Verification for borderline cases:

‣ For special fluids and media used for cleaning, the manufacturer is happy to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but disclaims any warranty or liability.

Residual risks
Due to heat transfer from the process as well as power dissipation within the electronics, the temperature of the electronics housing and the assemblies contained therein may rise to 80 °C (176 °F) during operation. When in operation, the sensor may reach a temperature close to the medium temperature.

Danger of burns from contact with surfaces!

‣ In the event of elevated fluid temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

‣ Wear the required personal protective equipment according to federal/national regulations.

For welding work on the piping:

‣ Do not ground the welding unit via the device.
If working on and with the device with wet hands:
- Due to the increased risk of electric shock, gloves must be worn.

### 2.4 Operational safety

**Risk of injury.**
- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

**Conversions to the device**

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
- If, despite this, modifications are required, consult with the manufacturer.

**Repair**

To ensure continued operational safety and reliability,
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to repair of an electrical device.
- Use original spare parts and accessories from the manufacturer only.

**Hazardous area**

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

### 2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.
3  Product description

Compact point level switch for liquids and pastes; to be used preferably in pipes and in storage, mixing and process vessels with or without an agitator for flush-mounted installation.

3.1  Product design

1. M12 plug
2. Plastic housing cover IP65/67
3. Metal housing cover IP66/68/69
4. Housing
5. Process connection
6. Sensor
4  Incoming acceptance and product identification

4.1  Incoming acceptance
Check the following during incoming acceptance:
❑ Are the order codes on the delivery note and the product sticker identical?
❑ Are the goods undamaged?
❑ Do the nameplate data match the ordering information on the delivery note?
❑ If required (see nameplate): Are the safety instructions (XA) provided?

If one of these conditions is not met, please contact the manufacturer's sales office.

4.2  Product identification
The following options are available for the identification of the measuring device:
 Nameplate specifications
 Extended order code with breakdown of the device features on the delivery note

➤ Enter the serial number from the nameplates into W@M Device Viewer (www.endress.com/deviceviewer)
  ➤ All the information about the measuring device and the scope of the associated Technical Documentation are displayed.

➤ Enter the serial number from the nameplate into the Endress+Hauser Operations App or use the Endress+Hauser Operations App to scan the 2-D matrix code (QR Code) provided on the nameplate
  ➤ All the information about the measuring device and the scope of the associated Technical Documentation are displayed.

4.3  Manufacturer address
Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany
Address of the manufacturing plant: See nameplate.
4.4  Nameplate

1  Device name
2  Manufacturer address
3  Order code
4  Serial number
5  Marking for test magnet
6  Extended order code
7  Supply voltage
8  Signal output
9  Ambient temperature range
10 Process pressure
11 Certificate symbols, communication mode (optional)
12 Degree of protection: e.g. IP, NEMA
13 Certificate and approval relevant data
14 Measuring point identification (optional)
15 Manufacturing date: year-month
16 2-D matrix code (QR code)
17 Document number of Operating Instructions

4.5  Storage, Transport

4.5.1  Storage conditions

- Permitted storage temperature: –40 to +85 °C (−40 to +185 °F)
- Use original packaging.

4.5.2  Transporting the product to the measuring point

Transport the device to the measuring point in the original packaging.
5  Installation

5.1  Installation conditions

5.1.1  Mounting location
Installation is possible in any position in a vessel, pipe or tank.

2  Installation examples
1  Overfill prevention or upper level detection (maximum safety)
2  Dry running protection for pump (minimum safety)
3  Lower level detection (minimum safety)

5.1.2  Installation in pipes

3  Mounting position in horizontal pipes

4  The measurement can be impaired if the sensor is partially covered or if air bubbles occur at the sensor.
5.1.3 Special mounting instructions

- Protect housing against impact.
- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- In the IP69 version, only remove the protection cap from the M12 plug shortly before establishing the electrical connection.

5.2 Installing the device

5.2.1 Required tools

Open-ended wrench or, for measuring points that are difficult to access, a hexagon tubular socket wrench 32 mm ¹)

- When screwing in, turn by the hex bolt only.
- Torque: 15 to 30 Nm (11 to 22 lbf ft).

5.2.2 Installation

| A | Thread G ½" |
| B | Thread G ¾"/G 1" |
| C | Thread M24 × 1.5 |

5.3 Post-installation check

- Is the device undamaged (visual inspection)?
- Does the device comply with the measuring point specifications?
  - Process temperature
  - Process pressure
  - Ambient temperature range
  - Measuring range

¹) Can be ordered as an optional accessory
☐ Are the measuring point identification and labeling correct (visual inspection)?
☐ Is the device adequately protected against precipitation and direct sunlight?
☐ Is the device adequately protected against impact?
☐ Are all mounting and safety screws securely tightened?
☐ Is the device properly secured?
6 Electrical connection

6.1 Connection conditions

The measuring device has two modes of operation:

- **Maximum point level detection (MAX):** e.g. for overfill prevention. The device keeps the electrical switch closed as long as the sensor is not yet covered by liquid or the measured value is within the process window.
- **Minimum point level detection (MIN):** e.g. to protect pumps from dry running. The device keeps the electrical switch closed as long as the sensor is covered by liquid or the measured value is outside the process window.

Choosing the "MAX"/"MIN" mode of operation ensures that the device switches in a safe manner even in the event of an alarm condition, e.g. if the power supply line is disconnected. The electronic switch opens if the point level is reached, if a fault occurs or if the power fails (quiescent current principle).

- **IO-Link:** Communication on pin 4; switch mode on pin 2.
- **SIO mode:** If there is no communication, the device switches to the SIO mode = standard IO mode.

The functions configured in the factory for the MAX and MIN modes can be changed via IO-Link:

- HNO/HNC hysteresis

6.2 Supply voltage

- **SIO mode**
  10 to 30 VDC

- **IO-Link mode**
  18 to 30 VDC

IO-Link communication is guaranteed only if the supply voltage is at least 18 V.

6.3 Connecting the device

**WARNING**
Risk of injury from the uncontrolled activation of processes!

- Switch off the supply voltage before connecting the device.
- Make sure that downstream processes are not started unintentionally.

**WARNING**
Electrical safety is compromised by an incorrect connection!

- In accordance with IEC/EN61010 a separate circuit breaker must be provided for the device.
- Voltage source: Non-hazardous contact voltage or Class 2 circuit (North America).
- The device must be operated with a fine-wire fuse 500 mA (slow-blow).
- Protective circuits against reverse polarity are integrated.
Pin 1  Supply voltage +
Pin 2  2nd switch output
Pin 3  Supply voltage -
Pin 4  IO-Link communication or 1st switch output (SIO mode)

6.3.1  SIO mode (without IO-Link communication)

<table>
<thead>
<tr>
<th>Minimum safety</th>
<th>Terminal assignment</th>
<th>MIN output</th>
<th>LED yellow (ye) 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="Diagram1.png" alt="Diagram" /></td>
<td>![Diagram2.png]</td>
<td>![Diagram3.png]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum safety</th>
<th>Terminal assignment</th>
<th>MAX output</th>
<th>LED yellow (ye) 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="Diagram1.png" alt="Diagram" /></td>
<td>![Diagram2.png]</td>
<td>![Diagram3.png]</td>
</tr>
</tbody>
</table>

Function monitoring

When both outputs are connected, the MIN and MAX outputs assume opposite states (XOR) when the device is operating fault-free. In the event of an alarm condition or a cable break, both outputs are de-energized. This means that function monitoring is possible in addition to level monitoring. The behavior of the switch outputs can be configured via IO-Link.

<table>
<thead>
<tr>
<th>Connection for function monitoring using XOR operation</th>
<th>Terminal assignment</th>
<th>MAX output</th>
<th>LED yellow (ye) 2</th>
<th>MIN output</th>
<th>LED yellow (ye) 1</th>
<th>LED red (rd)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Diagram1.png" alt="Diagram" /></td>
<td>![Diagram2.png]</td>
<td>![Diagram3.png]</td>
<td>![Diagram4.png]</td>
<td>![Diagram5.png]</td>
<td>![Diagram6.png]</td>
<td>![Diagram7.png]</td>
</tr>
</tbody>
</table>
### 6.4 Post-connection check

- Are the device and cable undamaged (visual inspection)?
- Does the supply voltage match the specifications on the nameplate?
- If supply voltage is present, is the green LED lit?
- With IO-Link communication: is the green LED flashing?
7 Operation options

7.1 Local operation

7.1.1 Operational display (LEDs)

![LEDs in the housing cover](image)

1 Status/Communication
2 Switch status/switch output 2
3 Warning/Maintenance required
4 Switch status/switch output 1

There is no external signaling via LEDs on the metal housing cover (IP69). A connecting cable with an M12 plug and LED indicator can be ordered as an accessory if necessary. See "Accessories".

7.2 Operation via test magnet

The test magnet is included in the scope of delivery.

A switch output function test can be carried out directly at the machine by means of a test magnet.

7.3 Operation via IO-Link operating menu

7.3.1 IO-Link information

IO-Link is a point-to-point connection for communication between the device and an IO-Link master. This requires an IO-Link compatible module (IO-Link master) for operation. The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the device while in operation.

Physical layer, the devices supports the following features:
- IO-Link specification: version 1.1
- IO-Link Smart Sensor Profile 2nd Edition
- SIO mode: Yes
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: TBD
- Process data width: 16 bit
- IO-Link data storage: Yes
- Block configuration: Yes
- Device operational: The device is operational 4 s after the supply voltage has been applied
7.3.2  IO-Link download

http://www.endress.com/download

- Select 'Software' as the media type.
- Select 'Device Driver' as the software type.
  Select IO-Link (IODD).
- In the 'Text Search' field enter the device name.
8  Overview of the operating menu

The menu structure has been implemented according to VDMA 24574-1 and complemented by Endress+Hauser-specific menu items.

<table>
<thead>
<tr>
<th>IO-Link</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>Serial number</td>
<td>Firmware version</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extended Ordercode</td>
<td>ProductName</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductText</td>
<td>Capacitance point level switch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VendorName</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VendorText</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hardware Revision</td>
<td>ENP_VERSION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Application Specific Tag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Actual Diagnostics (STA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Last Diagnostic (LST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulation Switch Output (OU1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulation Switch Output (OU2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device search</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensor check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Application</td>
<td>Active switchpoints</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reset user switchpoints</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calibrate coverage, Output 1/2 (OU1/OU2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch point value, Output 1/2 (SP1/SP2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switchback point value, Output 1/2 (rP1/rP2) (Coverage)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switching delay time, Output 1/2 (dS1/dS2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switchback delay time, Output 1/2 (dR1/dS2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output 1/2 (OU1/OU2)</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>Operating hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>μC-temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unit changeover (UNI) · μC-temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum μC-temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum μC-temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reset μC-temperatures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reset to factory settings (RES)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Access Locks.Data Storage Lock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation</td>
<td>Coverage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switch State Output 1 (OU1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switch State Output 2 (OU2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9 System integration

9.1 Process data

The device has two switch outputs. Both outputs are transmitted as process data via IO-Link:
- In the SIO mode, switch output 1 is switched at pin 4 of the M12 plug. In the IO-Link communication mode, this pin is reserved exclusively for communication.
- In addition, switch output 2 is always switched at pin 2 of the M12 plug.
- The process data of the point level switch are transmitted cyclically in 16-bit chunks.

<table>
<thead>
<tr>
<th>Bit</th>
<th>0 (LSB)</th>
<th>1</th>
<th>...</th>
<th>12</th>
<th>13 (MSB)</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Coverage [0 to 100 %], resolution approx. 0.1 %</td>
<td>OU1</td>
<td>OU2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bit 14 reflects the status of switch output 1 and bit 15 the status of switch output 2. Here, the logical state "1" at the specific switch output corresponds to "closed" or 24 V\textsubscript{DC}.

The remaining 14 bits contain the value for the coverage [0 to 100 %] following conversion using the factor 0.1.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Process value</th>
<th>Value range</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>OU1</td>
<td>0 = open, 1 = closed</td>
</tr>
<tr>
<td>15</td>
<td>OU2</td>
<td>0 = open, 1 = closed</td>
</tr>
<tr>
<td>0 to 13</td>
<td>Coverage [0 to 100 %]</td>
<td>Integer</td>
</tr>
</tbody>
</table>

In addition, the coverage value can be read via ISDU (hex) 0x0028 – acyclic service.

9.2 Reading out and writing device data (ISDU – Indexed Service Data Unit)

Device data are always exchanged acyclically and at the request of the IO-Link master. Using the device data, the following parameter values or device statuses can be read out:

9.2.1 Endress+Hauser–specific device data
<table>
<thead>
<tr>
<th>Designation</th>
<th>ISDU (dec)</th>
<th>ISDU (hex)</th>
<th>Size (byte)</th>
<th>Data type</th>
<th>Access</th>
<th>Default value</th>
<th>Value range</th>
<th>Offset/Gradient</th>
<th>Data storage</th>
<th>Range limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation Switch output (OU2)</td>
<td>68</td>
<td>0x0044</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>Off</td>
<td>0 ~ Off</td>
<td>0/1</td>
<td>No</td>
<td>0 to 2</td>
</tr>
<tr>
<td>Device search</td>
<td>69</td>
<td>0x0045</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>Off</td>
<td>0 ~ Off, 1 ~ On</td>
<td>0/1</td>
<td>No</td>
<td>0 to 1</td>
</tr>
<tr>
<td>Sensor check</td>
<td>70</td>
<td>0x0046</td>
<td>1</td>
<td>UInt8</td>
<td>-/w</td>
<td>–</td>
<td>1 ~ Check</td>
<td>0/1</td>
<td>No</td>
<td>–</td>
</tr>
<tr>
<td>Active switchpoints</td>
<td>64</td>
<td>0x0040</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>Standard</td>
<td>0 ~ Standard, 1 ~ Extended, 3 ~ User</td>
<td>0/1</td>
<td>No</td>
<td>0 to 3</td>
</tr>
<tr>
<td>Reset user switchpoints (1/2)</td>
<td>65</td>
<td>0x0041</td>
<td>1</td>
<td>UInt16</td>
<td>r/w</td>
<td>False</td>
<td>0 ~ False, 1 ~ True</td>
<td>0/1</td>
<td>No</td>
<td>0 to 1</td>
</tr>
<tr>
<td>Switching delay time, Output 1 (dS1)</td>
<td>81</td>
<td>0x0051</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>0.5</td>
<td>0.3 to 60</td>
<td>0/0.1</td>
<td>Yes</td>
<td>0.3 to 60</td>
</tr>
<tr>
<td>Switching delay time, Output 2 (dS2)</td>
<td>83</td>
<td>0x0053</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>1</td>
<td>0.3 to 60</td>
<td>0/0.1</td>
<td>Yes</td>
<td>0.3 to 60</td>
</tr>
<tr>
<td>Switchback delay time, Output 1 (dR1)</td>
<td>82</td>
<td>0x0052</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>0.5</td>
<td>0.3 to 60</td>
<td>0/0.1</td>
<td>Yes</td>
<td>0.3 to 60</td>
</tr>
<tr>
<td>Switchback delay time, Output 2 (dR2)</td>
<td>84</td>
<td>0x0054</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>1</td>
<td>0.3 to 60</td>
<td>0/0.1</td>
<td>Yes</td>
<td>0.3 to 60</td>
</tr>
<tr>
<td>Switch point value Output 1 (SP1) 1)</td>
<td>71</td>
<td>0x0047</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>20</td>
<td>0/0.1</td>
<td>Yes</td>
<td>15 to 100</td>
<td></td>
</tr>
<tr>
<td>Switch point value Output 1 (SP1)</td>
<td>73</td>
<td>0x0049</td>
<td>2</td>
<td>UInt16</td>
<td>r/-</td>
<td>Standard: 23, Extended: 40</td>
<td>0 / 0.1</td>
<td>Yes</td>
<td>0 to 6553.5</td>
<td></td>
</tr>
<tr>
<td>Switch point value Output 2 (SP2) 1)</td>
<td>75</td>
<td>0x004B</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>20</td>
<td>0/0.1</td>
<td>Yes</td>
<td>15 to 100</td>
<td></td>
</tr>
<tr>
<td>Switch point value Output 2 (SP2)</td>
<td>78</td>
<td>0x004F</td>
<td>2</td>
<td>UInt16</td>
<td>r/-</td>
<td>Standard: 23, Extended: 40</td>
<td>0 / 0.1</td>
<td>Yes</td>
<td>0 to 6553.5</td>
<td></td>
</tr>
<tr>
<td>Switchback point value Output 1 (rP1) 1)</td>
<td>72</td>
<td>0x0048</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>18</td>
<td>0/0.1</td>
<td>Yes</td>
<td>15 to 100</td>
<td></td>
</tr>
<tr>
<td>Switchback point value Output 1 (rP1)</td>
<td>74</td>
<td>0x004A</td>
<td>2</td>
<td>UInt16</td>
<td>r/-</td>
<td>Standard: 21, Extended: 38</td>
<td>0 / 0.1</td>
<td>Yes</td>
<td>0 to 6553.5</td>
<td></td>
</tr>
<tr>
<td>Switchback point value Output 2 (rP2) 1)</td>
<td>76</td>
<td>0x004C</td>
<td>2</td>
<td>UInt16</td>
<td>r/w</td>
<td>18</td>
<td>0/0.1</td>
<td>Yes</td>
<td>15 to 100</td>
<td></td>
</tr>
<tr>
<td>Switchback point value Output 2 (rP2) 1)</td>
<td>79</td>
<td>0x004A</td>
<td>2</td>
<td>UInt16</td>
<td>r/-</td>
<td>Standard: 21, Extended: 38</td>
<td>0 / 0.1</td>
<td>Yes</td>
<td>0 to 6553.5</td>
<td></td>
</tr>
<tr>
<td>Output 1 (OU1)</td>
<td>101</td>
<td>0x0065</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>HNO</td>
<td>0 ~ HNO, 1 ~ HNC</td>
<td>Yes</td>
<td>0 to 1</td>
<td></td>
</tr>
<tr>
<td>Output 2 (OU2)</td>
<td>95</td>
<td>0x005F</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>HNC</td>
<td>0 ~ HNO, 1 ~ HNC</td>
<td>Yes</td>
<td>0 to 1</td>
<td></td>
</tr>
<tr>
<td>Operating hours</td>
<td>96</td>
<td>0x0060</td>
<td>4</td>
<td>UInt32</td>
<td>r/-</td>
<td>0</td>
<td>0/0.016667</td>
<td>No</td>
<td>0 to 2 ^32</td>
<td></td>
</tr>
<tr>
<td>µC-temperature</td>
<td>91</td>
<td>0x005B</td>
<td>1</td>
<td>Int8</td>
<td>r/-</td>
<td>°C: 0/1, °F: 32/1.8, K: 273.15/1</td>
<td>No</td>
<td>–128 to 127</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 9.2.2 IO-Link-specific device data

<table>
<thead>
<tr>
<th>Designation</th>
<th>ISDU (dec)</th>
<th>ISDU (hex)</th>
<th>Size (byte)</th>
<th>Data type</th>
<th>Access</th>
<th>Default value</th>
<th>Value range</th>
<th>Offset/Gradient</th>
<th>Data storage</th>
<th>Range limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial number</td>
<td>21</td>
<td>0x0015</td>
<td>max. 16</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firmware version</td>
<td>23</td>
<td>0x0017</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ProductID</td>
<td>19</td>
<td>0x0013</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FTW33</td>
</tr>
<tr>
<td>ProductName</td>
<td>18</td>
<td>0x0012</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Capacitance point level switch</td>
</tr>
<tr>
<td>ProductText</td>
<td>20</td>
<td>0x0014</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Liquipoint</td>
</tr>
<tr>
<td>VendorName</td>
<td>16</td>
<td>0x0010</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Endress+Hauser</td>
</tr>
<tr>
<td>VendorID</td>
<td>7 to 8</td>
<td>0x0007 to 0x000B</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VendorText</td>
<td>17</td>
<td>0x0011</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>People for Process Automation</td>
</tr>
<tr>
<td>Device ID</td>
<td>9 to 11</td>
<td>0x0009 to 0x000B</td>
<td></td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0x000500</td>
</tr>
<tr>
<td>Hardware revision</td>
<td>22</td>
<td>0x0016</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Specific Tag</td>
<td>24</td>
<td>0x0018</td>
<td>32</td>
<td>String</td>
<td>r/w</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual Diagnostics (STA)</td>
<td>260</td>
<td>0x0104</td>
<td>4</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Last Diagnostic (LST)</td>
<td>261</td>
<td>0x0105</td>
<td>4</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

1) Only visible if active switchpoints = USER

Please refer to parameter description for explanation of abbreviations

### 9.2.3 System commands

<table>
<thead>
<tr>
<th>Designation</th>
<th>ISDU (dec)</th>
<th>ISDU (hex)</th>
<th>Value range</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset to factory settings (RES)</td>
<td>130</td>
<td>0x0082</td>
<td>0 ~ False</td>
<td>r/w</td>
</tr>
<tr>
<td>Device Access Locks.Data Storage Lock</td>
<td>12</td>
<td>0x000C</td>
<td>2 ~ True</td>
<td>r/w</td>
</tr>
</tbody>
</table>
10 Commissioning

10.1 Function check
Prior to commissioning, make sure that the post-installation and post-connection checks have been performed.

See:
- ‘Post-installation check’ checklist
- ‘Post-connection check’ checklist

10.2 Commissioning the local display

10.2.1 Light signals (LEDs)

Position of LEDs in housing cover

<table>
<thead>
<tr>
<th>Position</th>
<th>LED color</th>
<th>Description of function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>green (gn)</td>
<td>Status/Communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• lit: SIO mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• flashing: Active communication, flash frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• flashes with increased luminosity: Device search (device identification), flash frequency</td>
</tr>
<tr>
<td>2</td>
<td>yellow (ye)</td>
<td>Switch status/switch output 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lit: If the sensor is covered by medium</td>
</tr>
<tr>
<td>3</td>
<td>red (rd)</td>
<td>Warning/Maintenance required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>flashing: Error remediable, e.g. invalid calibration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fault/device failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lit: see Diagnostics and troubleshooting</td>
</tr>
<tr>
<td>4</td>
<td>yellow (ye)</td>
<td>Switch status/switch output 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lit: If the sensor is covered by medium</td>
</tr>
</tbody>
</table>

There is no external signaling via LEDs on the metal housing cover (IP69). A connecting cable with an M12 plug and LED indicator can be ordered as an accessory if necessary. See "Accessories".

10.2.2 Function of LEDs

Any configuration of the switch outputs is possible. The following table shows the behavior of the LEDs in the SIO mode:
LEDs on housing cover with M12 plug, IO-Link

<table>
<thead>
<tr>
<th>Operating modes</th>
<th>MAX</th>
<th>MIN</th>
<th>Warning</th>
<th>Fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>free</td>
<td>covered</td>
<td>free</td>
<td>covered</td>
</tr>
</tbody>
</table>

1: green (gn)
2: yellow (ye) 2
3: red (rd)
4: yellow (ye) 1

LEDs on M12 plug (signals status of switch outputs)

<table>
<thead>
<tr>
<th>Operating modes</th>
<th>MAX</th>
<th>MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>free</td>
<td>covered</td>
</tr>
</tbody>
</table>

1: green (gn)
2: yellow (ye) 2
3: yellow (ye) 1

10.3 Commissioning with an operating menu

If an existing configuration is changed, measuring operation continues! The new or modified entries are only accepted once the setting has been made.

Parameter changes are not accepted until after the parameters have been downloaded.

If using block configuration, parameter changes are accepted only after the parameters have been downloaded.

⚠️ WARNING
Risk of injury and damage to property due to uncontrolled activation of processes!
- Make sure that downstream processes are not started unintentionally.
IO-Link communication
- Commissioning with factory settings: The device is configured for use with water-based media. The device can be commissioned directly when used with water-based media.
  Factory setting: Output 1 and output 2 are configured for XOR operation.
- Commissioning with customer-specific settings: The device can be configured differently to the factory settings via IO-Link. Select User in the Active switchpoints parameter.
  - Each change must be confirmed with Enter to ensure that the value is accepted.
  - Incorrect switching is suppressed by adjusting the settings in the switching delay/switchback delay (Switching delay time/Switchback delay time parameters).

11 Operation

11.1 Customer-specific IO-Link settings

11.1.1 Hysteresis function, level detection

Wet calibration (required only for non-conductive media)

1. Navigate to the Application menu level
   - Configuration: Parameter → Application → Active switchpoints = User
2. Immerse the device in the medium to be detected
3. Adopt the \( \varepsilon_r \) of the process medium present.
   - Configuration: Parameter → Application → User Calibration → Get Calibration

1/2
   The switch limits can be adjusted accordingly

11.2 Advanced settings

11.2.1 Process fluid

For reliable point level detection, the device can be adapted to the process conditions in question.

The following settings can be made via IO-Link: Parameter → Application → Active switchpoints

- **Standard** preconfigured for:
  - Water- or alcohol-based media (\( \varepsilon_r \geq 10 \))
  - For example, water, milk and various dairy products, soft drinks, beer
- **Extended** preconfigured for:
  - Oil-based media (\( \varepsilon_r > 2.4 \))
  - For example: Oils, ketchup, mustard, mayonnaise, honey, nougat spread
- **User**: can be freely configured to customer medium:
  - Switch point value Output 1/2
  - Switchback point value Output 1/2
  - \( \varepsilon_r \)

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)
Adhesive and viscous media

<table>
<thead>
<tr>
<th>Setting</th>
<th>Light buildup</th>
<th>Heavy buildup</th>
<th>Surface drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>✔ ✔</td>
<td>✗</td>
<td>✔ ✔ ✔</td>
</tr>
<tr>
<td>Extended</td>
<td>✔ ✗ 1)</td>
<td>✔</td>
<td>✔ 1)</td>
</tr>
</tbody>
</table>

1) Surface drying or insulating, non-homogeneous layers can cause the sensor to signal "free" and should therefore be avoided or eliminated, particularly in maximum safety mode (overflow). The Standard setting is preferable in this type of application.

Media with foam formation

<table>
<thead>
<tr>
<th>Setting</th>
<th>Light buildup</th>
<th>Heavy buildup</th>
<th>Surface drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Sensor signal 'covered'</td>
<td>Sensor signal 'free' 1)</td>
<td></td>
</tr>
<tr>
<td>Extended</td>
<td>Sensor signal 'free'</td>
<td>Sensor signal 'free'</td>
<td></td>
</tr>
</tbody>
</table>

1) Very coarsely-pored foam cannot be detected by the sensor.

The device is delivered with the "Standard" setting. Optionally, it can be ordered with "Extended" as the default setting.

11.3 Switch output function test

⚠️ WARNING
Risk of injury!
- Ensure that no uncontrolled processes are activated in the system.

Carry out a function test while the device is in operation.

1. Hold the test magnet against the marking for approx. 2 seconds

2. Remove test magnet
   - Original status is adopted once again

3. Test magnet is held against the marking for longer than 30 seconds
   - Red LED flashing; original status is adopted once again
12 Diagnostics and troubleshooting

12.1 Troubleshooting

If an electronic/sensor defect is present, the device changes to error mode and displays the diagnostic event F270. The status of the process data is rendered invalid. The switch output(s) is/are opened.

**General errors**

<table>
<thead>
<tr>
<th>Error</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device does not respond</td>
<td>Supply voltage does not match the value indicated on the nameplate.</td>
<td>Apply correct voltage.</td>
</tr>
<tr>
<td></td>
<td>The polarity of the supply voltage is wrong.</td>
<td>Correct the polarity.</td>
</tr>
<tr>
<td></td>
<td>Connecting cables are not in contact with the terminals.</td>
<td>Check for electrical contact between cables and correct.</td>
</tr>
<tr>
<td>No communication</td>
<td>Communication cable not connected.</td>
<td>Check wiring and cables.</td>
</tr>
<tr>
<td></td>
<td>Communication cable incorrectly attached to device.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication cable incorrectly attached to the IO-Link master.</td>
<td></td>
</tr>
<tr>
<td>No transmission of process data</td>
<td>There is an error in the device.</td>
<td>Correct errors that are displayed as a diagnostic event.</td>
</tr>
</tbody>
</table>

12.2 Diagnostic information via LED indicator

**LED indicator on housing cover**

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Possible cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green LED not lit</td>
<td>No power supply</td>
<td>Check plug, cable and power supply.</td>
</tr>
</tbody>
</table>
| Red LED flashing | Overload or short-circuit in load circuit | • Clear the short-circuit.  
• Reduce maximum load current to below 200 mA if one switch output is active.  
• Maximum load current = 105 mA per output if both switch outputs are active. |
| | Ambient temperature outside of specification | Operate measuring device in specified temperature range. |
| | Test magnet held against marking for too long | Repeat function test. |
| Red LED lit | Internal sensor error | Replace device. |

12.3 Diagnostic events

12.3.1 Diagnostic message

Faults that are detected by the device's self-monitoring system are displayed as a diagnostic message via IO-Link.
**Status signals**

The overview of diagnostic events lists the messages that may occur. The Actual Diagnostic (STA) parameter displays the message with the highest priority. The device has four different status information codes according to NE107:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>“Failure” A device error has occurred. The measured value is no longer valid.</td>
</tr>
<tr>
<td>M</td>
<td>“Maintenance required” Maintenance is required. The measured value is still valid.</td>
</tr>
<tr>
<td>C</td>
<td>“Function check” The device is in the service mode (e.g. during a simulation).</td>
</tr>
</tbody>
</table>
| S      | “Out of specification” The device is being operated:  
|        | • Outside its technical specifications (e.g. during warm-up or cleaning process)  
|        | • Outside the parameter configuration undertaken by the user (e.g. level outside of configured span) |

**Diagnostics event and event text**

The fault can be identified by means of the diagnostic event.

<table>
<thead>
<tr>
<th>Diagnostic event</th>
<th>Status signal</th>
<th>Event number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example

<table>
<thead>
<tr>
<th>Status signal</th>
<th>Event number</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>469</td>
</tr>
</tbody>
</table>

If two or more diagnostic events are pending simultaneously, only the message with the highest priority is shown.

The last diagnostic message is displayed - see Last Diagnostic (LST) in the **Diagnosis** submenu.
12.3.2 Overview of diagnostic events

<table>
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<th>Diagnostic behavior</th>
<th>IO-Link EventQualifier</th>
<th>EventCode</th>
<th>Event text</th>
<th>Reason</th>
<th>Corrective measure</th>
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<td>F270</td>
<td>Fault</td>
<td>IO-Link Error</td>
<td>0x5000</td>
<td>Defect in electronics/sensor</td>
<td>Electronics/sensor defective</td>
<td>Replace device</td>
</tr>
<tr>
<td>S804</td>
<td>Warning</td>
<td>IO-Link Warning</td>
<td>0x1801</td>
<td>Load current &gt; 200 mA</td>
<td>Overload at switch output 2</td>
<td>Increase load resistance at switch output</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
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<td>Check output wiring</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Replace device</td>
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</tr>
<tr>
<td>C485</td>
<td>Warning</td>
<td>IO-Link Warning</td>
<td>0x8C01 1)</td>
<td>Simulation active</td>
<td>When the simulation of a switch output or current output is active, the device displays a warning.</td>
<td>Switch off simulation</td>
</tr>
<tr>
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</tr>
<tr>
<td>C182</td>
<td>Message</td>
<td>IO-Link Message</td>
<td>0x1807 2)</td>
<td>Invalid calibration</td>
<td>Sensor check failed</td>
<td>Switch off simulation</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<td>C103</td>
<td>Message</td>
<td>IO-Link Message</td>
<td>0x1813</td>
<td>Sensor check failed</td>
<td>Sensor check failed</td>
<td>Replace device</td>
</tr>
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<td>New calibration recommended and check switching behavior</td>
</tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>S825</td>
<td>Warning</td>
<td>IO-Link Warning</td>
<td>0x1812</td>
<td>Ambient temperature outside of specification</td>
<td>Ambient temperature outside of specification</td>
<td>Operate device in the specified temperature range</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

1) EventCode as per IO-Link standard 1.1

12.4 Behavior of the device in the event of a fault

The device displays warnings and faults via IO-Link. All the device warnings and faults are for information purposes only and do not have a safety function. The errors diagnosed by the device are displayed via IO-Link in accordance with NE107. Depending on the diagnostic message, the device behaves as per a warning or fault condition. A distinction must be made between the following types of error here:

- **Warning:**
  - The device continues measuring if this type of error occurs. The output signal is not affected (exception: simulation is active).
  - The switch output remains in the state defined by the switch points.

- **Fault:**
  - The device does **not** continue measuring if this type of error occurs. The output signal assumes its fault state (switch outputs de-energized).
  - The fault state is displayed via IO-Link.
  - The switch output changes to the "open" state.

12.5 Resetting to factory settings (reset)

Reset to factory settings (RES)
Navigation
Parameter → System → Reset to factory settings (RES)

Description

⚠️ WARNING
Confirming the "Standard Command" with "Reset to factory settings" causes an immediate reset to the factory settings of the order configuration.
If the factory settings have been changed, downstream processes might be affected following a reset (the behavior of the switch output or current output might be changed).
▷ Make sure that downstream processes are not started unintentionally.

The reset is not subject to additional locking, such as in the form of device locking. The reset also depends on the device status.
Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

The following parameters are not reset when a reset is performed:
- Minimum µC-temperature
- Maximum µC-temperature
- Last Diagnostic (LST)
- Operating hours

Note
The last error is not reset in a reset.
13  Maintenance
No special maintenance work is required.

13.1  Cleaning
The sensor must be cleaned if necessary. Cleaning can also be done while it is installed (e.g. CIP Cleaning in Place / SIP Sterilization in Place). Care must be taken to ensure that no damage occurs to the sensor in the process.

14  Repairs
Repair is not envisaged for this measuring device.

14.1  Return
The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:
   http://www.endress.com/support/return-material

2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

14.2  Disposal
When disposing, separate and recycle the device components based on the materials.
15 Description of Device Parameters

15.1 Identification

<table>
<thead>
<tr>
<th>Extended ordercode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Navigation</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
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<tr>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENP_VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Navigation</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application Specific Tag</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Navigation</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Factory setting</strong></td>
</tr>
</tbody>
</table>
## 15.2 Diagnosis

### Actual Diagnostics (STA)

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Diagnosis → Actual Diagnostics (STA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Displays the current device status.</td>
</tr>
</tbody>
</table>

### Last Diagnostic (LST)

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Diagnosis → Last Diagnostic (LST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Displays the latest device status (error or warning) that was rectified during operation.</td>
</tr>
</tbody>
</table>

### Simulation Switch Output 1 (OU1)

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Diagnosis → Simulation Switch Output 1 (OU1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>The simulation affects the process data only. It does not affect the physical switch output. If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in simulation mode. A warning is communicated via IO-Link (C485 - simulation active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and power is then resupplied, simulation mode is not resumed, and instead the device continues operation in measuring mode.</td>
</tr>
</tbody>
</table>
| Options | • OFF  
• OU1 = HIGH  
• OU1 = LOW |

### Simulation Switch Output 2 (OU2)

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Diagnosis → Simulation Switch Output 2 (OU2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>The simulation affects the process data and the physical switch output. If a simulation is active, a warning to this effect is displayed via IO-Link so that it is obvious to the user that the device is in simulation mode (C485 - simulation active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and power is then resupplied, simulation mode is not resumed, and instead the device continues operation in measuring mode.</td>
</tr>
</tbody>
</table>
| Options | • OFF  
• OU2 = HIGH  
• OU2 = LOW |
### Device search

**Navigation**
Diagnosis → Device search

**Description**
This parameter is used to uniquely identify the device during installation. The green LED is lit (= operational) on the device and starts to flash with increased luminosity, flash frequency .

**Note**
There is no external signaling via LEDs on the metal housing cover (IP69).

**Options**
- OFF
- ON

**Factory setting**
OFF

### Sensor check

**Navigation**
Diagnosis → Sensor check

**Description**
This parameter is used to test if the measuring point is functioning correctly. The sensor must not be covered and must be free of residue. The device compares the current measured values with the measured values from the factory calibration.

The device must be removed before the sensor check since the free value is influenced by the type of installation.

**Options**
Check: Following the test, one of the following messages is displayed:
- Message (0x1814) for sensor check passed
- Message C103 (0x1813) for sensor check failed
15.3 Parameter

15.3.1 Application

Active switchpoints

Navigation  Parameter → Application → Active switchpoints

Description  Choice between standard or customer-specific, user-definable switch points

Switch-on value  Last setting selected prior to switching off device

Options
- Standard
- Extended
- User

Factory setting  Standard

Switch point value, Output 1/2 (SP1/SP2)

Switchback point value, Output 1/2 (rP1/rP2)

Navigation
- Application → Output Switch 1/2 → Switch point value, Output 1/2 (SP1/SP2)
- Application → Output Switch 1/2 → Switchback point value, Output 1/2 (rP1/rP2)

Note
The switching sensitivity of the sensor is set using the SP1/rP1 or SP2/rP2 parameters. Since the parameter settings depend on one another, the parameters are described all together.
- SP1 = switch point 1
- SP2 = switch point 2
- rP1 = switchback point 1
- rP2 = switchback point 2

Description
The switching sensitivity of the sensor can be configured using the switch point and switchback point. The switch sensitivity can be adapted to the medium (depending on the DC value (dielectric constant) or conductivity of medium).
- Sensor switches if there is slight coverage = very sensitive.
- Sensor switches if there is heavy buildup = not sensitive.

The set value for the switch point SP1/SP2 must be greater than the switchback point rP1/rP2!
A diagnostic message is displayed if a switch point SP1/SP2 is entered that is ≤ switchback point rP1/rP2.
When the set switchback point rP1/rP2 is reached, an electrical signal change takes place again at the switch output (OU1/OU2). The difference between the value of the switch point SP1/SP2 and the value of the switchback point rP1/rP2 is known as the hysteresis.
Liquipoint FTW33

Description of Device Parameters

**Endress+Hauser**

---

**B Calibration (default)**

- **0**: signal, output open
- **1**: signal, output closed
- **A**: Hysteresis (difference between the value of the switch point SP1/SP2 and the value of the switchback point rP1/rP2)

- **%**: Coverage of sensor
- **HNO**: Normally open contact (MIN)
- **HNC**: Normally closed contact (MAX)
- **SP1**: Switch point 1/SP2: Switch point 2
- **rP1**: Switchback point 1/rP2: Switchback point 2

---

**Note**

The various points for the switching delay can be adjusted to ensure that rapid switching back and forth at the switch limits is suppressed.

**Switch-on value**

Last value selected prior to switching off.

**Options**

No selection. The user is free to edit the values.

**Input range**

15 to 100 %

---

**Switching delay time, Output 1/2 (dS1/dS2)**

**Switchback delay time, Output 1/2 (dR1/dR2)**

---

**Navigation**

Application → Output Switch 1/2 → Switching delay time, Output 1/2 (dS1/dS2)
Application → Output Switch 1/2 → Switchback delay time, Output 1/2 (dR1/dR2)

---

**Note**

The switching delay time/switchback delay time functions are implemented using the ‘dS1’/‘dS2’ and ‘dR1’/‘dR2’ parameters. Since the parameter settings depend on one another, the parameters are described all together.

- **dS1** = switching delay time, output 1
- **dS2** = switching delay time, output 2
- **dR1** = switchback delay time, output 1
- **dR2** = switchback delay time, output 2
Description

To prevent rapid switching back and forth when values are close to the switch point 'SP1'/'SP2' or switchback point 'rP1'/'rP2', a delay in the range of 0.3 to 60 seconds, to one decimal place, can be set for individual points.

If the measured value leaves the switching range during the delay time, the delay time starts again from scratch.

Switch on value

Last value selected prior to switching off.

Options

No selection. The user is free to edit the values.

Input range

0.3 to 60 s

Factory setting

0.5 s (Switching delay time dS1/dS2)
1.0 s (Switchback delay time dR1/dR2)

Output 1/2 (OU1/OU2)

Navigation

Application → Output Switch 1/2 → Output 1/2 (OU1/OU2)

Description

Hysteresis: Determining whether sensor is free or covered.

Switch on value

Last function selected prior to switching off.

Options

- Hysteresis normally open (MIN)
- Hysteresis normally closed (MAX)
### Factory setting
- Output 1 (OU1): HNO
- Output 2 (OU2): HNC

### 15.3.2 System

#### Operating hours

**Navigation**
- Parameter → System → Operating hours

**Description**
This parameter counts the operating hours in minutes during the period in which operating voltage is present.

#### µC-temperature

**Navigation**
- Parameter → System → µC-temperature

**Description**
This parameter displays the current µC-temperature on the electronics.

#### Unit changeover (UNI) - µC-temperature

**Navigation**
- Parameter → System → Unit changeover (UNI) - µC-temperature

**Description**
This parameter is used to select the electronics temperature unit. Once a new electronics temperature unit has been selected, the new unit is calculated and displayed.

**Switch on value**
Last unit selected prior to switching off.

**Options**
- °C
- °F
- K

**Factory setting**
°C

#### Minimum µC-temperature

**Navigation**
- Parameter → System → Minimum µC-temperature

**Description**
This parameter is used as the minimum peak indicator and makes it possible to call up retroactively the lowest electronics temperature measured. If the value of the peak indicator is overwritten, the value is automatically set to the temperature currently measured.

#### Maximum µC-temperature
Description of Device Parameters

**Liquipoint FTW33**

### Description

**Parameter → System → Maximum µC-temperature**

This parameter is used as the maximum peak indicator and makes it possible to call up retroactively the highest electronics temperature measured. If the value of the peak indicator is overwritten, the value is automatically set to the temperature currently measured.

### Reset to factory settings (RES)

**Parameter → System → Reset to factory settings (RES)**

**WARNING**

Confirming the "Standard Command" with "Reset to factory settings" causes an immediate reset to the factory settings of the order configuration.

If the factory settings have been changed, downstream processes might be affected following a reset (the behavior of the switch output or current output might be changed).

- Make sure that downstream processes are not started unintentionally.

The reset is not subject to additional locking, such as in the form of device locking. The reset also depends on the device status.

Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

The following parameters are **not** reset when a reset is performed:

- Minimum µC-temperature
- Maximum µC-temperature
- Last Diagnostic (LST)
- Operating hours

**Note**

The last error is not reset in a reset.

### Device Access Locks.Data Storage Lock

**Activation/deactivation of DataStorage**

1) The 'Device Access Locks.Data Storage Lock' parameter is an IO-Link standard parameter. The name of the parameter may exist in the configured language in the IO-Link operating tool used. The display depends on the operating tool in question.

**Navigation**

**Parameter → System → Device Access Locks.Data Storage Lock**

**Description**

The device supports DataStorage. If a device is being replaced, this allows the configuration of the old device to be written to the new device. If, when a device is being replaced, the original configuration of the new device is to be retained, the **Device Access Locks.Data Storage Lock** parameter can be used to prevent the parameters from being overwritten. If this parameter is set to 'true', the new device does not adopt the data stored in the master's DataStorage.

**Options**

- false
- true

**15.4 Observation**

The process data are transmitted acyclically.
16 Accessories

Accessories can be ordered with the device (optional) or separately.

16.1 Device-specific accessories

16.1.1 Test magnet

Order number: 71267011

16.1.2 Hexagon tubular socket wrench 32 mm

Order number: 52010156

To mount the device in locations that are difficult to access.

16.1.3 Plug-in jack

Example: M12 with LED
Plug-in jack M12 IP69 with LED
- Elbowed 90°, terminated at one end
- 5 m (16 ft) PVC cable (orange)
- Body: PVC (transparent)
- Slotted nut 316L
- 52018763

Plug-in jack M12 IP69 without LED
- Elbowed 90°, terminated at one end
- 5 m (16 ft) PVC cable (orange)
- Body: PVC (orange)
- Slotted nut 316L (1.4435)
- 52024216

Plug-in jack M12 IP67 without LED
- Elbowed 90°
- 5 m (16 ft) PVC cable (gray)
- Slotted nut Cu Sn/Ni
- Body: PUR (blue)
- 52010285

<table>
<thead>
<tr>
<th>ø20 (0.8)</th>
<th>~52.5 (2.07)</th>
</tr>
</thead>
</table>

12 Dimensions of self-terminated connection, engineering unit: mm (in)

Plug-in jack M12 IP67 without LED
- Straight, self-terminated connection to M12 plug
- Slotted nut Cu Sn/Ni
- Body: PBT
- 52006263

Core colors for M12 plug:
- 1 = BN (brown)
- 2 = WT (white)
- 3 = BU (blue)
- 4 = BK (black)

16.1.4 Process adapter M24 thread

Material
For all versions:
- Adapter
  316L (1.4435)
- Seal
  EPDM

Process adapter M24 PN25
Available versions:
- DIN11851 DN50 with slotted nut
- SMS 1 ½”

Process adapter M24 PN40
Available versions:
- Varivent F
- Varivent N
16.1.5  Weld-in adapter

![Sample drawing of weld-in adapter](image)

1  Leakage hole

G ¾"
Available versions:
- Ø 50 mm (1.97 in) - Installation on vessel
- Ø 29 mm (1.14 in) - Installation in pipe

G 1"
Available versions:
- Ø 53 mm (2.09 in) - Installation on vessel
- Ø 60 mm (2.36 in) - Installation on pipe

M24
Available versions:
Ø 65 mm (2.56 in) - Installation on vessel

16.1.6  Grooved union nut DIN11851

![Sample drawing of grooved union nut](image)

Material
For all versions:
304 (1.4307)

For milk pipe DIN11851
Available versions:
- DN25 - F26
- DN40 - F40
- DN50 - F50
17  Technical data

17.1  Input

Measured variable
The change in medium capacitance is detected by the electrode in contact with the process. Detection occurs based on the medium covering the electrode.

Measuring range
- Standard: Water- or alcohol-based media, $\varepsilon_r \geq 10$
- Extended: Oil-based media $2.4 < \varepsilon_r < 10$ or media that form heavy buildup
- Device with IO-Link communication: Adjustment up to $\varepsilon_r > 2.4$ via the IO-Link interface for water-, alcohol- and oil-based liquids or powdered products

17.2  Output

Switch output
- 2 DC-PNP outputs, freely configurable
- 1 switch output active: 200 mA connectable load (short-circuit proof)
  ≠ Unlike the IO-Link standard, the SIO mode supports 200 mA
- Both switch outputs active: Connectable load of 105 mA each (short-circuit proof)
- Safety-related switching
  The electrical switch opens if the point level is reached or if faults or a power outage occur.
  - Maximum point level detection (MAX): e. g. for overfill protection
  - Minimum point level detection (MIN): e. g. to protect pumps from dry running
- Residual voltage: < 3 V
- Residual current: < 100 µA

17.3  Performance characteristics

Reference operating conditions
The following reference conditions apply to the performance characteristics:
- Ambient temperature: 20 °C (68 °F) ±5 °C (9 °F)
- Medium: Water, conductivity approx. 200 µS/cm

Maximum uncertainty
±1 mm (0.04 in) in accordance with DIN 61298-2

Hysteresis
Maximum 1 mm (0.04 in)

Non-repeatability
±0.5 mm (0.02 in) in accordance with DIN 61298-2

Switching delay
Switching delay time/switchback delay time of outputs
- 0.5 s when the sensor is covered (can be configured via IO-Link 0.3 to 60 s)
- 1 s when the sensor is free (can be configured via IO-Link 0.3 to 60 s)
Optional: 0.3 s; 1.5 s or 5 s when the sensor is covered and free, see product structure, order code for "Service", option HS 'Switching delay'

Switch-on time
< 2 s (no defined switching status before this)
17.4 Environment

Ambient temperature range  
At the housing: −40 to +70 °C (−40 to +158 °F)

Storage temperature  
−40 to +85 °C (−40 to +185 °F)

Operating altitude  
Up to 2,000 m (6,600 ft) above sea level

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

Degree of protection  
- IP65/67 NEMA type 4X enclosure (plastic housing cover)
- IP66/68/69 NEMA type 4X/6P enclosure (metal housing cover)

Vibration resistance  
As per test Fh, EN 60068-2-64:2008: a(RMS) = 50 m/s², f = 5 to 2,000 Hz, t = 3 axes × 2 h

Shock resistance  
As per test Ea, prEN 60068-2-27:2007: a = 300 m/s² = 30 g, 3 axes × 2 directions × 3 shocks × 18 ms

Cleaning  
Resistant to typical cleaning agents from the outside, in accordance with Ecolab test.

Electromagnetic compatibility  
Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series. For details, refer to the Declaration of Conformity.

Only the requirements of IEC/EN 61131-9 are met if IO-Link communication is used.

If the device is installed in plastic structures, its function may be influenced by strong electromagnetic fields. Emission requirements for class A equipment are met (only for use in "industrial environments").

17.5 Process

Process temperature range  
−20 to +100 °C (−4 to +212 °F)
- For 1 h: +150 °C (+302 °F)
- M24 process adapter with EPDM process seal for 1 h: +130 °C (+266 °F)

Process pressure range  
−1 to +25 bar (−14.5 to +362.5 psi)

Process fluid  
For reliable point level detection, the device can be adapted to the process conditions in question.
The following settings can be made via IO-Link: **Parameter → Application → Active switchpoints**

- **Standard** preconfigured for:
  - Water- or alcohol-based media ($\varepsilon_r \geq 10$)
    - For example, water, milk and various dairy products, soft drinks, beer
  - **Extended** preconfigured for:
    - Oil-based media ($\varepsilon_r > 2.4$)
    - For example: Oils, ketchup, mustard, mayonnaise, honey, nougat spread
  - **User**: can be freely configured to customer medium:
    - Switch point value Output 1/2
    - Switchback point value Output 1/2
    - $\varepsilon_r$

  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)

**Adhesive and viscous media**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Light buildup</th>
<th>Heavy buildup</th>
<th>Surface drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>✔️ ✔️</td>
<td>✗</td>
<td>✔️ ✔️</td>
</tr>
<tr>
<td>Extended</td>
<td>✔️ 1)</td>
<td>✔️ ✔️</td>
<td>✔️ 1)</td>
</tr>
</tbody>
</table>

1) Surface drying or insulating, non-homogeneous layers can cause the sensor to signal 'free' and should therefore be avoided or eliminated, particularly in maximum safety mode (overflow). The Standard setting is preferable in this type of application.

**Media with foam formation**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Light buildup</th>
<th>Heavy buildup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Sensor signal 'covered'</td>
<td>Sensor signal 'free' 1)</td>
</tr>
<tr>
<td>Extended</td>
<td>Sensor signal 'free'</td>
<td>Sensor signal 'free'</td>
</tr>
</tbody>
</table>

1) Very coarsely-pored foam cannot be detected by the sensor.

The device is delivered with the "Standard" setting. Optionally, it can be ordered with "Extended" as the default setting.
Index

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\(\mu\text{C-temperature} \quad 39\)

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