Operating Instructions
Liquitrend QMW43

Conductive and capacitive measurement of conductivity and thickness of buildup
Table of contents

1 About this document ................ 4
  1.1 Symbols .............................. 4
  1.2 Terms and abbreviations .......... 5
  1.3 Documentation ...................... 6
  1.4 Registered trademarks ............. 6

2 Basic safety instructions .......... 6
  2.1 Requirements for the personnel ..... 6
  2.2 Designated use ...................... 6
  2.3 Workplace safety .................... 7
  2.4 Operational safety .................. 7
  2.5 Product safety ...................... 7
  2.6 IT security ........................... 7

3 Product description ............... 7
  3.1 Product design ...................... 8

4 Incoming acceptance and product
    identification ....................... 8
  4.1 Incoming acceptance ................ 8
  4.2 Product identification ............. 8
  4.3 Manufacturer address .............. 9
  4.4 Nameplate ........................... 9
  4.5 Storage, transport .................. 10

5 Installation .......................... 10
  5.1 Installation conditions ............ 10
  5.2 Mounting the measuring device ... 11
  5.3 Post-installation check ............ 12

6 Electrical connection ............... 12
  6.1 Connecting the device .............. 12
  6.2 Post-connection check ............. 13

7 Operation options ................... 13
  7.1 IO-Link information ............... 13
  7.2 IO-Link download ................... 13
  7.3 Structure of the operating menu ... 14

8 System integration ................... 14
  8.1 Process data ........................ 14
  8.2 Reading out and writing device data (ISDU – Indexed Service Data Unit) ... 14

9 Commissioning ....................... 16
  9.1 Function check ...................... 16
  9.2 Light signals (LEDs) ............... 16
  9.3 Changing device parameters via IO-Link ... 17

10 Operation ............................ 17
    10.1 Measurement of buildup in pipes or tanks ... 17

11 Diagnostics and troubleshooting ... 19
    11.1 Error indication ................... 19
    11.2 General troubleshooting ........... 19
    11.3 Diagnostic information via light emitting diodes ............... 19
    11.4 Diagnostic events .................. 21
    11.5 Behavior of the device in the event of a fault ... 23
    11.6 Resetting the measuring device .... 23

12 Maintenance .......................... 24
    12.1 Cleaning ........................... 24

13 Repair ............................... 24
    13.1 Return ............................. 24
    13.2 Disposal ............................ 25

14 Accessories .......................... 25
    14.1 Hexagon tubular socket wrench 32 mm ... 25
    14.2 Plug-in jack, elbowed 90° ......... 25
    14.3 Plug-in jack, straight .............. 26
    14.4 Process adapter M24 thread ........ 26
    14.5 Weld-in adapter .................... 27
    14.6 Grooved union nut DIN11851 ....... 27

15 Overview of the operating menu ... 28

16 Description of Device Parameters ... 29
    16.1 Identification ..................... 29
    16.2 Diagnosis ........................... 29
    16.3 Parameters ......................... 31

17 Technical data ........................ 36
    17.1 Input ............................... 36
    17.2 Output .............................. 36
    17.3 Performance characteristics ...... 37
    17.4 Environment ....................... 39
    17.5 Process .............................. 40

Index .................................. 41
1  About this document

1.1  Symbols

1.1.1  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

1.1.2  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.

1.1.3  Tool symbols

🔧 Open-ended wrench

1.1.4  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.

💡 Tip
Indicates additional information
Safety instructions
Observe the safety instructions contained in the associated Operating Instructions.

Connecting cable immunity to temperature change
Specifies the minimum value of the temperature resistance of the connection cables.

1.2 Terms and abbreviations

Measuring range, span (conductivity)
1 Maximum conductivity measuring range
2 Adjusted span

Maximum conductivity measuring range
Span between 0 to 100 for editable range.

Adjusted span
Span between LRV (Lower Range Value) and URV (Upper Range Value)
The difference between the LRV and URV must be at least 1 mS/cm.
Factory setting: 0 to 100 mS/cm
Other configured spans can be ordered as customized spans.

Other abbreviations
UHT: Ultra-High Temperature
CIP: Cleaning in Place
1.3 Documentation

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

1.4 Registered trademarks

IO-Link is a registered trademark of the IO-Link company group.

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks, e.g., commissioning and maintenance:
- Trained, qualified specialists must have a relevant qualification for the specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Must have read and understood the instructions in the manual and supplementary documentation
- Follow instructions and comply with conditions

2.2 Designated use

Improper use can pose hazards
- Ensure that the measuring device is free of defects while it is in operation
- Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or undershoot the relevant limit values of the measuring device → see the "Technical data" section

2.2.1 Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use. Clarification of borderline cases:
- For special materials and media used for cleaning, the manufacturer is happy to provide assistance in verifying the corrosion resistance of medium-wetted materials, but disclaims any warranty or liability.

Residual risks

Due to heat transfer from the process, the temperature of the electronics housing and the assemblies contained therein may rise to 80 °C (176 °F) during operation.

Danger of burns from contact with surfaces!
- If necessary, ensure protection against contact to prevent burns.
2.3 Workplace safety

When working 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 only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for ensuring the interference-free operation of the device.

Modifications 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 Endress+Hauser.

Repair

Repairs are not envisaged for this device → ❄ "Repair" section.

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.

2.6 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device has safety mechanisms integrated to prevent users from inadvertently changing settings.

Provide additional protection for the device and data transfer to/from the device
- IT security measures defined in the plant owner/operator's own security policy must be implemented by plant owners/operators themselves.

3 Product description

- Compact measuring device
- Continuous measurement of conductive and capacitive components of media for the measurement of buildup thickness and conductivity

Flush-mounting of the device in pipes or in storage, mixing and process vessels enables the optimization of CIP cleaning, UHT applications as well as process cycle times.
3.1 Product design

2 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
- Serial number
- 2-D matrix code (QR code)
- Extended order code with breakdown of the device features on the delivery note

- Enter the serial number from the nameplates in the W@M Device Viewer (www.endress.com/deviceviewer)
  All the information about the measuring device and all associated Technical Documentation are displayed.
Enter the serial number on the nameplate into the Endress+Hauser Operations App or use the Endress+Hauser Operations App to scan the 2-D matrix code (QR Code) on the nameplate.

All the information about the measuring device and all 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 Manufacturer name/logo
2 Device name
3 Manufacturer’s address
4 Order code
5 Serial number
6 Extended order code
7 Supply voltage
8 Signal output
9 Process temperature
10 Ambient temperature range
11 Process pressure
12 Firmware
13 Certificate symbols, communication mode (optional)
14 Degree of protection, e.g. IP, NEMA
15 Approval-specific information
16 Measuring point identification (optional)
17 Document number of Operating Instructions
18 Manufacturing date: year-month
19 2-D matrix code (QR code)
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 in vessel, pipe or tank.

5.1.2 Vessel or tank

5.1.3 Pipes

Installation examples

Horizontal orientation → preferred orientation
The possibility of buildup or bubbles forming on the sensor when installed vertically must be taken into account. If the sensor is partially covered, or if encrustations or air bubbles have formed on the sensor, this will be reflected in the measured value.

5.1.4 Special mounting instructions
- When installing the plug, do not allow moisture to enter the plug or socket area
- Protect housing against impact

5.2 Mounting the measuring device

5.2.1 Required tools
- Open-ended wrench
- Hexagon socket wrench for measuring points that are difficult to access

When screwing into place, turn by the hex bolt only 32 mm.
Torque: 15 to 30 Nm (11 to 22 lbf ft)
5.2.2  Installation instructions

![Installation example diagram]

A Thread G ¾", G 1"
B Thread M24x1.5

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
☐ 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  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 suitable 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.
6.2 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 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 during operation.

The device supports the following characteristics of the physical layer:
- IO-Link specification: version 1.1
- IO-Link Smart Sensor Profile 2nd Edition
- SIO mode: Yes
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: 6 ms
- Process data width: 32 bit
- IO-Link data storage: Yes
- Block configuration: Yes

Regardless of the customer-specific default settings selected, the device always has the option of communicating or being configured via IO-Link.

7.2 IO-Link download

http://www.endress.com/download
- Select "Device Driver" from the list displayed
- In the Type search field, select "IO Device Description (IODD)"
- In the Product Code search field, select the product root
- Click "Search" button → Select result → Download

Optional: In the Text Search search field, enter the device name.
7.3 Structure of the operating menu

In addition, the value for buildup and conductivity can be read via ISDU (hex) 0x0028 – acyclic service.

8 System integration

8.1 Process data

<table>
<thead>
<tr>
<th>Bit</th>
<th>0 (LSB)</th>
<th>1</th>
<th>...</th>
<th>22</th>
<th>23 (MSB)</th>
<th>24</th>
<th>...</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device</td>
<td>Conductivity: 0 to 110 000 µS/cm, resolution 0.1 µS/cm</td>
<td>Buildup: 0 to 10 mm, resolution 0.1 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UInt24: offset = 0, gradient = 0.1</td>
<td>UInt8: offset = 0, gradient = 0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.2 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:

8.2.1 Endress+Hauser-specific device data

<table>
<thead>
<tr>
<th>Identifier</th>
<th>ISDU (dec)</th>
<th>ISDU (hex)</th>
<th>Size</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>Extended order code</td>
<td>259</td>
<td>0x0103</td>
<td>60</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENP_VERSION</td>
<td>257</td>
<td>0x0101</td>
<td>16</td>
<td>String</td>
<td>r/-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device Type</td>
<td>256</td>
<td>0x0100</td>
<td>2</td>
<td>Uinteger16</td>
<td>r/-</td>
<td>0x91FB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation buildup</td>
<td>66</td>
<td>0x0042</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>0 – OFF</td>
<td>0 – OFF 1 – ON</td>
<td>No</td>
<td>0 to 1</td>
<td></td>
</tr>
<tr>
<td>Simulated buildup</td>
<td>85</td>
<td>0x0055</td>
<td>4</td>
<td>Int16</td>
<td>r/w</td>
<td>10</td>
<td>0 to 10.0</td>
<td>Yes</td>
<td>0 to 10.0</td>
<td></td>
</tr>
<tr>
<td>Simulation conductivity</td>
<td>90</td>
<td>0x005A</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>0 – OFF</td>
<td>0 – OFF 1 – ON</td>
<td>No</td>
<td>0 to 1</td>
<td></td>
</tr>
<tr>
<td>Simulated conductivity</td>
<td>86</td>
<td>0x0056</td>
<td>4</td>
<td>UInt32</td>
<td>r/w</td>
<td>100000.0</td>
<td>0 to 110000.0</td>
<td>Yes</td>
<td>0 to 110000.0</td>
<td></td>
</tr>
<tr>
<td>Device search</td>
<td>69</td>
<td>0x0045</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>0 – 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>r/w</td>
<td>0 – OFF</td>
<td>0 – OFF 1 – ON</td>
<td>0/1</td>
<td>No</td>
<td>0 to 1</td>
</tr>
<tr>
<td>Operating Mode 1 (OU1)</td>
<td>108</td>
<td>0x006C</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>OFF</td>
<td>0 – OFF 3 – Frequency</td>
<td>Yes</td>
<td>0 to 4</td>
<td></td>
</tr>
<tr>
<td>Operating Mode 2 (OU2)</td>
<td>97</td>
<td>0x0061</td>
<td>1</td>
<td>UInt8</td>
<td>r/w</td>
<td>3 – Frequency (Conductivity)</td>
<td>2 – 4-20 mA (Buildup) 3 – Frequency 4 – 4-20 mA (Conductivity)</td>
<td>Yes</td>
<td>0 to 4</td>
<td></td>
</tr>
</tbody>
</table>
### 8.2.2 IO-Link-specific device data

<table>
<thead>
<tr>
<th>Identifier</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>QMW43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ProductName</td>
<td>18</td>
<td>0x0012</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td>Liquitrend</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ProductText</td>
<td>20</td>
<td>0x0014</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td>Buildup, homogeneity, product recognition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VendorName</td>
<td>16</td>
<td>0x0010</td>
<td>max. 64</td>
<td>String</td>
<td>r/-</td>
<td>Endress+Hauser</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VendorId</td>
<td>7 to 8</td>
<td>0x0007 to 0x0008</td>
<td></td>
<td>String</td>
<td>r/-</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please refer to the parameter description for an explanation of abbreviations.
8.2.3 System commands

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

9 Commissioning

9.1 Function check

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

Checklists in sections
- Post-installation check
- Post-connection check

9.2 Light signals (LEDs)

![Position of LEDs in housing cover](image)

1. green (GN), status, communication
2. red (RD), warning or fault

Description of the function of the LEDs

**Position 1: green (GN) status, communication**
- Lit: no communication
- Flashing: active communication, flash frequency
- Flashing with increased luminosity: device search (device identification), flash frequency

**Position 2: red (RD), warning or fault**
Position 2: red (RD) warning or fault
- Warning/maintenance required:
  Flashing: error is remediable, e.g. invalid adjustment
- Fault/device failure:
  Lit: see diagnostics and troubleshooting

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

9.3 Changing device parameters via IO-Link

Block configuration:
All changed parameters become active only after download.

Direct configuration:
A single changed parameter becomes active immediately after input.
Confirm each change with Enter to ensure that the value is accepted.

⚠️ WARNING
Risk of injury and damage to property due to uncontrolled activation of processes!
- Make sure that downstream processes are not started unintentionally.

Commissioning with customer-specific default settings:
The device can be put into operation without any additional configuration.

Commissioning with factory settings:
If an application-specific setting is required, the span and the output assignment can be adjusted via the IO-Link interface.

10 Operation

10.1 Measurement of buildup in pipes or tanks

10.1.1 Application example
- System state = emptied
- Output OU1 setting on device = buildup (buildup measurement)
- Output OU2 setting on device = conductivity

The device is installed in a pipe or on a tank wall. During the process, there are times when the pipe or tank is not filled.

For the purpose of controlling a cleaning cycle and ensuring the quality of the end product, it is important to know whether residues of the medium or cleaning agent are still present.

The device detects the thickness of the buildup in the pipe or on the tank wall. The buildup measurement is output as a measured value at the output used.

The thickness of the buildup can be output in the range from 0 to 10 mm, as shown in this example.

The output is set to ≥ 0.1 mm as long as it is still possible to detect an electrical conductivity of a medium or cleaning agent, for example.

Examples of media: biofilms, very thin, conductive films of dirt or films caused by residue of the cleaning agent used are output with a value of 0.1 mm.

Output OU2 (set to conductivity) outputs the conductivity actually present without temperature compensation. This makes it possible to differentiate contamination with chemicals from the medium. Examples:
• A very low residual conductivity in the single-digit µS/cm range is indicative of a film of water that has not drained due to the sensor installation.
• If the residual conductivity value is far higher, this indicates fluid or cleaning agent residue.

**Description of the graphic "Application example: tank cleaning"**

At the end of a production run:

1. Tank is emptied.
   - Considerable product residue in the tank.
     - Signal OU1: buildup ≥ 1 mm
     - Signal OU2: conductivity < conductivity of medium when tank is filled

2. Perform cleaning in place (CIP); rinse, e.g. with water.

3. Tank is emptied.
   - Product residue still in the tank.
     - Signal OU1: buildup ≥ 0.1 mm
     - Signal OU2: conductivity < measured values from point 1, but > 0 µS/cm

4. Clean or rinse again.

5. Tank is emptied.
   - Product residue still in the tank.
     - Signal OU1: buildup ≥ 0.1 mm
     - Signal OU2: conductivity < measured values from point 1, but > 0 µS/cm

6. Clean or rinse again.
7. Tank is emptied.
   - The sensor no longer detects any product residue.
     Signal OU1: buildup ~ 0 mm
     Signal OU2: conductivity ~ 0 µS/cm

Contact your Endress+Hauser sales partner if the device is to be used in pipes or tanks that are always filled, or to determine the homogeneity of mixtures.

11  Diagnostics and troubleshooting

11.1  Error indication
If an electronics/sensor defect is present in the device, the device changes to the error mode and displays the diagnostic event F270 via IO-Link communication. The status of the process data is rendered invalid.

When an error or a defect occurs, the analog outputs used (4 to 20 mA/frequency) switch to the defined failure current/frequency range.

11.2  General troubleshooting

Device does not respond
Supply voltage does not match the value indicated on the nameplate.
   - Apply correct voltage.

The polarity of the supply voltage is wrong.
   - Correct the polarity.

Connecting cables are not in contact with the terminals.
   - Check for electrical contact between cables and correct.

No communication
Connecting cable is defective, incorrectly connected or is not making contact.
   - Check wiring and cables.
There is an error in the device, which is preventing communication.
   - Replace device.

No transmission of process data
Internal sensor error or electronics error.
   - Correct all errors that are displayed as a diagnostic event.

11.3  Diagnostic information via light emitting diodes

Green LED not lit
No supply voltage.
   - Check connector, cable and supply voltage.

LED not flashing
No communication.
   - Check connector, cable, supply voltage and IO-Link master.
**LED flashing red**
Overload or short-circuit in load circuit.
- Clear the short-circuit.
Ambient temperature outside of specification.
- Operate measuring device in specified temperature range.

**Red LED continuously lit**
Internal sensor error.
- Replace device.

ℹ️ There is no external signaling via LEDs on the metal housing cover (IP69).
11.4  Diagnostic events

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

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

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.
## 11.4.2 Overview of diagnostic events

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>C485</td>
<td>Warning</td>
<td>IO-Link Warning</td>
<td>0x8C01 1)</td>
<td>Simulation active</td>
</tr>
<tr>
<td>S825</td>
<td>Warning</td>
<td>IO-Link Warning</td>
<td>0x1812</td>
<td>Ambient temperature outside of specification</td>
</tr>
<tr>
<td>S971</td>
<td>Warning</td>
<td>IO-Link Warning</td>
<td>0x1811</td>
<td>Measured value is outside sensor range</td>
</tr>
<tr>
<td>F270</td>
<td>Fault</td>
<td>IO-Link Error</td>
<td>0x5000</td>
<td>Defect in electronics/sensor</td>
</tr>
<tr>
<td>S803</td>
<td>Fault</td>
<td>IO-Link Error</td>
<td>0x1804</td>
<td>Current loop</td>
</tr>
<tr>
<td>S804</td>
<td>Fault</td>
<td>IO-Link Error</td>
<td>0x1801</td>
<td>Overload at output 1/2</td>
</tr>
<tr>
<td>C103</td>
<td>Message</td>
<td>IO-Link Message</td>
<td>0x1813</td>
<td>Sensor check failed</td>
</tr>
<tr>
<td>C182</td>
<td>Message</td>
<td>IO-Link Message</td>
<td>0x1807</td>
<td>Invalid calibration</td>
</tr>
<tr>
<td>-</td>
<td>Message</td>
<td>IO-Link Message</td>
<td>0x1814</td>
<td>Sensor check passed</td>
</tr>
</tbody>
</table>

1) EventCode as per IO-Link standard 1.1

### Causes and remedial action

#### Warnings

**C485**
When the simulation of conductivity or buildup is active, the device displays a warning.
- Deactivate simulation.

**S825**
Ambient temperature outside of specification.
- Operate the device in the specified temperature range.

**S971**
The measured value is outside the set sensor range.
- Operate the device in the configured measuring range or set the measuring range.

#### Faults

**F270**
Electronics/sensor defective.
- Replace device.

**S803**
Impedance of load resistance at analog output too high.
- Check the cable and load at the current output.
- If a current output is not required, then switch off the current output via the configuration.
- Connect current output to load.
S804
Output 1/2 overloaded.
‣ Load at analog output is too high.
‣ Check the output circuit.
‣ Increase the load resistance at output 1/2.

Messages
C103
Sensor check failed.
‣ Check the installation position
‣ Clean or replace the sensor.

C182
Measuring range too small.
‣ Increase the measuring range

Sensor check passed
Sensor check passed (no status signal indicator).
‣ No action required.

11.5 Behavior of the device in the event of a fault

■ Warnings and faults displayed via IO-Link
■ The warnings and faults displayed are for information purposes only and do not have a safety function
■ 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.
■ Warning:
■ The device continues measuring if this type of error occurs. The output signal is not affected (exception: simulation is active).
■ The current output or frequency output remains in the measuring mode.
■ Fault:
■ The fault state is displayed via IO-Link.
■ In the fault state, the output concerned adopts its fault signal (current output < 3.6 mA/frequency output < 260 Hz)

11.6 Resetting the measuring device

<table>
<thead>
<tr>
<th>Standard Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigation</td>
</tr>
</tbody>
</table>
Description

**WARNING**

If the user confirms the "Standard Command" function by pressing the "Reset to factory settings" button, this causes the device to be immediately reset to the as-delivered state.

Downstream processes can be affected. The behavior of the current outputs can change.

- Make sure that downstream processes are not started unintentionally.

To perform a reset there is no additional locking, e.g. device unlocking is not required to perform a reset. Furthermore, the device status is also reset. 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

12  Maintenance

No special maintenance work is required.

12.1  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.

13  Repair

Repair is not envisaged for this measuring device.

13.1  Return

The measuring device must be returned if the wrong device has been ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

For the procedure and conditions for safe, swift and professional device returns, see the information on the Endress+Hauser website at [http://www.endress.com/support/return-material](http://www.endress.com/support/return-material)

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](http://www.endress.com/support/return-material)

2. Return the device if the device must be repaired or replaced, or if the wrong device was ordered or delivered.
13.2 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

14 Accessories

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

14.1 Hexagon tubular socket wrench 32 mm

Order number: 52010156

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

14.2 Plug-in jack, elbowed 90°

Plug-in jack M12 IP69
- Terminated connector
- 5 m (16 ft) PVC cable (orange)
- Body: PVC (orange)
- Slotted nut 316L (1.4435)
- Order number: 52024216
14.3 Plug-in jack, straight

![Dimensions of self-terminated connection. Unit of measurement mm (in)](image)

**Plug-in jack M12 IP67**
- Terminated connector
- 5 m (16 ft) PVC cable (gray)
- Body: PUR (blue)
- Slotted nut Cu Sn/Ni
- Order number: 52010285

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

14.4 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
14.5  Weld-in adapter

![Sample drawing of weld-in adapter](image1)

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

14.6  Grooved union nut DIN11851

![Sample drawing of grooved union nut](image2)

Material
For all versions:
304 (1.4307)

For milk pipe DIN11851
Available versions:
- DN25 - F26
- DN40 - F40
- DN50 - F50
## Overview of the operating menu

<table>
<thead>
<tr>
<th>Level 0 - IO-Link</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>Serial number</td>
<td>Firmware Version</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extended order code</td>
<td>ProductID</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductName</td>
<td>ProductText</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VendorName</td>
<td>VendorText</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hardware Revision</td>
<td>ENP_VERSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Application Specific Tag</td>
<td>Device Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Actual Diagnostics (STA)</td>
<td>Last Diagnostic (LST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulation build up</td>
<td>Simulated build up</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulation conductivity</td>
<td>Simulated conductivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device search</td>
<td>Sensor check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameters</td>
<td>Application</td>
<td>Sensor</td>
<td>Operating Mode (OU1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operating Mode (OU2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Damping buildup (TAU)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Damping conductivity (TAU)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>DC-Media</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Calibrate buildup zero (GTZ)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Offset buildup</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Get DC-Media</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current Output 2 (OU2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lower Range Value for 4 mA</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Upper Range Value for 20 mA</td>
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<tr>
<td></td>
<td></td>
<td>Frequency Output 2 (OU2)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Lower Range Value for 300 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Upper Range Value for 3000 Hz</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td></td>
<td></td>
<td>Operating hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>μC-Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unit changeover (UNI) - μC-Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimum μC-Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maximum μC-Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reset μC-Temperatures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standard Command</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Device Access Locks, Data Storage Lock</td>
<td></td>
</tr>
</tbody>
</table>
16  Description of Device Parameters

16.1  Identification

Extended order code

Navigation  Identification → Extended order code
Description  Used to replace (reorder) the device. Displays the extended order code (max. 60 alphanumeric characters).
Factory setting  As per order specifications

ENP_VERSION

Navigation  Identification → ENP_VERSION
Description  Displays the ENP version (ENP: electronic name plate)

Application Specific Tag

Navigation  Identification → Application Specific Tag
Description  Used for unique identification of device in the field. Enter device tag (max. 32 alphanumeric characters).
Factory setting  As per order specifications

16.2  Diagnosis

Actual Diagnostics (STA)

Navigation  Diagnosis → Actual Diagnostics (STA)
Description  Displays the current device status.

Last Diagnostic (LST)

Navigation  Diagnosis → Last Diagnostic (LST)
Description  Displays the last device status (error or warning) that was rectified during operation.
## Simulation buildup/Simulation conductivity

**Navigation**

Diagnosis → Simulation buildup/Simulation conductivity

**Description**

Parameter switches the simulation on or off. The value to be simulated can be configured in the Simulated buildup/Simulated conductivity parameter.

**Options**

- ON
- OFF

**Factory setting**

OFF

### Simulated buildup

**Navigation**

Diagnosis → Simulated buildup

**Description**

The value to be simulated is entered in this parameter. If simulation is activated, the value is output via the corresponding outputs and IO-Link. A warning indicates that the device is in the simulation mode. A warning is output 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, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.

**Options**

- 0 to 10.0 mm (editable)

### Simulated conductivity

**Navigation**

Diagnosis → Simulated conductivity

**Description**

The value to be simulated is entered in this parameter. When simulation is activated, this value is output via the corresponding outputs and IO-Link. If a simulation is active, a warning to this effect is displayed so that it is clear to the user that the device is in the 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, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.

**Options**

- 0 to 110 000.0 (editable)

### 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 sequence `...`.
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 sensor 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.

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

Options
One of the following messages is displayed following the test:
- Sensor check passed; message (0x1814)
- Sensor check failed; message C103 (0x1813)

16.3 Parameters

16.3.1 Application

Sensor

Operating Mode (OU1)
Operating Mode (OU2)

Navigation
Application → Sensor → Operating Mode (OU1)
Application → Sensor → Operating Mode (OU2)

Description
The parameter is used to assign the physical outputs to the process data.

Note
Options for:
- Physical output 1: off or frequency (buildup)
- Physical output 2: off, current (conductivity or buildup) or frequency (conductivity)

Switch-on value
As per current configuration in the device

Options
OU1
- OFF
- Frequency (buildup)
OU2
- OFF
- 4 to 20 mA (buildup)
- 4 to 20 mA (conductivity)
- Frequency (conductivity)
**Damping buildup (TAU)**

**Damping conductivity (TAU)**

**Navigation**
- Application → Sensor → Damping buildup (TAU)
- Application → Sensor → Damping conductivity (TAU)

**Description**
The parameter affects the display of the measured value with a time lag according to the behavior of a PT₁ element. A TAU corresponds to 63.2% of the expected measured value. The measured value is reached after 5 TAU.

**Switch-on value**
As set in the device.

**Input range**
0.1 to 60.0 s

**Factory setting**
2 s

**Note**
The damping setting can be ordered as a preset value in the product structure via order code 570 'Service', option HS 'Damping setting to spec.'.

**DC-Media**

**Navigation**
- Application → Sensor → DC-Media

**Note**
The dielectric constant can be ordered as preset to 2.7 in the product structure via order code 570 'Service', option HT 'Configuration output 1 + output 2'.

**Description**
For applications with non-conductive media, the preset value for the dielectric constant can be adjusted or changed to the value of the current medium. The dielectric constant value is used as a multiplier for calculating the buildup of non-conductive media.

**Input range**
1.5 to 85

**Factory setting**
13

**Calibrate buildup zero (GTZ)**

**Navigation**
- Application → Sensor → Calibrate buildup zero (GTZ)

**Note**
Only perform this function when the installation is empty.

**Description**
Permanent buildup which is not relevant can be automatically suppressed with this function. The value determined is applied to the 'Offset buildup' parameter.

**Options**
- Set Zero
- Empty

**Offset buildup**
Description of Device Parameters

Liquitrend QMW43

Navigation Application → Sensor → Offset buildup

Description The parameter displays the value that was last suppressed by the device in the 'Calibrate buildup zero (GTZ)' parameter. Alternatively, a manually defined value for signal suppression can also be entered here.

Input range 0 to 9.0 mA

Get DC-Media

Navigation Application → Sensor → Get DC-Media

Note This function can only be used with media conductivity values ≥ 5 µS/cm. The system must be filled completely to use this function.

Description This function determines the current dielectric constant of the medium present. The value determined for the dielectric constant is communicated to the DC-Media parameter.

Current Output 2 (OU2)

Lower Range Value for 4 mA (LRV)
Upper Range Value for 20 mA (URV)

Navigation Application → Current Output 2 (OU2) → Lower Range Value for 4 mA (LRV)
Application → Current Output 2 (OU2) → Upper Range Value for 20 mA (URV)

Note The configured measuring range for buildup is always = 0 to 10. The parameter is therefore not displayed in this case. The configured measuring range for conductivity can be changed. The span can be ordered as a preset value in the product structure via order code 570 "Service", option HT "Configuration output 1 + output 2".

Description For specifying the measuring range for the current output.

Input range:
Minimum span: 0 to 110 000.0
1 000.0

Switch on value Last configured value.

Frequency Output 2 (OU2)

Lower Range Value for 300 Hz (LRV)
Upper Range Value for 3000 Hz (URV)

Navigation Application → Frequency Output 2 (OU2) → Lower Range Value for 300 Hz (LRV)
Application → Frequency Output 2 (OU2) → Upper Range Value for 3000 Hz (URV)
Description of Device Parameters

Note
The configured measuring range for buildup is always = 0 to 10. The parameter is therefore not shown/displayed in this case. The configured measuring range for conductivity can be changed.
The span can be ordered as a preset value in the product structure via order code 570 "Service", option HT "Configuration output 1 + output 2".

Description
For specifying the measuring range for the frequency output.

Input range
0 to 110
Minimum span
1000.0

Switch on value
Last configured value.

16.3.2 System

Operating hours

Navigation
Parameter → System → Operating hours

Description
This parameter counts the operating hours during the period in which operating voltage is present. The value is output in industrial hours.

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 value is converted to the new unit 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.

---

**Maximum µC-Temperature**

**Navigation**  
Parameter → System → Maximum µC-Temperature

**Description**  
This parameter is used as the maximum peak indicator and makes it possible to call up retroactively the highest electronics temperature measured.

---

**Reset µC-Temperature**

**Navigation**  
Parameter → System → Reset µC-Temperature

**Description**  
Use this function to set the maximum/minimum peak indicators for the µC temperature to the temperature currently present. The minimum and maximum indicators have the same value once the function has been executed.

---

**Standard Command**

**Navigation**  
Parameter → System → Standard Command

**Description**  
⚠️ **WARNING**  
If the user confirms the "Standard Command" function by pressing the "Reset to factory settings" button, this causes the device to be immediately reset to the as-delivered state.  
Downstream processes can be affected. The behavior of the current outputs can change.  
▶ Make sure that downstream processes are not started unintentionally.

To perform a reset there is no additional locking, e.g. device unlocking is not required to perform a reset. Furthermore, the device status is also reset. 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

---

**Device Access Locks.Data Storage Lock**  
Activation/deactivation of data storage

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

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

The device supports data storage. When the device is replaced, the configuration of the old device can be written to the new device. The Device Access Locks.Data Storage Lock parameter can be used to prevent the parameters from being overwritten. The original configuration of the new device is maintained. If the "true" option is selected, the new device does not apply the data that are saved in the master's data storage.

Options

false
true

17  Technical data

17.1  Input

Measured process variable
Electrical conductivity, dielectric constant ($\varepsilon_r$) of the medium

Calculated process variable
Thickness of buildup

Measuring range

<table>
<thead>
<tr>
<th>Conductivity</th>
<th>0 $\mu$S/cm to 100 mS/cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum permitted span: 3 000 $\mu$S/cm can be ordered; 1 000 $\mu$S/cm can be configured at the device via the IO-Link interface</td>
<td></td>
</tr>
</tbody>
</table>

| Thickness of buildup | 0 to 10 mm |

17.2  Output

Output signal
The following options can be selected in the Product Configurator, order code for "Output":

Preconfigured assignment of the outputs:

- Option B
  - OU1: frequency (buildup)
  - OU2: frequency (conductivity)

- Option C
  - OU1: frequency (buildup)
  - OU2: 4 to 20 mA (conductivity)

Select the HT option if the device is to be adjusted to non-conductive media and the measuring range is to be preconfigured.

Variable assignment of the outputs with the conductivity and thickness of buildup parameters:

- Option 7
  - OU1: IO-Link
  - OU2: 4 to 20 mA (off, conductivity or buildup depending on the order, select the HT option)

- Option 8
  - OU1: IO-Link
  - OU2: frequency (off or conductivity depending on the order, select the HT option)
Signal on alarm

The behavior of the output in the event of a failure is regulated in accordance with NAMUR NE43.

**Frequency**

f < 260 Hz

**Current**

I < 3.6 mA (as per NAMUR NE43)

- Failure current is output and "S803" displayed (output: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

Signal range

- Frequency, lower range value: 300 Hz
- Frequency, end: 3000 Hz
- Signal range: 270 to 3100 Hz
- Current: 3.8 to 20.5 mA

Load

**Load for 4 to 20 mA output**

Depends on the supply voltage $U_B$ of the power supply unit: do not exceed the maximum load resistance $R_L$ (including supply line resistance) as otherwise it will not be possible to set the corresponding current.

\[
R_{L,\text{max}} = \frac{U_B \cdot 6.5 \text{ V}}{21 \text{ mA}}
\]

![Graph showing RLmax vs U_B](image)

16  Load for 4 to 20 mA output

17.3  Performance characteristics

**Reference operating conditions**

- Ambient temperature: constant 20 °C (68 °F) ±5 °C (9 °F)
- Medium: water, conductivity approx. 200 µS/cm
- Medium temperature: 20 °C (68 °F) ±5 °C (9 °F)
  - Conductivity: fully covered, sensor covered by 20 mm of medium
  - Coverage: up to max. 6 mm

**Maximum measured error under reference conditions**

**Conductivity**

≤ 5 %

**Typical measured error**

**Conductivity**

0 to 2 mS/cm: ≤ 5 % of reading ± 0.2 µS/cm
2 to 20 mS/cm: ≤ 7 % of reading
20 to 50 mS/cm: ≤ 10 % of reading
50 to 100 mS/cm: ≤ 15 % of reading

The sensor must be covered by at least 20 mm of medium.
The data indicated are typical measured errors. In individual cases, the effects of factors such as polarization can result in different values.
**Buildup**

The typical measured error is between the limits indicated.

<table>
<thead>
<tr>
<th>Buildup measured value</th>
<th>Actual buildup</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0 to 100 mS/cm</td>
<td>0.01 to 20 mS/cm</td>
</tr>
</tbody>
</table>

**Non-repeatability**

**Conductivity**

<table>
<thead>
<tr>
<th>Conductivity</th>
<th>Non-repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2 mS/cm:</td>
<td>≤ 0.5 % of reading ± 0.2 µS/cm</td>
</tr>
<tr>
<td>2 to 20 mS/cm:</td>
<td>≤ 0.75 % of reading</td>
</tr>
<tr>
<td>20 to 50 mS/cm:</td>
<td>≤ 1.5 % of reading</td>
</tr>
<tr>
<td>50 to 100 mS/cm:</td>
<td>≤ 2.5 % of reading</td>
</tr>
</tbody>
</table>

**Buildup**

≤ 0.25 mm

**Switch-on time**

< 2 s

**Response time**

**Configurable damping**

0.1 to 60 s

T63: as per set damping. Output has behavior of PT₁ element.

**Dead time**

250 ms

### 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)
### Technical data

**Liquitrend QMW43**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Humidity</strong></td>
<td>Operation up to 100 %. Do not connect in a condensing atmosphere.</td>
</tr>
<tr>
<td><strong>Operating altitude</strong></td>
<td>Up to 2,000 m (6,600 ft) above sea level</td>
</tr>
<tr>
<td><strong>Pollution degree</strong></td>
<td>Pollution degree 4</td>
</tr>
<tr>
<td><strong>Climate class</strong></td>
<td>DIN EN 60068-2-38/IEC 68-2-38: Test Z/AD</td>
</tr>
</tbody>
</table>
| **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: $a_{(RMS)} = 50 \text{ m/s}^2$, $f = 5 \text{ to } 2,000 \text{ Hz}$, $t = 3 \text{ axes } \times 2 \text{ h}$ |
| **Shock resistance**  | As per test Ea, prEN 60068-2-27:2007: $a = 300 \text{ m/s}^2 = 30 \text{ g}$, $3 \text{ axes } \times 2 \text{ directions } \times 3 \text{ shocks } \times 18 \text{ ms}$ |
| **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. |
|                       | [Details: 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)
# Index

## Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>µC-temperature</td>
<td>34</td>
</tr>
</tbody>
</table>

## A

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Diagnostics (STA)</td>
<td>29</td>
</tr>
<tr>
<td>Application</td>
<td>31</td>
</tr>
<tr>
<td>Application Specific Tag</td>
<td>29</td>
</tr>
</tbody>
</table>

## C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibrate buildup zero (GTZ)</td>
<td>32</td>
</tr>
<tr>
<td>CE mark</td>
<td>7</td>
</tr>
<tr>
<td>Current Output 2 (OU2)</td>
<td>33</td>
</tr>
</tbody>
</table>

## D

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damping buildup (TAU)</td>
<td>32</td>
</tr>
<tr>
<td>Damping conductivity (TAU)</td>
<td>32</td>
</tr>
<tr>
<td>DC-Media</td>
<td>32</td>
</tr>
<tr>
<td>Declaration of Conformity</td>
<td>7</td>
</tr>
<tr>
<td>Designated use</td>
<td>6</td>
</tr>
<tr>
<td>Device Access Locks.Data Storage Lock (activation/deactivation of data storage)</td>
<td>35</td>
</tr>
<tr>
<td>Device search</td>
<td>30</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>29</td>
</tr>
<tr>
<td>Diagnostic event</td>
<td>21</td>
</tr>
<tr>
<td>Diagnostic events</td>
<td>21</td>
</tr>
<tr>
<td>Diagnostic message</td>
<td>21</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>21</td>
</tr>
<tr>
<td>Symbols</td>
<td>21</td>
</tr>
<tr>
<td>Disposal</td>
<td>25</td>
</tr>
<tr>
<td>Document</td>
<td>4</td>
</tr>
<tr>
<td>Document function</td>
<td>4</td>
</tr>
</tbody>
</table>

## E

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical connection</td>
<td>12</td>
</tr>
<tr>
<td>ENP_VERSION</td>
<td>29</td>
</tr>
<tr>
<td>Error indication</td>
<td>19</td>
</tr>
<tr>
<td>Event text</td>
<td>21</td>
</tr>
<tr>
<td>Extended order code</td>
<td>29</td>
</tr>
</tbody>
</table>

## F

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Output 2 (OU2)</td>
<td>33</td>
</tr>
</tbody>
</table>

## G

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get DC-Media</td>
<td>33</td>
</tr>
</tbody>
</table>

## I

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>In alarm condition</td>
<td>21</td>
</tr>
</tbody>
</table>

## L

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last Diagnostic (LST)</td>
<td>29</td>
</tr>
<tr>
<td>Lower Range Value for 4 mA (LRV)</td>
<td>33</td>
</tr>
<tr>
<td>Lower Range Value for 300 Hz</td>
<td>33</td>
</tr>
</tbody>
</table>

## M

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum µC-Temperature</td>
<td>35</td>
</tr>
</tbody>
</table>

## Menu

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>28</td>
</tr>
<tr>
<td>Parameter description</td>
<td>29</td>
</tr>
<tr>
<td>Minimum µC-Temperature</td>
<td>34</td>
</tr>
</tbody>
</table>

## N

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nameplate</td>
<td>9</td>
</tr>
</tbody>
</table>

## O

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset buildup</td>
<td>32</td>
</tr>
<tr>
<td>Operating hours</td>
<td>34</td>
</tr>
<tr>
<td>Operating menu</td>
<td>28</td>
</tr>
<tr>
<td>Parameter description</td>
<td>29</td>
</tr>
<tr>
<td>Operating Mode (OU1)</td>
<td>31</td>
</tr>
<tr>
<td>Operating Mode (OU2)</td>
<td>31</td>
</tr>
<tr>
<td>Operational safety</td>
<td>7</td>
</tr>
</tbody>
</table>

## P

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>31</td>
</tr>
<tr>
<td>Product identification</td>
<td>8</td>
</tr>
<tr>
<td>Product safety</td>
<td>7</td>
</tr>
</tbody>
</table>

## R

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for the personnel</td>
<td>6</td>
</tr>
<tr>
<td>Reset µC-Temperature</td>
<td>35</td>
</tr>
<tr>
<td>Return</td>
<td>24</td>
</tr>
</tbody>
</table>

## S

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety instructions Basic</td>
<td>6</td>
</tr>
<tr>
<td>Sensor</td>
<td>31</td>
</tr>
<tr>
<td>Sensor check</td>
<td>31</td>
</tr>
<tr>
<td>Simulated buildup</td>
<td>30</td>
</tr>
<tr>
<td>Simulated conductivity</td>
<td>30</td>
</tr>
<tr>
<td>Simulation buildup / Simulation conductivity</td>
<td>30</td>
</tr>
<tr>
<td>Standard Command</td>
<td>23, 35</td>
</tr>
<tr>
<td>Status signals</td>
<td>21</td>
</tr>
<tr>
<td>System</td>
<td>34</td>
</tr>
</tbody>
</table>

## U

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit changeover (UNI) - µC-Temperature</td>
<td>34</td>
</tr>
<tr>
<td>Upper Range Value for 20 mA (URV)</td>
<td>33</td>
</tr>
<tr>
<td>Upper Range Value for 3000 Hz</td>
<td>33</td>
</tr>
</tbody>
</table>

## W

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workplace safety</td>
<td>7</td>
</tr>
</tbody>
</table>