

Operating Instructions

Density Calculator QML51

Vibronic

Density calculator for liquids





A0023555

- Make sure the document is stored in a safe place such that it is always available when working on or with the device
- Avoid danger to individuals or the facility: read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures

The manufacturer reserves the right to modify technical data without prior notice. The Endress+Hauser sales organization will supply you with current information and updates to these instructions.

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1 About this document

1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.2 Symbols

1.2.1 Safety symbols

DANGER

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

WARNING

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

CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Symbols on the device

Safety instructions:  → 

Observe the safety instructions contained in the associated Operating Instructions. Observe the information on the degree of protection and shock resistance.

1.2.3 Communication-specific symbols

 LED is off

 LED is on

 LED flashing

1.2.4 Symbols for certain types of information

 **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



Reference to documentation



Reference to page



Reference to graphic

1.2.5 Symbols in graphics

1, 2, 3, ...

Item numbers

1., 2., 3.

Series of steps



Result of a step



Notice or individual step to be observed

A, B, C, ...

Views



Viewing angle

Indicates the object is shown from another view



Hazardous area

Indicates the hazardous area



Safe area (non-hazardous area)

Indicates the non-hazardous area

1.3 Documentation



For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid for your device This document provides all technical data for the device and gives an overview of the accessories and additional items that can be ordered for it.
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.
Operating Instructions (BA)	Your reference document The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Document type	Purpose and content of the document
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions.  The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the device documentation.

1.3.1 Supplementary device-dependent documentation

Operating Instructions

- BA02593F: FTL51B Density
- BA02599F: FTL62 Density
- BA02600F: FTL63 Density

Special Documentation

- SD03498S: OPC UA server
- SD03501S: Modbus TCP server
- SD03538S: DATEXEL DAT8024M

1.4 Registered trademarks

Google Chrome™ browser

Registered trademark of Google LLC in Mountain View, California, USA

HART®

Registered trademark of the FieldComm Group, Austin, Texas, USA

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

OPC UA

Registered trademark of the OPC Foundation, Scottsdale, Arizona, USA

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 Intended use

Density Calculator QML51 is used to calculate the medium density, reference density and concentration of liquids, as well as for media detection.

The measuring system consists of the following equipment:

- One Density Calculator QML51
- Up to two 2 Liquiphant Density devices (electronic insert FEL60D)
- Up to 2 temperature sensors
- Up to 2 pressure measuring cells

Density Calculator QML51 uses mathematical methods and standards to calculate derived variables such as the concentration of a medium.

 The exact number of sensors depends on the specific installation and configuration.

The input and output connections must be established as described in the documentation accompanying the product.

Use only the power supply unit described in the documentation accompanying the product for the power supply.

Incorrect use

 The manufacturer is not liable for harm caused by improper or unintended use.

2.3 Workplace safety

For work on and with the device:

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

2.4 Operational safety

When performing configuration, testing, and maintenance work on the device, alternative supervisory measures must be taken to guarantee the operational safety and process safety.

Damage to the device!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for 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 modifications are nevertheless 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 national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It 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 EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

2.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product features security mechanisms to protect it against any inadvertent changes to the settings. Security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

2.7 Device-specific IT security

The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section: Access to the device's web server is only possible with the correct login credentials.

3 Product description

3.1 Measuring principle

The measuring system consists of the following main components:

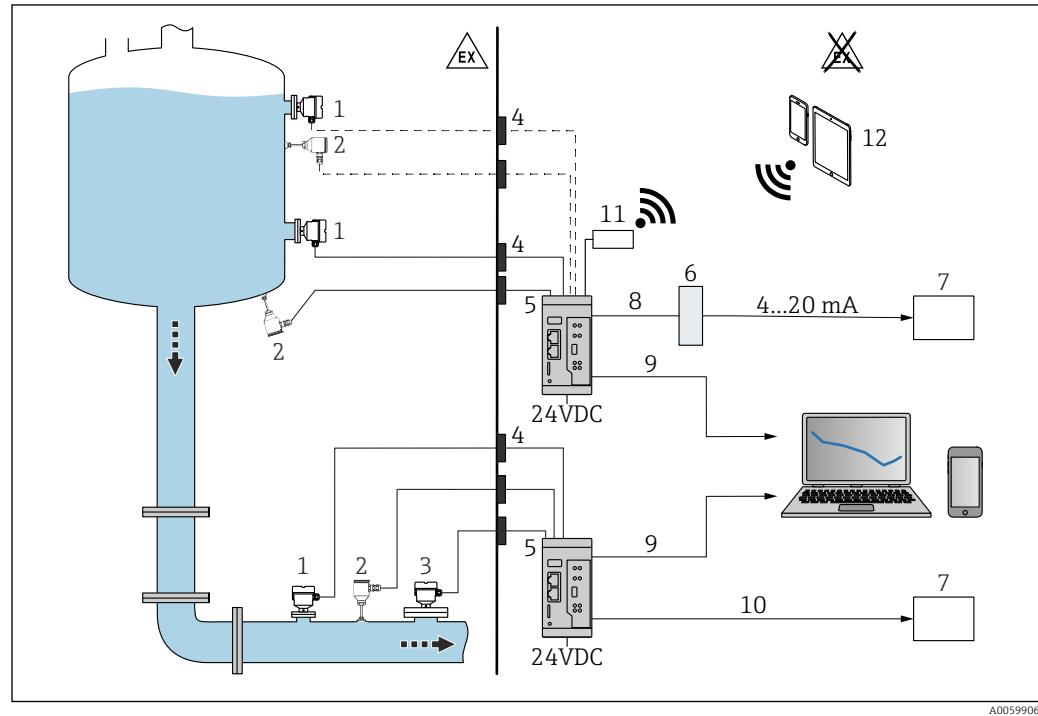
- Liquiphant Density
- Density calculator

In conjunction with the density calculator, the Liquiphant Density measures the density of a Newtonian, purely viscous, liquid in pipes and tanks.

A piezoelectric drive causes the vibrating fork of the Liquiphant Density to vibrate at its resonance frequency. Changes in liquid density cause a change in the resonance frequency of the vibrating fork. As a result, the density of the medium has a direct impact on the resonance frequency of the vibrating fork. This effect is used for density measurement.

In the density calculator, the density of the liquid is calculated from the resonance frequency of the vibrating fork transmitted by the sensor and from stored sensor-specific parameters. To compensate for temperature and pressure influences, additional corresponding sensors can be connected to the density calculator.

3.2 Measuring system



1 Density measurement with Density Calculator QML51

- 1 Liquiphant Density with electronic insert FEL60D → pulse output
- 2 Temperature sensor, e.g. 4 to 20 mA output
- 3 Pressure transmitter 4 to 20 mA output; required for pressures above 6 bar (87 psi) or for pressure fluctuations.
- 4 Ex barrier (Liquiphant Density, temperature and/or pressure measuring cell installed in the hazardous area)
- 5 Density Calculator QML51
- 6 Modbus TCP to 4 to 20 mA converter
- 7 Programmable logic controller (PLC)
- 8 Modbus TCP
- 9 Ethernet
- 10 Modbus TCP or OPC UA
- 11 TELTONIKA Router RUT241 (accessory). For a wireless connection.
- 12 Mobile devices

i For use in hazardous areas: Ex barrier via RN22 active barrier. The two-channel RN22 active barrier powers analog device circuits and safety equipment up to SIL 2 (SC 3). The intrinsically safe, HART® transparent interface provides a reliable connection between the field devices and Density Computer QML51. It is connected to 2-wire/4-wire devices in hazardous areas and provides a second galvanically isolated signal output in accordance with NAMUR NE 175.

In addition to calculating the density of a liquid medium, Density Calculator QML51 can also determine the reference density of the medium and the concentration of a solution, as well as detect up to four different media or an empty pipeline.

In doing so, the density calculator evaluates up to two measuring points and directly supplies connected two-wire transmitters with auxiliary power. This allows the connection of up to two Liquiphant Density sensors and two temperature sensors for compensation of temperature effects in order to calculate reference densities.

For concentration determination, stored standards such as ICUMSA for sugar concentrations, OIML ITS-90 for ethanol, and various preconfigured calculations for electrolyte solutions (according to the Laliberté-Cooper model) can be used.

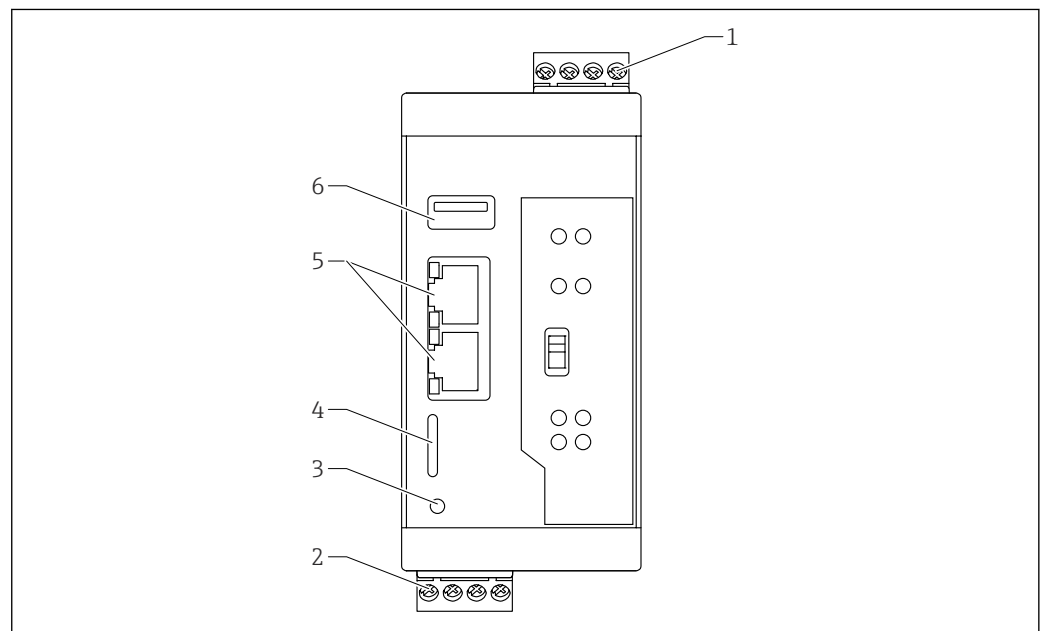
Specific reference density or concentration tables can be entered manually in the form of linearization tables or imported into the density calculator in standard data formats (e.g., .csv, .xlsx) and used for calculations.

Density and concentration values can be output in various units, for example, SI units, °Baume, °Brix or °API.

Configuration of the QML51 is performed via an integrated web server, which can be accessed via a secure TLS connection using a standard web browser.

For output to a PLC or a SCADA system, the QML51 supports the Ethernet protocols Modbus TCP and OPC UA. If a current signal is required for connection to a PLC, this can be generated via a converter. A converter that generates up to 4 channels with an analog 4 to 20 mA signal from the Modbus TCP protocol is available as an accessory.

3.3 Product design



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- 1 Terminals for inputs
- 2 Power supply terminal
- 3 Reset button
- 4 microSD card slot
- 5 LAN interfaces
- 6 USB slot

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
 - ↳ Report all damage immediately to the manufacturer.
Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.



If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Enter the serial number from the nameplate in the *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number from the nameplate into the *Endress+Hauser Operations app* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations app*: all the information about the device and the technical documentation pertaining to the device are displayed.

4.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:

- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values such as supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

► Compare the information on the nameplate with the order.

4.2.2 Manufacturer address

Endress+Hauser SE+Co. KG

Hauptstraße 1

79689 Maulburg, Germany

Place of manufacture: See nameplate.

4.3 Storage and transport

4.3.1 Storage conditions

- Use the original packaging
- Store the device in clean and dry conditions and protect from damage caused by shocks

Storage temperature

–25 to 85 °C (–13 to 185 °F)

5 Installation

5.1 Installation requirements

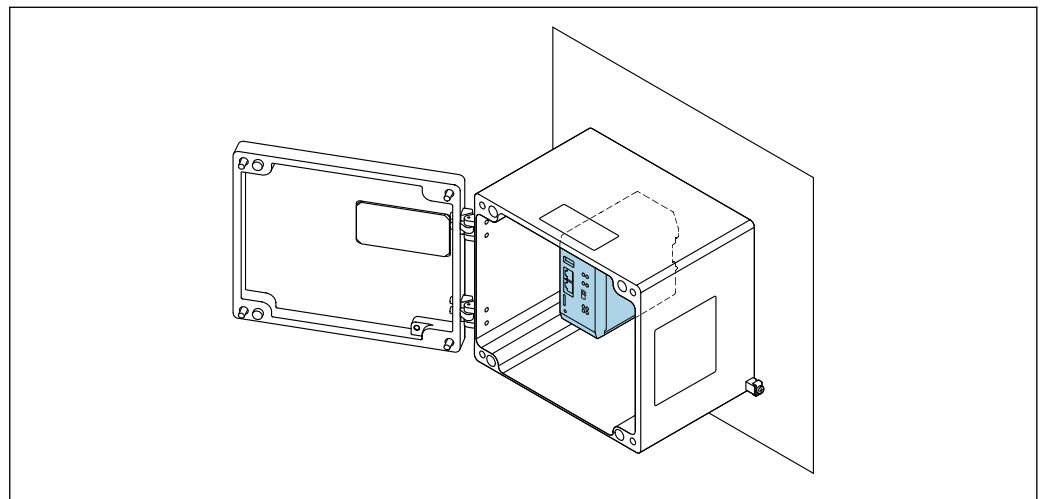
5.1.1 Ambient temperature range

–20 to 60 °C (–4 to 140 °F)

5.1.2 Mounting location

Installation requirements:

- Install the device outside the hazardous area.
- Use a control cabinet. The control cabinet must be securely and firmly mounted.
- For installation in a humid environment or outdoors:
The degree of protection of the control cabinet must be at least IP67 in accordance with IEC 60529



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 2 Example illustration: installation in a control cabinet

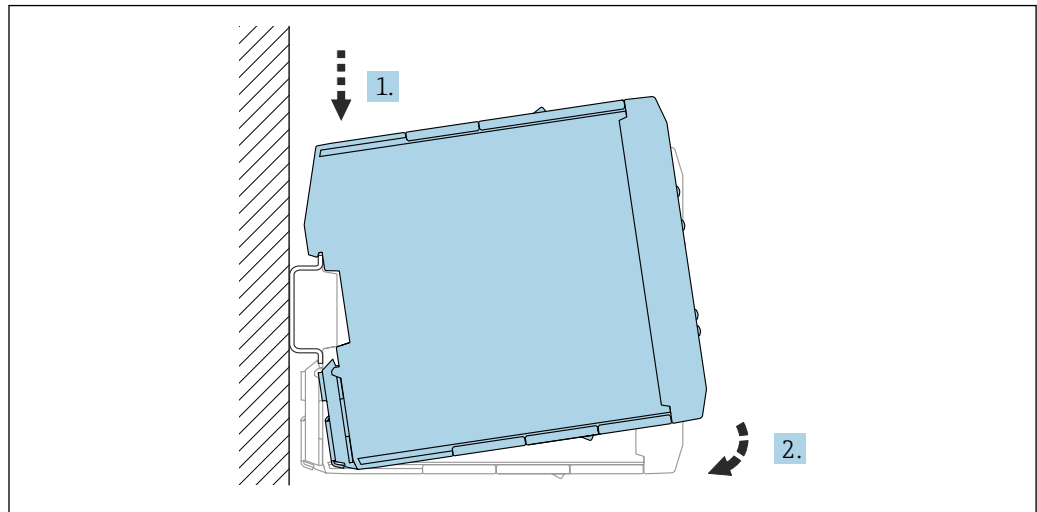
 Check the environmental requirements before installing the device in an outdoor location.

5.1.3 Orientation

Vertical or horizontal installation on DIN rail (TH35 in accordance with EN 60715).

5.2 Installing the device

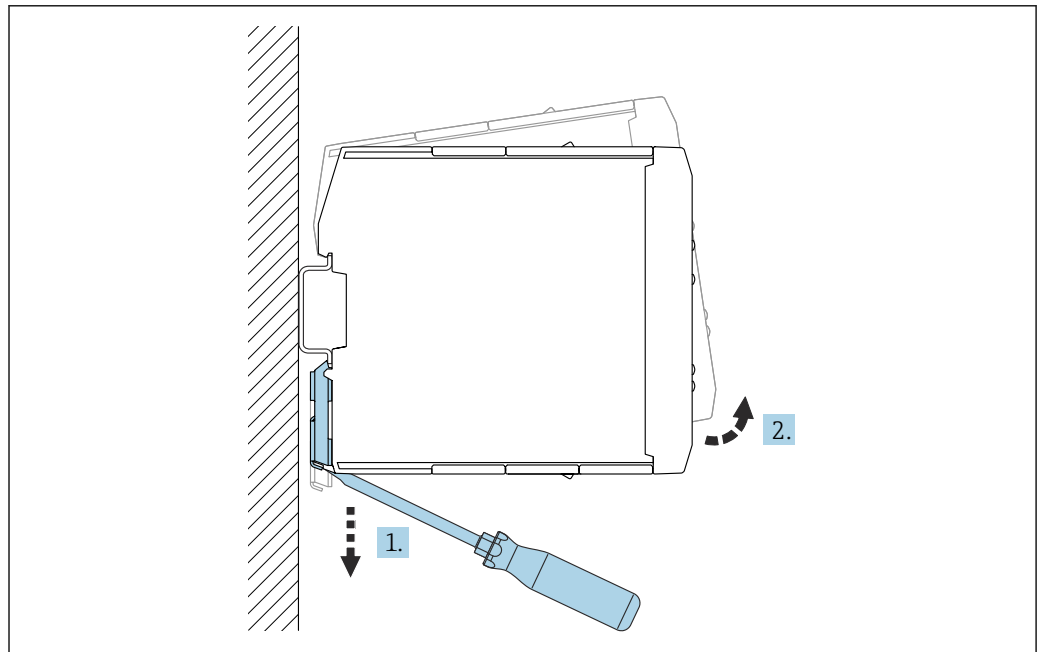
- Install the device on a DIN rail.



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1. Hook the housing onto the DIN rail.
2. Press the housing downward until it snaps into place on the DIN rail.

5.3 Removing device from top-hat rail



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1. Unlock the latch.
2. Pull up the housing.

5.4 Post-installation check

After mounting, make sure that:

- ☐ The device is in the correct position and the orientation is correct
- ☐ The device is protected from precipitation and direct sunlight
- ☐ The device is securely seated on the top-hat rail
- ☐ The top-hat rail clip is engaged
- ☐ The temperature limits are observed at the mounting location
- ☐ The mechanical connections are tightened

6 Electrical connection

WARNING

Risk of electric shock!

Burn injuries, cardiac arrhythmia, and other injuries caused by shock reactions following an electric shock can result.

- ▶ Always switch off the supply voltage first and measure to check that it is de-energized. Only then install or wire the device.
- ▶ Only properly trained specialist staff may perform electrical connection work.
- ▶ Before the supply voltage is applied, connect the protective ground to the device.
- ▶ Take the plant grounding concept into consideration.
- ▶ Comply with local workplace safety regulations.

6.1 Connecting requirements

- Provide a suitable switch or circuit breaker according to IEC EN 61010 in the building installation that can interrupt the supply voltage. This switch must be within easy reach, close to the device and marked as a circuit breaker.
- The supply voltage to which the device is to be connected must match the specifications on the nameplate. Only connect the device if this condition is met.

6.1.1 Cable specification

Power supply line

Conductor cross-section: 0.5 to 2.5 mm² (20 to 13 AWG)

Shielded cable not required.

Fieldbus connection

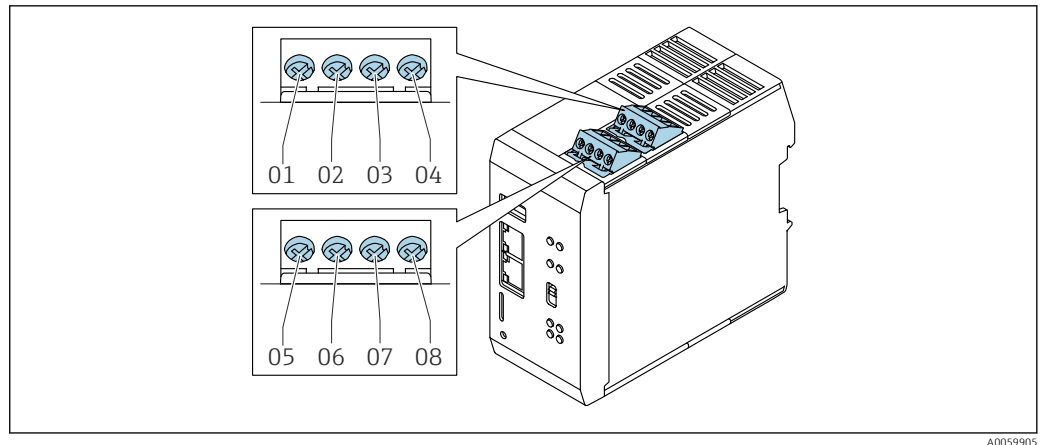
Conductor cross-section: 0.5 to 2.5 mm² (20 to 13 AWG)

 Use shielded cables.

HART communication line

- For applications with HART protocol transmission, use a shielded cable.
- For applications with pure analog signal transmission, an unshielded cable may be used.

 Observe the grounding concept of the plant. Connect the shielding according to the application.



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3 Terminal assignment

- 01 Channel 3 (+), default setting: PFM
- 02 Channel 3 (-), default setting: PFM
- 03 Channel 4 (+), default setting: operating mode 4 to 20 mA
- 04 Channel 4 (-), default setting: operating mode 4 to 20 mA
- 05 Channel 1 (+), default setting: PFM
- 06 Channel 1 (-), default setting: PFM
- 07 Channel 2 (+), default setting: operating mode 4 to 20 mA
- 08 Channel 2 (-), default setting: operating mode 4 to 20 mA

i The channels are preset. The configuration can be changed.

i It is not possible to connect a device with a pulse output (PFM) and a device with a 4 to 20 mA HART or HART-only transmission to the same terminal block if the measured values are to be transmitted via HART communication.

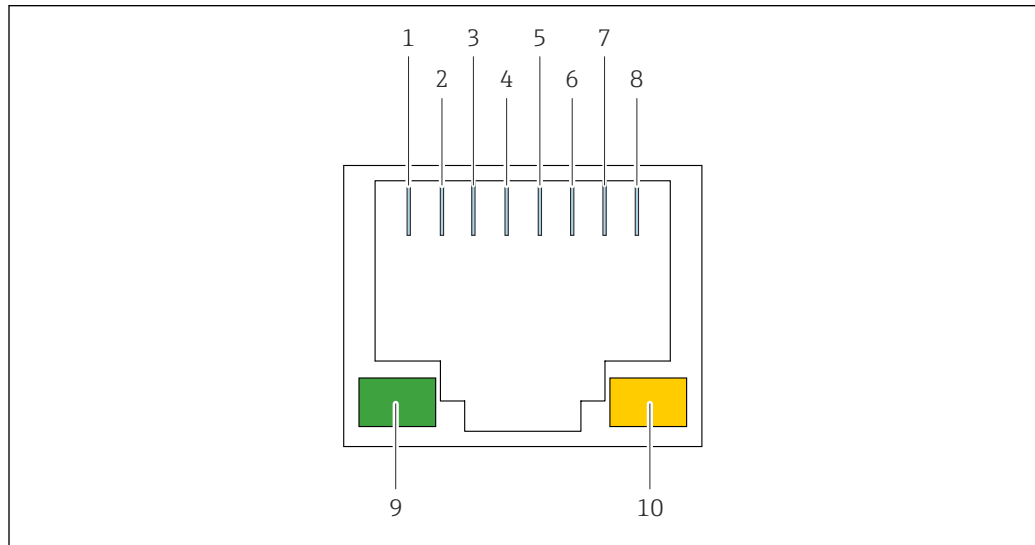
i It is not possible to connect two devices with a pulse output (PFM) to the same terminal block.

The following devices can be connected to one terminal block:

- One device with a pulse output and one additional device with an analog output (4 to 20 mA).
- One device with a pulse output and one additional device with a 4 to 20 mA HART output, provided that HART communication is not used.
- Only one device with a pulse output. An additional device with a pulse output cannot be connected to the same terminal block.
- One or two devices with 4 to 20 mA or 4 to 20 mA HART. In this case, HART communication can be used by both devices.

6.4 LAN interface

- 2 shielded RJ45 sockets are available.
- The LAN interface is compatible with the IEEE 802.3 standard.
- The assignment corresponds to a standard-compliant MDI interface (AT&T258).
- The device can be connected to other devices via the LAN interface using a hub or switch.
- Half-duplex and full-duplex data transmission are supported.
- A shielded 1:1 cable with a maximum length of 100 m (328 ft) can be used.
- The LAN interface is designed for a bandwidth of 1 Gbit/s, 100 Mbit/s and 10 Mbit/s.
- Observe the safety distances specified in the EN 60950 office equipment standard.



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4 Pin assignment of the RJ45 sockets and LED description

- 1 Tx+
- 2 Tx-
- 3 Rx+
- 4 Not connected
- 5 Not connected
- 6 Rx-
- 7 Not connected
- 8 Not connected
- 9 Green LED: link indicator
- 10 Yellow LED: active transfer indicator

6.5 Post-connection check

After connection, make sure that:

- ☐ The device is not damaged
- ☐ The cables are not damaged
- ☐ The mounted cables have adequate strain relief
- ☐ The plug-in terminals are securely engaged
- ☐ The supply voltage matches the specifications on the nameplate
- ☐ The terminal assignment is correct

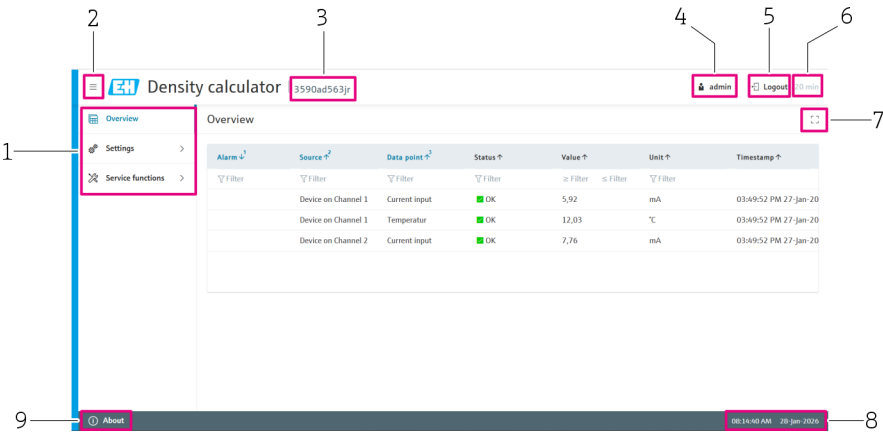
7 Operation options

7.1 Access to the operating menu via web browser

The device's web server can be called up at the LAN 2 port via `https://IPDDRESS`. Default IP address: 192.168.3.1. The connection is TLS secure.

All of the main settings required to operate the device are made on the software user interface. The functions and settings can be accessed via the navigation area on the left-hand side of the screen.

 The browser may detect an unsecured connection, e.g. if the browser recognizes that the issued server certificate is not trusted. This risk can be accepted. To have the device certificate recognized as trusted, contact your IT service provider or Endress +Hauser Service team.



The screenshot shows the web interface of the Density calculator. The interface includes a navigation menu on the left (1), a header bar with a hamburger menu (2), device identification (3), user login (4), and logout (5). The main content area displays an 'Overview' table with columns for Alarm, Source, Data point, Status, Value, Unit, and Timestamp. The footer shows the system time and date (8) and an 'About' button (9).

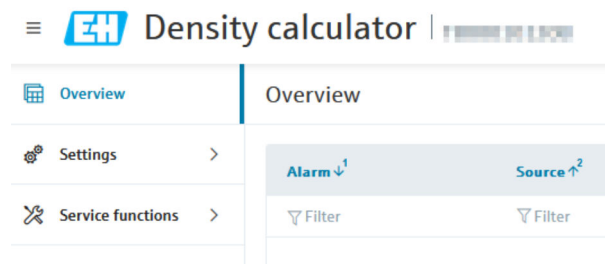
Alarm	Source	Data point	Status	Value	Unit	Timestamp
Filter	Device on Channel 1	Current input	OK	5,92	mA	03:49:52 PM 27-Jan-20
Filter	Device on Channel 1	Temperature	OK	12,03	°C	03:49:52 PM 27-Jan-20
Filter	Device on Channel 2	Current input	OK	7,76	mA	03:49:52 PM 27-Jan-20

- 1 Navigation
- 2 Hide navigation
- 3 Identification of the device (Hostname)
- 4 User logged in
- 5 Logout button
- 6 Remaining time until user is forced out due to inactivity
- 7 Hide header and menus. Only the opened menu item is displayed
- 8 System time and date of the device displayed
- 9 Access to system information such as the serial number, firmware version and device name (Device name)

7.2 Overview of the operating menu

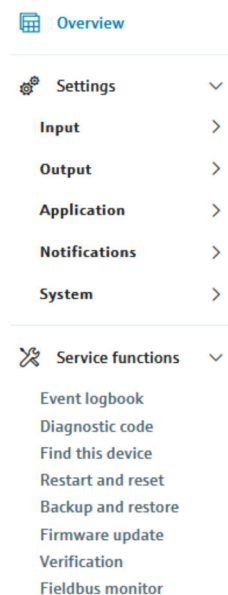
Within the user interface, the user reaches the individual functions via a menu tree of three levels. The menu tree is on the left-hand side and can be expanded or reduced by clicking on the hamburger menu at the top left.

7.2.1 Level 1



- **Overview** – Overview of alarms, data sources, data points, status information, values, units and timestamp. There are no further submenus here
- **Settings** – Main menu where all submenus for the settings of inputs, outputs, notifications, system and so on can be found
- **Service functions** – Main menu under which all of the submenus that are required for the service of the device are located

7.2.2 Level 2



The two **Settings** and **Service functions** menus contain submenus.

Only the submenus in the **Settings** menu contain additional submenus.

Settings

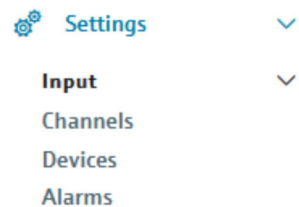
- **Input** – Access to the settings for input channels, connected devices and alarms
- **Output** – Overview of outputs and access to configuration settings for the output types. Overview of the assignment of the channels to the signal converter and access to the configuration
- **Application** – Add and delete linearizations, configure measuring points with sensor-specific parameters, select applications
- **Notifications** – Configure alarm messages and create email recipients
- **System** – Access to all settings relevant to the system. Basic settings for the operating language, date, system time, certificates, SMTP, system settings, units and much more

Service functions

- **Event logbook** – Overview of the events, organized by type, timestamp, category and description
- **Diagnostic code** – Diagnostic list with diagnostics codes according to NAMUR recommendation NE107, short description and troubleshooting measures
- **Find this device** – Turns a flashing LED on and off to find the device quickly
- **Restart and reset** – Restart the device by accessing the user interface or reset to the factory settings
- **Backup and restore** – Data backup and data recovery
- **Firmware update** – Install updated firmware and read the installed version
- **Verification** – Check the freely oscillating fork of the Liquiphant-type measuring instrument for frequency deviation
- **Fieldbus monitor** – Analyze messages that are exchanged between the device and other field devices

7.2.3 Level 3

Input



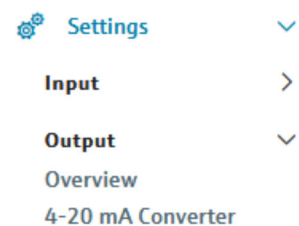
Only the submenus in the **Settings** menu contain additional submenus.

Input

Access to the settings for input channels, connected devices and alarms

- **Channels** – Set the fieldbus polling and power supply mode
- **Devices** – Define settings for connecting to field devices
- **Alarms** – Configure threshold values and other parameters for alarms

Output



Output

Overview of outputs and access to configuration settings for the output types. Overview of the assignment of the channels to the signal converter and access to the configuration

- **Overview** – Set the fieldbus polling and power supply mode
- **4-20 mA Converter** – Map the available data points to a Modbus output register

Application

 Settings	▼
Input	>
Output	>
Application	▼
Linearizations	
Measurement point 1	
Measurement point 2	

Application

Add and delete linearizations, configure measuring points with sensor-specific parameters, select applications

- **Linearizations** – Menu for managing linearizations
- **Measurement point 1** – Set up a measuring point with a Liquiphant-type measuring instrument
- **Measurement point 2** – Set up a measuring point with a Liquiphant-type measuring instrument

Notifications

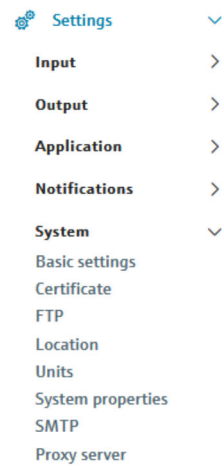
 Settings	▼
Input	>
Output	>
Application	>
Notifications	▼
Email	
Recipients	

Notifications

Configure alarm messages and create email recipients

- **Email** – Define text templates for alarm types
- **Recipients** – Configure and manage recipients of email notifications

System

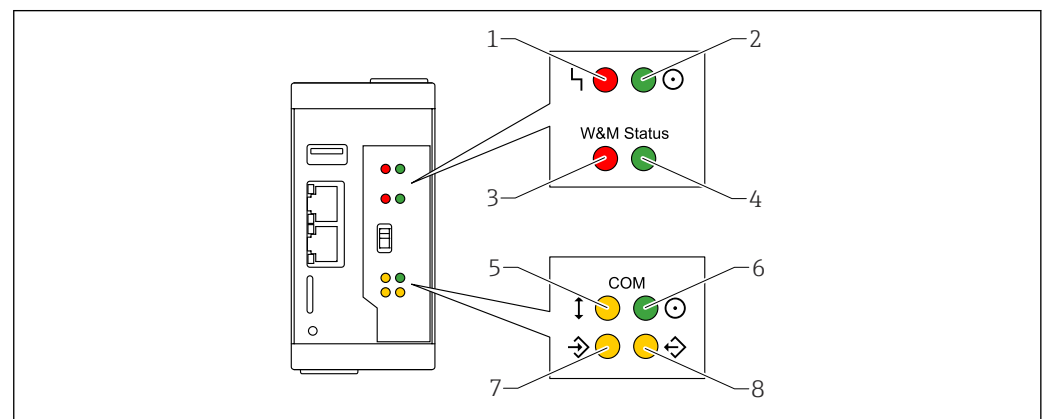


System

Access to all settings relevant to the system. Basic settings for the operating language, date, system time, certificates, SMTP, system settings, units and much more

- **Basic settings** – Setting the system language, network settings, date and time
- **Certificate** – Information about managing certificates
- **FTP** – Configure data transmission via FTP
- **Location** – Enter location information via the device
- **Units** – Manage units in the system
- **System properties** – System settings that may only be adjusted in special cases
- **SMTP** – Set up the SMTP server
- **Proxy server** – Enter data for proxy server

7.3 Local display



5 Description of LED statuses

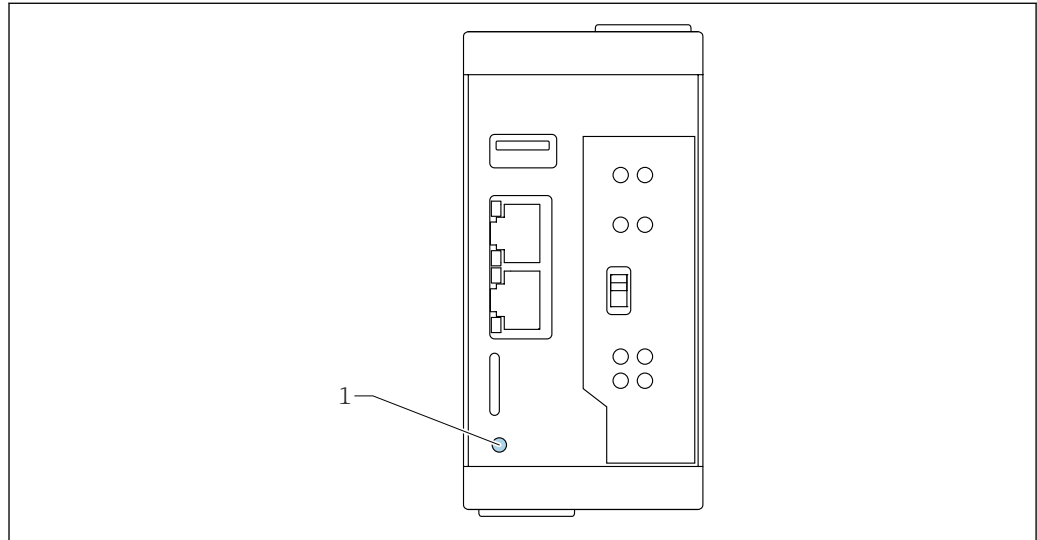
- 1 Red LED: Fault
- 2 Green LED: Power supply status
- 3 Red LED: verification switch in the locked position (no function assigned for Density Calculator QML51)
- 4 Green LED: verification switch in the unlocked position (no function assigned for Density Calculator QML51)
- 5 Yellow LED: Field communication status
- 6 Green LED: Power supply status of the communication interface
- 7 Yellow LED: Incoming data packets
- 8 Yellow LED: Outgoing data packets

7.4 Controls

Reset button

The device is reset to the factory settings.

Use a pen tip to press the reset button.

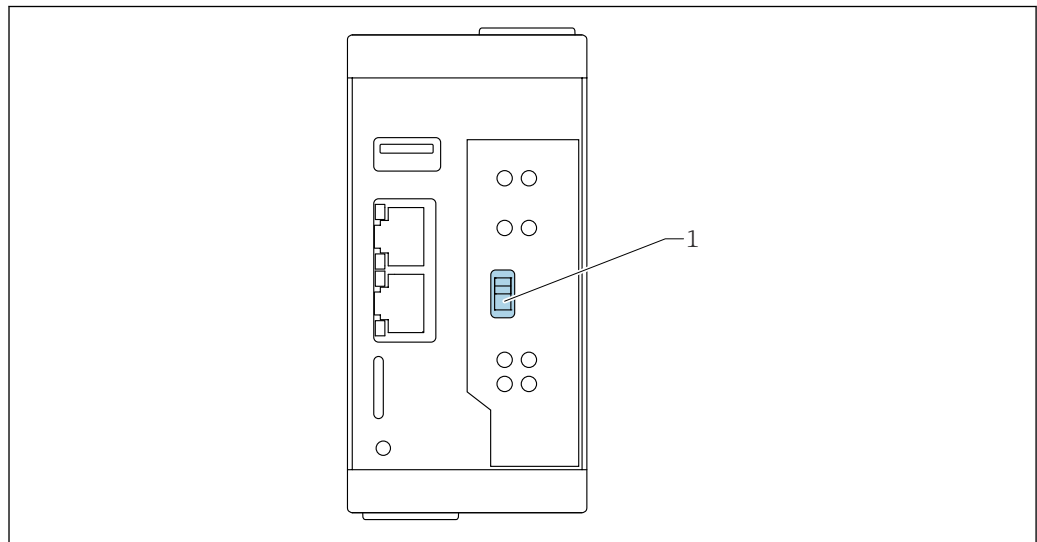


A0046191

 6 Reset button position

1 Reset button

Hardware switch (no function)



A0046237

1 Hardware switch (no function)

 This switch has no function on the Density Calculator QML51.

7.5 Interfaces for data transmission

The device configuration (user data, log files, certificates, or diagnostic codes) can be saved.

Prerequisites:

- To save a backup to a USB stick or an SD card, an appropriate permitted storage medium must be available and have been detected by the device.
- If the backup is to be saved on an FTP server, an FTP server must first be set up and connection must be possible.

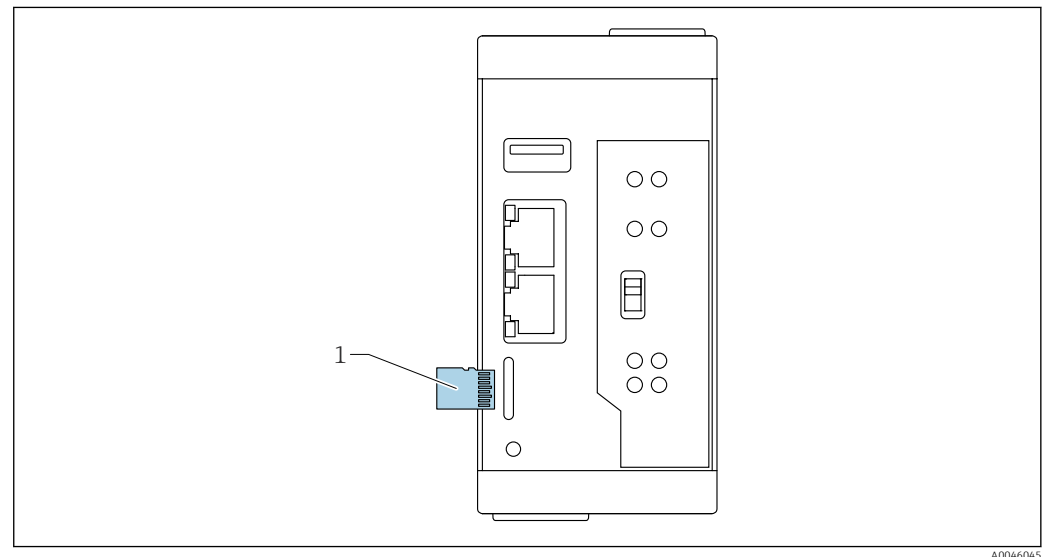
A backup can be protected with a password by the system. The password can be freely selected without restriction. A password-protected backup can only be imported to another system with the associated password.

7.5.1 Card slot

 The microSD card is not included in the delivery.

Endress+Hauser recommends using microSD cards with the following parameters:

- Storage capacity: 8 to 64 GB
- Temperature range: -40 to 85 °C (-40 to 185 °F)



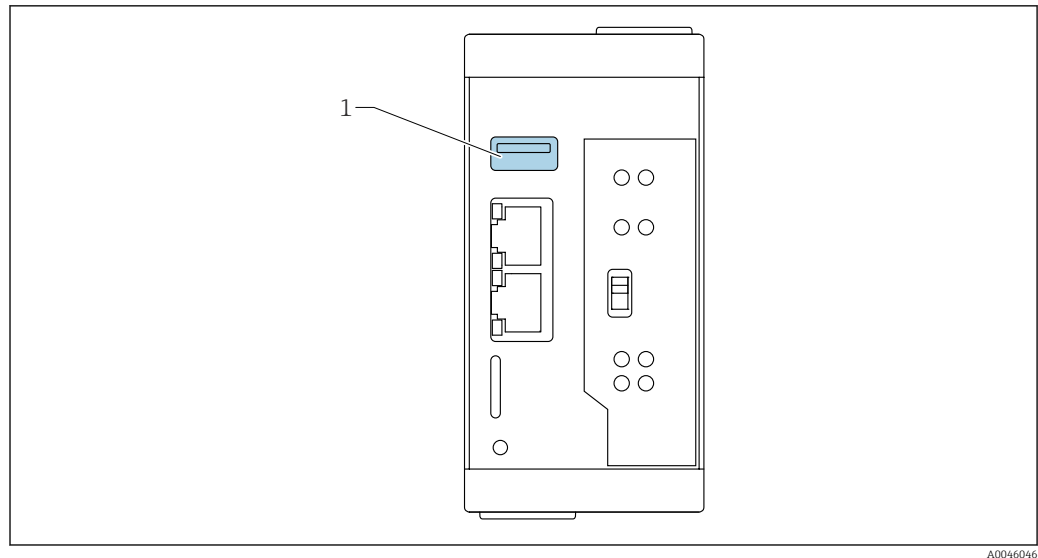
 7 Position of the card slot

1 microSD card

7.5.2 USB port

USB (type A) port data:

- USB 2.0 Host
- Up to 480 Mbit/s
- 5 V_{DC} up to 1.5 A



A0046046

8 USB port position

1 USB port

8 Commissioning

8.1 Prior to initial commissioning

i After connecting the power supply, the device requires up to 10 min to complete the boot process.

The device's web server can be called up via <https://IPDDRESS>. The connection is TLS secure.

Default IP address on LAN 2: 192.168.3.1

Establishing a connection to the device's web server

1. Connect an Ethernet cable to the **LAN 2** port to establish a connection to the web server.
2. Start the web browser on the connected PC and enter the default IP address in the format <https://IPDDRESS>.
3. Log onto the device as administrator. To do this, log in as the user **admin** with the default password **admin** and then set a new password with at least 12 characters.

NOTICE

The password cannot be reset.

If the assigned password can no longer be retrieved, the device must be reset to factory settings using the reset button. See the "Device reset" section.

► Keep the password in a safe place!

i A message may be displayed the first time the system is started, indicating that the existing connection is not secure. The reason is that the stored certificate is not known to the web browser used. Once the device certificate has been added to the trusted websites list, the connection is recognized as secure. See the "Integrating certificates" section.

i If the device has already been configured and the IP address changed, use the configured IP address of LAN 1 or LAN 2.

i The connection is TLS secure.

8.2 Initial commissioning via the Basic settings

 Parameters marked with * are mandatory fields.

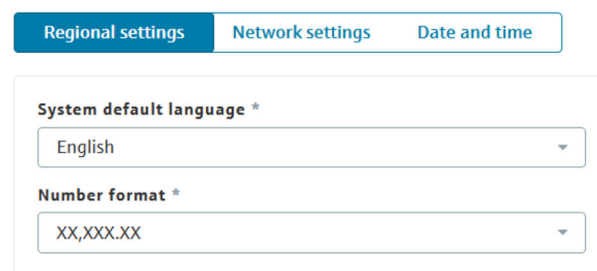
Path: Settings → System → Basic settings

During initial commissioning, the user is guided through the most important settings and given explanations of the parameters available. The basic settings configured can be called up and edited again later.

8.2.1 Regional settings

Path: Settings → System → Basic settings

Basic settings



1. Open the **System default language** drop-down list and select the language for the graphical user interface.
2. Open the **Number format** drop-down list and select a number format.

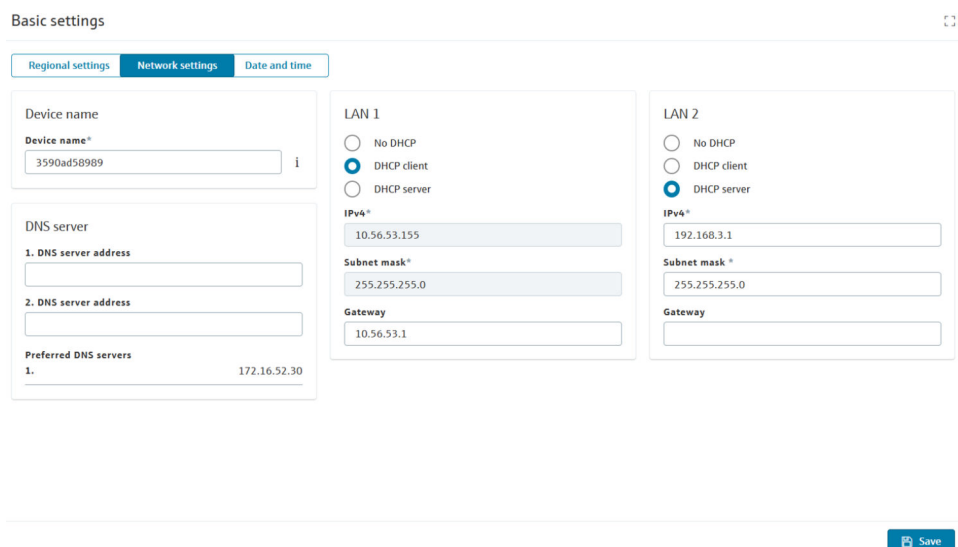
8.2.2 Network settings

Path: Settings → System → Basic settings

On the **Network settings** tab, various settings must be entered to connect the device to the network correctly.

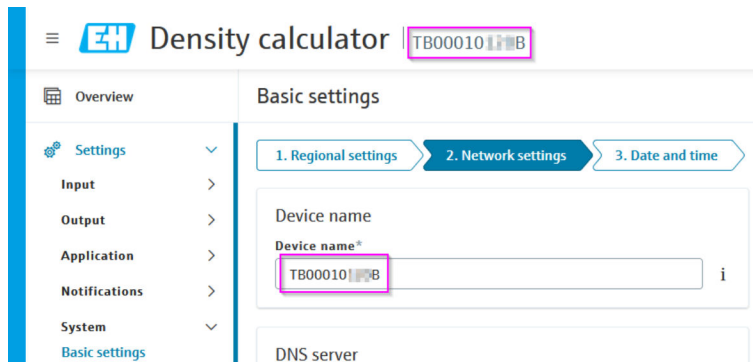
 LAN 1 and LAN 2 should be in different networks.

 It is not recommended to change the factory preset service IP address 192.168.3.1 on LAN 2.



1. Connect an Ethernet cable to LAN 1.
 2. Start up LAN 1.
 3. Enter a host name for the device in the **Device name** field. If multiple devices of the same type are used in a network, it is recommended to assign individual names to help identification.
 4. In the **LAN** section, select one of the check boxes to determine the role the device is to assume in the network.
 5. Enter an IP address in the **IPv4** field in the **LAN** section if **No DHCP** or **DHCP server** is selected. If **DHCP client** is selected, the IP address is taken from the network where the device is located.
 6. Enter the subnet mask in the **Subnet mask** field in the **LAN** section.
 7. Click the **Save** button to save the settings.
-  If there are any changes to the IP addresses, the device must be called up via the new IP address.

A restart is not necessary if the connection has been established.



The screenshot shows the 'Density calculator' web interface. The top navigation bar includes a menu icon, the 'Density calculator' title, and a user profile icon labeled 'TB00010111B'. The left sidebar contains a list of settings categories: Overview, Settings (selected), Input, Output, Application, Notifications, System, and Basic settings. The main content area is titled 'Basic settings' and features three tabs: '1. Regional settings', '2. Network settings' (active), and '3. Date and time'. Under the 'Network settings' tab, the 'Device name' section is visible, containing a text input field labeled 'Device name*' with the value 'TB00010111B' and a small 'i' icon to its right. Below this, the 'DNS server' field is shown as an empty text input.

- **Device name** - Host name of device. The host name of the device is shown in the header of the user interface. Default setting: Serial number of the device
- **LAN 1** - Ethernet interface on the housing front provided for connection to the network
 - **No DHCP** - Parameters for network configuration are not assigned automatically. Static IP address, subnet mask and gateway must therefore be entered
 - **DHCP server** - The device acts as a DHCP server and can distribute IP addresses. The IP address and subnet mask must be entered
 - **DHCP client** - The device is given a free IP address from a DHCP server in the network. The IP address is displayed when a connection is established
 - **Gateway** - Gateway that connects the device to another network. It ensures that data is forwarded to other networks
- **DNS server** - Up to 2 DNS servers can be configured on the device. Format of IP addresses: IPv4
 - **1.DNS server address** - IP address of the first DNS server
 - **2.DNS server address** - IP address of the second DNS server
 - **Preferred DNS servers** - If the device receives an IP address from a DHCP server, the server may also provide a DNS server. The specified DNS server is identified as the preferred DNS server and displayed
- **LAN 2** - This interface is provided as a service LAN port. It is accessed via IP address 192.168.3.1 by default and acts as a DHCP server. This configuration should be retained to ensure easy service access. If necessary, LAN 2 can then be reconfigured like LAN 1
 - **No DHCP** - Parameters for network configuration are not assigned automatically. Static IP address, subnet mask and gateway must therefore be entered
 - **DHCP server** - The device acts as a DHCP server and can distribute IP addresses. The IP address and subnet mask must be entered
 - **DHCP client** - The device is given a free IP address from a DHCP server in the network. The IP address is displayed when a connection is established
 - **Gateway** - Gateway that connects the device to another network. It ensures that data is forwarded to other networks

8.2.3 Date and time

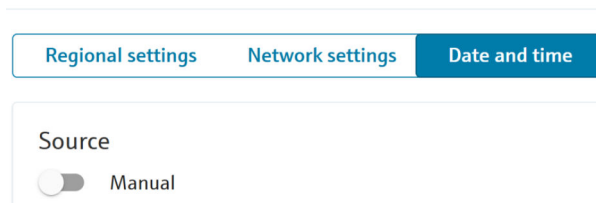
Path: Settings → System → Basic settings

- Click the **Date and time** tab.

The date and time can either be entered manually or sourced using the NTP (Network Time Protocol) via the browser.

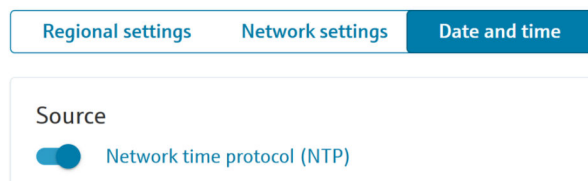
Click the **Source** toggle switch to switch between the two options:

Basic settings



 9 Toggle switch set to manual entry (default setting)

Basic settings



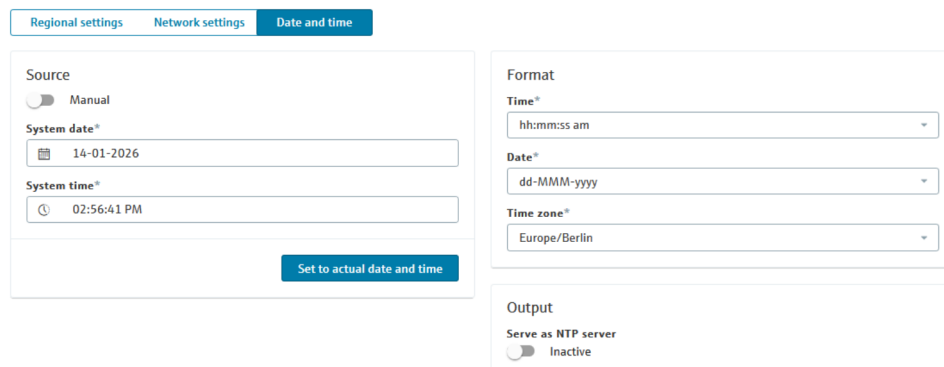
Regional settings Network settings **Date and time**

Source

☒ Network time protocol (NTP)

 10 Toggle switch set to obtain date and time via NTP

Configure Date and time manually



Regional settings Network settings **Date and time**

Source

☐ Manual

System date*
14-01-2026

System time*
02:56:41 PM

Set to actual date and time

Format

Time*
hh:mm:ss am

Date*
dd-MMM-yyyy

Time zone*
Europe/Berlin

Output

Serve as NTP server
☐ Inactive

 11 Operating panel to set date and time

- **Source** - Clicking the toggle switch allows you to change between the options **Manual** and **Network time protocol (NTP)**.
- **System date** - Input box with date selector for the system date
- **System time** - Input box with time selector for the system time
- **Set to actual date and time** - Date and time are updated automatically. The date and time are taken from the browser of the operating system of the device used by the user to access the device.
- **Format**
 - **Time** - Drop-down list for time formats
 - **Date** - Drop-down list for date formats
 - **Time zone** - Drop-down list for time zones
- **Output**

Serve as NTP server - Clicking the toggle switch allows you to change between the options **Inactive** and **Active**. **Inactive**: The device does not operate as an NTP server. **Active**: The device operates as an NTP server.

Configuring the date and time manually

1. Use the **Source** toggle switch to select **Manual** if this option is not already selected (default).
2. Click **Set to actual date and time** to set the current date and time.
 - ↳ The date and time are updated automatically.
3. If the device's internal time recording is to start on another specific date, proceed as follows: Enter the data directly in the **System date** field or open the date picker and select the date.
4. If the device's internal time recording is to start at another specific time, proceed as follows: Enter the data directly in the **System time** field or open the time picker and select the time.
5. Click the **Save** button to save the settings.

Obtaining Date and time via NTP

- **Source** - Clicking the toggle switch allows you to change between the options **Manual** and **Network time protocol (NTP)**.
- **Synchronizes with** - IP address of the NTP server
- **Receive date and time** - Option box with 2 radio buttons. NTP servers are either detected automatically or selected by the user.
 - **Automatic** - Default setting. Automatic search carried out in the network for an NTP server. If an NTP server is found, it is used as the source and displayed in the **1.NTP address** field.
 - **According to preference** - Connect manually entered NTP servers as sources.
- **Preference** - List of NTP servers that can be specified in order of preference. Users can specify up to 3 additional NTP servers. The UDP port 123 is used as a default connection to NTP.
- **Save** - Saves the settings.

Using the NTP server as source for Date and time

1. Use the **Source** toggle switch to select **Network time protocol (NTP)** in order to obtain the date and time via NTP.
 - ↳ A window opens with a warning message.
2. Click the **Close** button.
 - ↳ The new window content displays the two radio buttons **Automatic** and **According to preference**. The **Automatic** radio button is selected by default.
3. If the system time is to be obtained from a detected NTP server, click **Save** to apply the new source for the system time.
4. If the system time is to be obtained from a different NTP server, select the **According to preference** radio button and enter the IP addresses of the NTP servers in the desired order.
5. Click **Save** to adopt the new source for the system time.



Changing the time settings may require users to log out and log in again.

Configuring the format

The drop-down lists can be used to select different formats for time, date and different time zones.

Format

Time*
hh:mm:ss am

Date*
dd-MMM-yyyy

Time zone*
Europe/Berlin

Output

Serve as NTP server
☐ Inactive

- **Format** - 3 drop-down lists for time, date and time zone
 - **Time** - Drop-down list for time formats
 - **Date** - Drop-down list for date formats
 - **Time zone** - Drop-down list for time zones
- **Output**

Serve as NTP server - Clicking the toggle switch allows you to change between the options **Inactive** and **Active**. **Inactive**: The device does not operate as an NTP server. **Active**: The device itself is available as an NTP server for network devices within the same network.

8.3 Input

Path: Settings → Input

8.3.1 Channels

Activation of the input signals

Path: Settings → Input → Channels

Settings: Fieldbus polling and power supply mode.

- Make selection

Channel 1 power supply
☒ Active

Channel 2 power supply
☒ Active

Channel 3 power supply
☒ Active

Channel 4 power supply
☒ Active

Polling
☐ Inactive

Options:

■ **Channel power supply 1...4**

- Active
- **Passive**

■ **Polling**

- Active
- **Inactive**



- The power supply of each channel can be configured individually before activating fieldbus polling.
- Default value: **Passive**. This means that the connected field devices are not supplied with power.
- Active power supply: power supply for the connected field devices.
- Activation of the voltage supply: set the changeover switch to the **Active** position. The field changes color from gray to blue. The connected field devices are then supplied with power.



- The power supply is configured centrally for the entire loop here.
- Once the fieldbus polling is activated, the ability to adjust the power supply is deactivated.
- Once the fieldbus polling has been deactivated, the power supply can be activated or deactivated individually via the individual changeover switches.



Polling describes the active, cyclic polling of measured values. When polling is enabled, the device continuously acquires measured values from the connected measuring instruments and uses them for display, outputs, and further calculations.

8.3.2 Devices

Path: Settings → Input → Devices

This menu item displays an overview of the channels and the devices connected there:

Devices ↗

Channel ¹	HART address ²	Name ³	Tag name ⁴	Operation mode ⁵	Status ⁶
▼ Filter	▼ Filter	▼ Filter	▼ Filter	▼ Filter	▼ Filter
1		Device on Channel 1		Pulse input	Inactive
2		Device on Channel 2		4-20 mA	Inactive
3		Device on Channel 3		Pulse input	Inactive
4		Device on Channel 4		4-20 mA	Inactive

- Click a channel to edit the device connected there.

↳ Opens the **Edit device** tab.

← Edit device ↗

Device details

Channel ¹

2

Name ²

Device on Channel 2

Tag name

Status ³

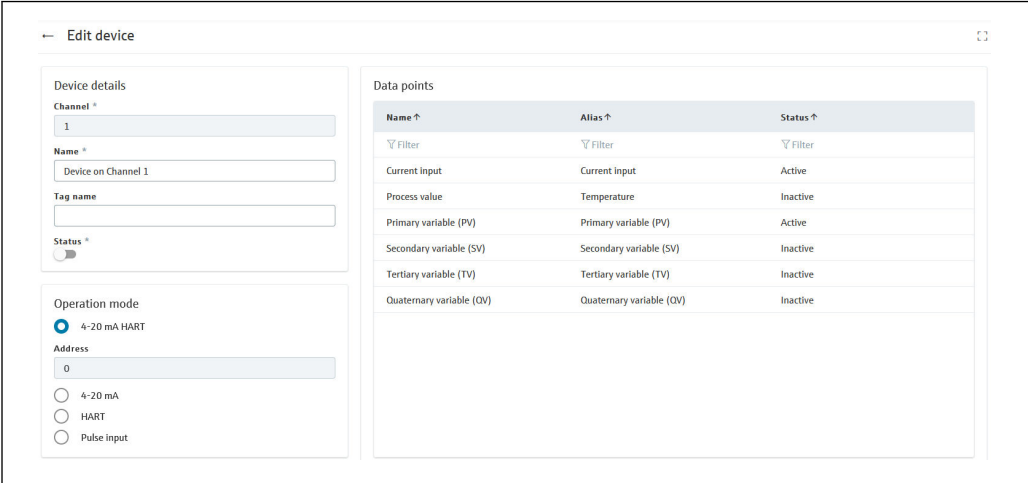
Operation mode

☐ 4-20 mA HART
☒ 4-20 mA
☐ HART
☐ Pulse input

Data points

Name ⁴	Alias ⁵	Status ⁶
▼ Filter	▼ Filter	▼ Filter
Current input	Current input	Active
Process value	Temperature	Active

Overview and explanation of device settings



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12 Edit device

Edit device

- **Channel** – Channel display only (cannot be edited).
- **Name** – Device name. The device name is set by default to **Channel _1 to 4**. A different device name can be assigned.
- **Tag name** – Enter the device tag (if device tags are used).

Status – Enables the reading in of the input value of a connected measuring instrument. In the basic setting, the changeover switch is displayed to the left and the field is gray. This deactivates the reading in of the input value. The status is active when this field is blue and the changeover switch is on the right-hand side. In addition, the fieldbus polling must be activated in the "Channels" section to read the input values of connected devices into the QML51 Density Calculator.

Operation mode

Defines the type of communication between the field device and the QML51 Density Calculator

- Channel 1 (and channel 3): pulse input is selected by default, since this input is typically assigned with a Liquiphant with density electronics.
Channel 2 (and channel 4): 4–20 mA is selected by default, since this input is typically assigned a temperature sensor. If pulse input is selected at channel 1, only 4–20 mA can be selected at channel 2. All other options are grayed out.
HART communication can only be operated via channels that are on terminals where only 4–20 mA or 4–20 mA HART devices are connected.
- **HART** option: A channel must be selected for which switching to the **HART** operation mode via the user interface is possible. Enter the HART address of the field device for HART communication. If you switch to HART communication, a warning message is displayed: "NOTE: All configured device parameters are lost if a new operation mode is selected". Confirm the warning message or cancel the process.
A HART address does not need to be entered for purely analog 4–20 mA communication.
Save the device. The operation mode is changed: the available data points can then be activated and edited.
- **Pulse input** – Input that is preconfigured for Liquiphant-type devices with density electronics.

Data points

Display of all data points available for the device. Activate and edit -> Click the desired data point.

- **Current input** – Can be edited if the **4-20 mA** option has been selected in **Operation mode**.
- **Process value** – Enter the process value (unit). Definition of the 4 mA value and the 20 mA value that is also configured in the field device.
 - Example: temperature sensor with a temperature range of 0 to 100 °C and a linearized current value.
 - 4 mA current** -> Temperature display: 0 °C
 - 20 mA current** -> Temperature display: 100 °C
 - Behavior if the 20 mA threshold is exceeded or the 4 mA threshold is undershot. Selection: The value stays at the limit (**Stay on minimum/maximum**) or the value is extrapolated (**Extrapolate**).
 - The data point must be activated. Move the **Active** changeover switch to the right to activate the data point. The color changes from gray to blue.
- **Raw frequency of vibrating fork** – Measuring frequency of Liquiphant-type devices. The pulse input is preconfigured and requires no adjustment. To be changed only by Endress+Hauser Service.
- **Primary variable (PV) / Secondary variable (SV) / Tertiary variable (TV) / Quaternary variable (QV)** – HART variable.
 - The unit of the process variable is automatically detected and used.
 - The variable is to be read and further processed -> Set the status to **Active**.
 - Operation mode **4-20 mA** – Only the **Process value** and **Current input** data points are available.
 - Operation mode **HART** – Only the 4 HART variables are available.
 - Operation mode **4-20 mA HART** – All of the data points mentioned above are available.

Device settings

Path: Settings → Input → Devices → Edit device

Channels 1 to 4 are on one terminal block each and are preconfigured

1. Channel 1 or channel 3
 - ↳ Connect a Liquiphant Density
2. Channel 2 or channel 4
 - ↳ Connect a temperature sensor or a pressure measuring cell (4 to 20 mA or 4 to 20 mA HART)



The individual channels are edited according to the same logic.



Channel 1 is edited with a Liquiphant density connection in the **Pulse input** section

Edit device, temperature

Edit the device on the channel and select the mode of operation

1. Click on a channel to edit it.

↳ Devices

Channel [↕]	HART address [↕]	Name [↕]	Tag name [↕]	Operation mode [↕]	Status [↕]
▼ Filter	▼ Filter	▼ Filter	▼ Filter	▼ Filter	▼ Filter
1		Device on Channel 1		Pulse input	Inactive
2		Device on Channel 2		4-20 mA	Inactive
3		Device on Channel 3		Pulse input	Inactive
4		Device on Channel 4		4-20 mA	Inactive

2.
- Click on channel 2 to select it.
- ↳ Opens the **Edit device** tab.

← Edit device

Device details

Channel *
2

Name *
Device on Channel 2

Tag name

Status *
☒

Operation mode
☐ 4-20 mA HART
☒ 4-20 mA
☐ HART
☐ Pulse input

Data points

Name ↑	Alias ↑	Status ↑
▽ Filter	▽ Filter	▽ Filter
Current input	Current input	Active
Process value	Temperature	Active

3.
- Click **Process value** (temperature default setting).
- ↳ Opens the **Edit data point** tab.

← Edit data point

Data point details

Name
Process value

Alias *
Temperature

Active *
☒

Current range configuration

Type of unit *
Temperature

Unit *
°C

4 mA current [°C] *
0

20 mA current [°C] *
100

☒ Stay on minimum/maximum
☐ Extrapolate

4.
- Enter a temperature value corresponding to the current value of 4 mA.
5.
- Enter a temperature value corresponding to the current value of 20 mA.
6.
- Select how the device should react if the value exceeds or falls below the 4 mA or 20 mA threshold (**Stay on minimum/maximum** or **Extrapolate**).

Edit device, pressure

Edit the device on the channel and select the mode of operation

1.
- Click on a channel to edit it.
- ↳

Devices

Channel ↑	HART address ↑	Name ↑	Tag name ↑	Operation mode ↑	Status ↑
▽ Filter	▽ Filter	▽ Filter	▽ Filter	▽ Filter	▽ Filter
1		Device on Channel 1		Pulse input	Inactive
2		Device on Channel 2		4-20 mA	Inactive
3		Device on Channel 3		Pulse input	Inactive
4		Device on Channel 4		4-20 mA	Inactive

2. Click on channel 4 to select it.
↳ Opens the **Edit device** tab.

← Edit device

Device details

Channel *

4

Name *

Device on Channel 4

Tag name

Status *

☒ 4-20 mA HART

☒ 4-20 mA

☐ HART

☐ Pulse input

Data points

Name ↑	Alias ↑	Status ↑
▽ Filter	▽ Filter	▽ Filter
Current input	Current Input	Active
Process value	Pressure	Active

3. Selecting the mode of operation (how the process value is transmitted).
↳ **4-20 mA HART** Select the process value or HART variable via which the measured value is transmitted
4-20 mA Select process value
HART Select the HART variable via which the measured value is transmitted.
4. Click **Process value** (pressure).
↳ Opens the **Edit data point** tab.

← Edit data point

Data point details

Name

Process value

Alias *

Pressure

Active *

☒ Stay on minimum/maximum

☐ Extrapolate

Current range configuration

Type of unit *

Pressure

Unit *

kPa

4 mA current [kPa] *

0

20 mA current [kPa] *

100

5. Enter a pressure value corresponding to the current value of 4 mA.
6. Enter a pressure value corresponding to the current value of 20 mA.
7. Select how the device should react if the value exceeds or falls below the 4 mA or 20 mA threshold (**Stay on minimum/maximum** or **Extrapolate**).
8. Enter the Input parameters via the path Settings → Application → Measurement point 1.

9. From the drop-down list, select whether a fixed value is evaluated or a pressure gauge will supply the measured values. Default setting: **Fixed value** (can be changed if necessary).

↳ Measurement point 1

10. Select the channel to which the pressure equipment is connected.

General information

If a channel is switched from **Pulse input** to another version, devices with the following features can be connected to the two channels of the terminal block:

- 4-20 mA
- HART
- 4-20 mA HART

 If **Pulse input** is selected, HART communication is not possible.

Path: Settings → Input → Devices → Edit device → Data points → Process value

The following units can be selected under Type of unit in the Current range configuration selection window:

- None
- Temperature
- Pressure
- Miscellaneous
- Time
- Current
- Relative density
- Frequency
- Alcohol concentration
- Sugar content
- Concentration
- Density

Pulse input

Path: Settings → Input → Devices → Edit device

Configuring the Pulse input

1. Connect the device

2. Click on channel 1 to select it. Preset for Liquiphant with density electronics.

↳ Devices

Channel [↑]	HART address [↑]	Name [↑]	Tag name [↑]	Operation mode [↑]	Status [↑]
▽ Filter	▽ Filter	▽ Filter	▽ Filter	▽ Filter	▽ Filter
1		Device on Channel 1		Pulse input	Inactive
2		Device on Channel 2		4-20 mA	Inactive
3		Device on Channel 3		Pulse input	Inactive
4		Device on Channel 4		4-20 mA	Inactive

3. The **Edit device** tab opens

↳ Edit device

Device details

Channel *
1

Name *
Device on Channel 1

Tag name

Status *
☒

Operation mode
☐ 4-20 mA HART
☐ 4-20 mA
☐ HART
☒ Pulse input

Data points

Name [↑]	Alias [↑]	Status [↑]
▽ Filter	▽ Filter	▽ Filter
Raw frequency of vibrating fork	Raw frequency of vibrating fork	Active

4. **Name** – Enter the device name.
5. **Tag name** – Enter (TAG) (optional).
6. Activate channel using the **Status** changeover switch.
7. Finish by clicking **Save**.
8. In the **Data points** overview, click the data point **Raw frequency of vibrating fork**.
 ↳ The **Edit data point** tab opens

↳ Edit data point

Data point details

Name
Raw frequency of vibrating fork

Alias*
Raw frequency of vibrating fork

Active*
☒

Configuration of pulse input

Type of unit*
Frequency

Unit*
Hz

Pulse value* ☒
8

i Operation mode must be set to **Pulse input**.

i The data point **Raw frequency of vibrating fork** is already preconfigured for the density electronics; therefore no further changes are required here.

8.3.3 Alarms

Path: Settings → Input → Alarms

Alarms are triggered if specific threshold values are exceeded or undershot. Threshold values and other parameters can be configured here.

The overview shows all the alarms set in the system:

Alarms ⌵

🗑️ Delete
0 of 250 possible entries + Add

☐	Device a... ↑	Source ↑	Data point ↑	Unit ↑	High-High	High	Low	Low-Low
	▼ Filter	▼ Filter	▼ Filter	▼ Filter				
Grid has no data.								

- **Device address** – Fieldbus address of the device
- **Source** – The name of the device at which the alarm is triggered
- **Data point** – The data point that causes the alarm
- **Unit** – Unit in which the data point value is displayed
- **High-High, High, Low, Low-Low** – 4 alarm categories. The alarm threshold entered is displayed here
- **Hysteresis** – Configured hysteresis that must be exceeded before an alarm is deactivated or activated. The value for the hysteresis is specified in the same unit as the data point. The value entered applies to all 4 alarms.
- **Delay time** – Minimum time for which a measured value must exceed or fall below the alarm threshold before the alarm is activated or deactivated. The time entered applies to all 4 alarms.

← New alarm

Source *

Please select
▼

Data point*

Please select
▼

High-High *

High *

Low *

Low-Low *

Hysteresis *

Delay time [s] *

Creating new alarms

1. Click the **Add** button.
 ↳ The input screen for alarms is displayed.
2. **Source** Select the device name for which the alarms are to be set.
3. Select the **Data point** for which alarms are to be set.

- 4. Select the alarm category and enter a value for the alarm. The four alarm categories are activated by default (changeover switch is on the right-hand side, the color is blue). To deactivate an alarm, click the changeover switch (the changeover switch is then on the left-hand side and the color changes to gray). All alarms can be activated or deactivated individually.
- 5. Enter a value for **Hysteresis**.
- 6. Enter the **Delay time**.
- 7. Click **Save** to save the settings.

NAMUR NE43 alarm

Path: Settings → Input → Devices → Edit device

 The information in this section applies only to devices using the 4-20 mA HART communication type.

This menu item displays an overview of the channels and the devices connected there:

Devices ⌵

Channel [⬆]	HART address [⬆]	Name [⬆]	Tag name [⬆]	Operation mode [⬆]	Status [⬆]
⌵ Filter	⌵ Filter	⌵ Filter	⌵ Filter	⌵ Filter	⌵ Filter
1		Device on Channel 1		Pulse input	Inactive
2		Device on Channel 2		4-20 mA	Inactive
3		Device on Channel 3		Pulse input	Inactive
4		Device on Channel 4		4-20 mA	Inactive

- Click a channel to edit the device connected there.
 - ↳ Opens the **Edit device** tab.

← Edit device ⌵

Device details

Channel *
2

Name *
Device on Channel 2

Tag name

Status *
☒

Operation mode
☐ 4-20 mA HART
☒ 4-20 mA
☐ HART
☐ Pulse input

Data points

Name [⬆]	Alias [⬆]	Status [⬆]
⌵ Filter	⌵ Filter	⌵ Filter
Current input	Current input	Active
Process value	Temperature	Active

The NAMUR NE43 alarm can be configured individually under the **Current input** data point.

NAMUR NE43 alarm

Status

Inactive

Alarm current selection

Minimum

Maximum

Alarm current setpoint [mA]

3.7

Behavior of process value

None

Last valid value

Current value (extrapolation)

- **Status**- Activates the alarm
 - **Inactive**: Changeover switch moved to the left by clicking, color gray.
 - **Active**: Changeover switch moved to the right by clicking, color blue.
- **Alarm current selection**- Must be set to match the configuration of the field device. The selection determines a default setting for the next input box.
 - **Minimum**
 - **Maximum**
- **Alarm current setpoint**- Default setting according to NAMUR NE43. The setting can be individually adapted to the field device connected.
 - **3.7**
 - **20.8**
- **Behavior of process value**
 - **None**- The measured value is not displayed as faulty.
 - **Last valid value** - The last valid value is retained. However, the status is displayed as "invalid".
 - **Current value (extrapolation)**- The process value is extrapolated beyond the defined 4 mA or 20 mA limit.

8.4 Output

8.4.1 Overview

Path: Settings → Output → Overview

 More information is provided in the "System integration" section.

Overview 

Name ↑	Description ↑	Output type ↑	Active ↑
▼ Filter	▼ Filter	▼ Filter	▼ Filter
MODBUS		Modbus TCP	Active
OPC UA		OPC UA	Inactive

1. In the "Overview" tab -> click "MODBUS".
↳ The "MODBUS" tab opens

← Overview

General information

Name*

MODBUS

Description

Output details

Output type*

Modbus TCP

Port*

502

Data transmission

Data is transmitted as live data.

Status

Active

Inactive

2. Enter the required data.

1. In the "Overview" tab -> click "OPC UA".
↳ The "OPC UA" tab opens

← Overview

General information

Name*

OPC UA

Description

Output details

Output type*

OPC UA

Port*

4840

Data transmission

Data is transmitted as live data.

Status

Active

Inactive

2. Enter the required data.

8.4.2 Modbus TCP to 4 to 20 mA converter

Path: Settings → Output → 4-20 mA Converter

The system is already preconfigured internally with a converter that can convert the measured values to corresponding current values.

i Configuring the converter is only relevant if an external converter is to be used to send an analog 4-20 mA signal to a receiver. This menu is not used if communication can take place directly via the Modbus protocol.

i The external converter is available as an accessory.

For more information on the external converter, see the "Accessories" section.

Density calculator | 3590ad5qml2

admin Logout 20 min

Overview 4-20 mA Converter

1 of 10 possible entries

4-20 mA Converter ↑	Modbus register ↑	Measurement point ↑	Data point ↑	0 % ↑	100 % ↑
≥ Filter ≤ Filter	≥ Filter ≤ Filter	≥ Filter ≤ Filter	▽ Filter	≥ Filter ≤ Filter	≥ Filter ≤ Filter
1	1	1		0	0
1	2	1		0	0
1	3	1		0	0
1	4	1		0	0

Measured values can be converted to corresponding current values in the **4-20 mA Converter** menu. A minimum measured value is assigned to the 4 mA signal and a maximum measured value is assigned to the 20 mA signal for this purpose. These values are then assigned to a Modbus register. As the device itself cannot output an analog 4-20 mA signal, the converted current values are forwarded to an external converter via Modbus TCP. The external converter then outputs the analog 4-20 mA signal.

For more information on the external converter, see the "Accessories" section.

A separate document describes how the external converter is connected and configured. More information on this can be found in the "Documentation" section.

- Four Modbus registers are available per internal converter for configuration. Up to 10 converters (40 Modbus registers) can be configured.
- The Modbus registers to be configured can be accessed at Modbus address 3 in the configured order.
- The calculated values are scaled to an integer value between 4,000 and 20,000 in accordance with the configured value limits.
Using a Modbus TCP client, it is also possible to verify whether plausible values are being provided for the external converter, even when no external converter is connected.
- When the external converter is correctly configured, the integer value is converted into a current value without any further modification. An integer value of 4000 corresponds to 4 mA.

Configuring internal Modbus converter

Path: Settings → Output → Overview

Enable Modbus TCP Output by clicking on the "Overview" -> "MODBUS" tab.

Path: Settings → Output → 4-20 mA Converter

The screenshot shows the 'Density calculator' web interface. The left sidebar has a menu with 'Settings' expanded, showing 'Input', 'Output', '4-20 mA Converter', 'Application', 'Notifications', and 'System'. The main content area is titled '4-20 mA Converter' and shows a table with 10 possible entries. The table has columns for '4-20 mA Converter', 'Modbus register', 'Measurement point', 'Data point', '0 %', and '100 %'. The first four rows are visible, showing values 1, 2, 3, and 4 for the Modbus register, and 1 for the Measurement point. The 'Data point' column is empty, and the '0 %' and '100 %' columns show 0.

4-20 mA Converter	Modbus register	Measurement point	Data point	0 %	100 %
1	1	1		0	0
1	2	1		0	0
1	3	1		0	0
1	4	1		0	0

A data point can be assigned to each Modbus register that is available. A row in the table corresponds to one Modbus register.

Click a row in the table to open the dialog to link the measuring point, Modbus register and data point.

The screenshot shows the 'Edit Modbus register' dialog box. It has a title bar with a back arrow and the text 'Edit Modbus register'. The main content area is titled 'Modbus register 1'. It has two radio buttons: 'Measurement point 1' (selected) and 'Measurement point 2'. Below the radio buttons is a dropdown menu labeled 'Select data points *' with 'Mass percentile' selected. Below the dropdown menu are two input fields: '4 mA current [%] *' and '20 mA current [%] *', both containing the value '0'.

1. Select the measurement point at which the data point to be converted is generated.
2. Select the data point. The selected data point determines which unit is displayed with the minimum and maximum current values.
3. Set lower limit for value range (4 mA). The unit is specified according to the selected data point.
4. Set upper limit for value range (20 mA). The unit is specified according to the selected data point.
5. Click the **Save** button to save the settings.

- Multiple external converters can be connected. In this case, the external converters receive their signal via the network or a switch. A single external converter can receive the Modbus signal via LAN 1.
- Additional internal converters can be added using the (+) button. The overview table is then expanded by 4 lines, each of which contains a Modbus register.
- Excess configured internal converters can be removed using the (-) button. The logic follows the LIFO principle, meaning that the most recently added converter is removed first.
- It is not possible to reduce the number of internal converters to zero, even if no external converter is to be connected.

8.5 Application

Path: Settings → Application

This menu is used to set up the measuring points and the linearization or concentration tables, if necessary.

8.5.1 Linearizations

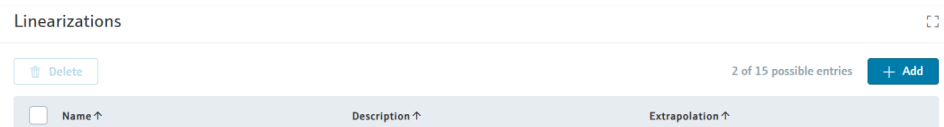
Path: Settings → Application → Linearizations

Menu for managing linearizations.

Linearizations can generally be applied to all data points. They serve to linearize the values that have been read in.

A distinction is made between 2D and 3D linearizations.

Up to 15 tables can be created via the **Add** button.



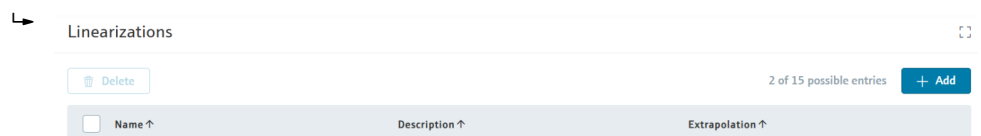
2D linearization

Creating a 2D table

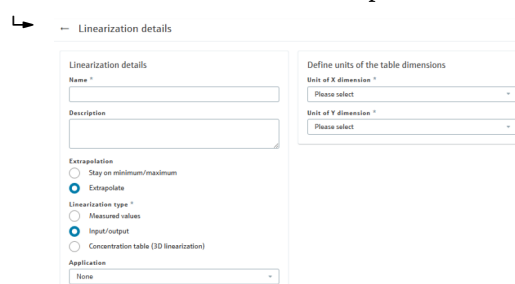
Path: Settings → Application → Linearizations

Creating a new table:

1. Create a new table with the **Add** button. Up to 15 tables can be created



2. The **Linearization details** tab opens.



3. In **Linearization type**
 - Select the **Input/output** option.
4. In the **Name** field, enter a unique identifier for the linearization (mandatory field).
Entering a description is optional.
5. Select the application in the **Application** drop-down list.
 - The **Reference density** or **Application specific linearization** options can be preferably selected for 2D linearizations.
6. Select the units in the **Define units of the table dimensions** field.
 - **Unit of X dimension**
Unit of Y dimension
7. Click the **Save** button.
 - The **Overview of linearization points** window opens.
2 value pairs are already predefined.

Linearization details

Linearization details

Name *

Test

Description

Extrapolation

Stay on minimum/maximum

Extrapolate

Linearization type *

Input/output

Application

None

Define units of the table dimensions

Unit of X dimension *

°C

Unit of Y dimension *

kg/m³

Overview of linearization points

Options

Import

Export

Chart

+ Add

	Input value °C	Linearized value kg/m³
☐	> Filter	< Filter
1	0	0
2	1	1

8. Click on the row to edit.
 - The **Edit linearization points** window opens.

Linearization details

Edit linearization points

Input value *

0

Linearized value *

0

Overview of linearization points

Options

Import

Export

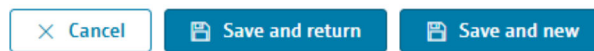
Chart

+ Add

	Input value °C	Linearized value kg/m³
	> Filter	< Filter
1	0	0
2	1	1

9. Edit linearization points.
 - Enter **Input value**.
Enter **Linearized value**.
When entering values, make sure that the y-values are linear, i.e. do not adopt arbitrarily ascending and descending values.
10. Click the **Save** button.
 - The **Overview of linearization points** table is displayed.
The linearization can be displayed graphically with the **Chart** button.
11. Click the **Add** button to insert further value pairs into the table.

12. You have two options after entering the new value pair.



Save and return -> the value pair is saved and you return to the **Overview of linearization points** table.

Save and new -> the value pair is saved and another value pair can be entered directly.



Value pairs can also be imported from a CSV file.



If **Input/output** is selected as the linearization type, the linearization can also be used in a reference density calculation. In this case, select **Reference density** in the **Application** drop-down list.

Delete linearization point(s)

1. Select the check boxes of all the linearization points to be deleted in **Overview of linearization points**.

2. Click the **Delete** button.

3. Confirm the security prompt to delete.

↳ Clicking the **Delete** button deletes the linearization point.



If you are deleting linearization points, make sure that a linearization table has at least 2 value pairs. Linearization points are not deleted if the linearization table would contain fewer than 2 value pairs after deletion.

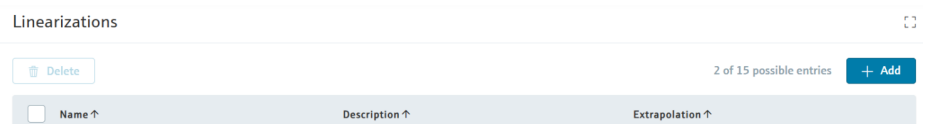
3D linearization

Creating a 3D table

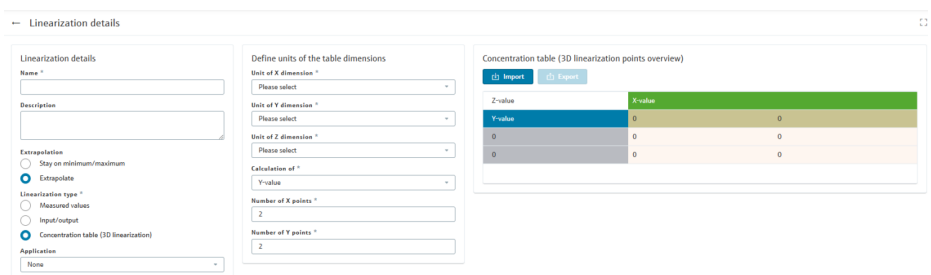
Path: Settings → Application → Linearizations

Creating a new table:

1. Create a new table with the **Add** button. Up to 15 tables can be created



2. The **Linearization details** tab opens.

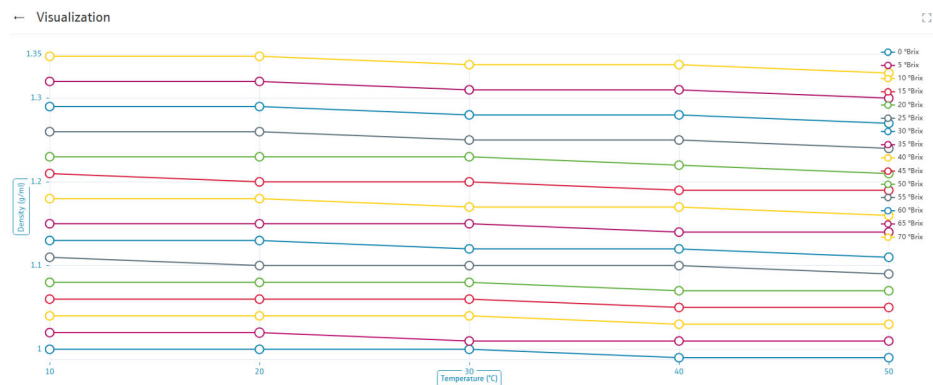


3. In **Linearization type**

↳ Select the **Concentration table (3D linearization)** option.

4. In the **Name** field, enter a unique identifier for the linearization (mandatory field). Entering a description is optional.

5. Select the units in the **Define units of the table dimensions** field.
 - ↳ **Unit of X dimension**
 - Unit of Y dimension**
 - Unit of Z dimension**
6. Enter the value to be calculated (output value).
 - ↳ The **Y-value** is preset and should not be changed.
7. Enter **Number of X points** (default: 2 points).
 - ↳ Defines the number of columns in the **Concentration table (3D linearization points overview)**.
8. Enter **Number of Y points** (default: 2 points).
 - ↳ Defines the number of rows in the **Concentration table (3D linearization points overview)**.
9. Complete the **Concentration table (3D linearization points overview)**.
 - ↳ **Enter x-values:** Double-click on the value in the first column of the x-values to enter the values.
 - Enter y-values:** Double-click the value in the first row of the y-values to enter the values.
 - The x and y-values are entered in ascending order in the columns. The sequence in which they are entered is not relevant.
 - Enter z-values:** Double-click the desired cell and enter the corresponding z-value.
10. Click the **Save** button.
 - ↳ Once you save, the **Concentration table (3D linearization points overview)** field shows the **Chart** button.
 - The **Chart** button can be used to display the linearization graphically. Input errors can thus be identified quickly.



i X and Z points specify the input values. Y points specify the output values. The calculation of y-values should always be selected.

Overview and explanations

- **Name** – Unique identifier for the table. The name is used in the overview to help identification and subsequent assignment to the data point
- **Description** – A description or piece of information for the user
- **Extrapolation** – Option to select whether the boundary points are displayed, or whether the linearization is also applied if the input values fall below or exceed the defined range.
 - **Stay on minimum/maximum** – If the value is undershot or overshoot, the value remains within the limits set by the linearization table. This also applies if the input value is greater than or smaller than the specified limit values
 - **Extrapolate** – Default value. The linearization is extrapolated

Linearization type

- **Measured values** – Linearization that is applied exclusively to the input value (generally not required)
- **Input/output** – 2D linearization (generally frequency to output unit)
- **Concentration table (3D linearization)** – If an output value depends on two measured variables (e.g. density and temperature), 3D linearizations can be used

Application, options for selection

- **None**
- **Alcohol concentration**
- **Sugar concentration**
- **Aqueous electrolyte concentration**
- **Application specific linearization**
- **Reference density** - Only for 2D linearizations

Importing linearization points**Import**

1. Click the **Import** button.

↳ ← **Linearization details**

Import linearization table

CSV separator*

Thousands separator *

Decimal separator*

Column: Input value *

Column: Linearized value*

File *

Drop file or

Select file

Selected file

No file selected

File size

2. Enter values in fields marked *. Upload a linearization table if available.
3. Drag the CSV file onto the **File** field and release the mouse button.
4. Alternatively, click the **Select file** button and select the file.
 - ↳ The size of the file is displayed once it has been uploaded successfully.



Tables in .csv, .xls, and .xlsx format can be imported.

- **CSV separator** – Separator for the individual values
; - Default value
- **Thousands separator** - Thousands separator
, - Default value
- **Decimal separator** - Decimal separator
. - Default value
- **Column: Input value** - Column number containing the x-values
1 - Default value
- **Column: Linearized value** - Column number containing the y-values.
2 - Default value

Export linearization points

Export

1. Click the **Export** button.



2. Enter the separator:

- **CSV separator**
- **Thousands separator**
- **Decimal separator**

3. Click the **Export** button to start the automatic download process. The file name is made up of the following structure: NameOfLinearizationTable_CurrentDate.csv

 Registered linearizations can be exported as a CSV file for documentation or reproduction purposes.

Delete linearization(s)

1. Select the check box of the linearization to be deleted.



Name	Description	Extrapolation
☒ Text	Filter	Extrapolate
☐ Text		Extrapolate
☐ Text		Extrapolate

2. Click the **Delete** button.
3. Confirm the security prompt to delete.
 ➔ Clicking the **Delete** button deletes the linearization.

8.5.2 Measurement point

Path: Settings → Application → Measurement point

 The measuring points are configured in guided setup.

- Measurement point 1: Channel 1 and channel 2 are preconfigured and assigned to the frequency or temperature.
- Measurement point 2: Channel 3 and channel 4 are preconfigured and assigned to the frequency or temperature.
- Measuring points 1 and 2 are configured according to the same logic.
- If the pressure value of one of the two measurement points is evaluated by a connected pressure measuring cell, the number of measuring points is reduced.
- The configured parameters and application details can be changed at any time after they are saved.
- If only density calculation (observed density) is required, the configuration can be completed immediately after entering the parameters displayed in step 1 by selecting **Save**.

Input parameters

Path: Settings → Application → Measurement point → Input parameters

13 Input parameters

The sensor-specific parameters of the device are entered in the **Sensor-specific parameters** area.

The following buttons can be used after saving:

- **Field adjustment of sensor**
- **Save frequency of covered sensor**
- **Save frequency of uncovered sensor**

i The sensor-specific parameters are supplied in printed form with the device (Adjustment Report) and are enclosed on a device passport in the device's housing (Liquiphant). This information is essential for calculating the density. The data can also be downloaded via the Asset Central Viewer with the serial number of the device.

i For information about the correction factor, see the Operating Instructions for the Liquiphant.

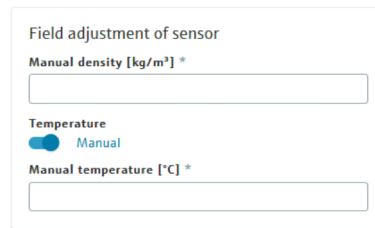
i During commissioning, save the frequency of the uncovered sensor in order to use the installation and sensor-specific oscillation frequency for verification.

Field adjustment of sensor

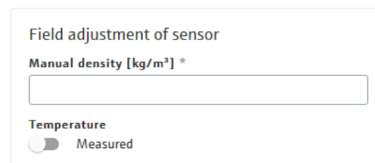
Field adjustment of sensor can be used to perform a field calibration if a significant deviation is detected between the calculated density and a comparison measurement.

i Do not perform field calibration until after commissioning has been completed and a relevant deviation in the densities has been determined.

- ▶ Enter the density measured manually.
 - ↳ Enter the associated temperature manually (Figure 1) or use the measured temperature for adjustment (Figure 2).



14 Figure 1



15 Figure 2

Save frequency of covered sensor / Save frequency of uncovered sensor

After commissioning, two states of the vibrating fork frequency can be recorded under defined conditions:

- Uncovered if the vibrating fork vibrates freely (uncovered by the medium in the pipe or vessel).
- Covered if the vibrating fork is completely covered by a reference medium or the medium in the pipe or vessel.

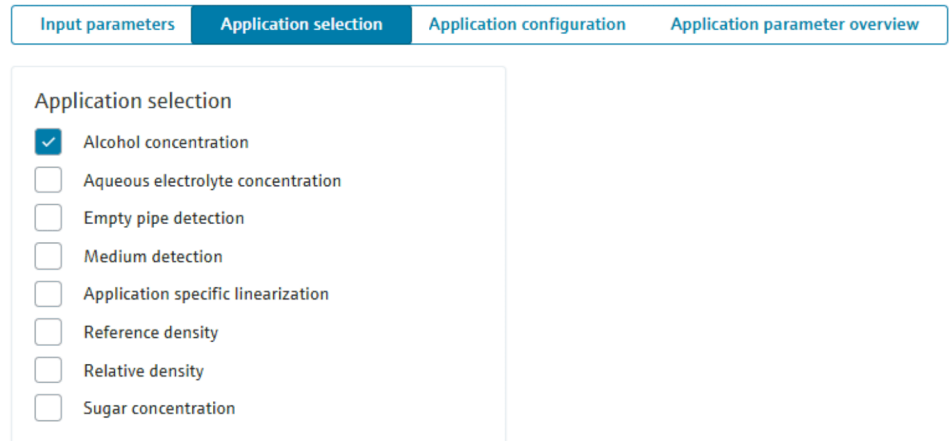
1. Click the desired button.
 - ↳ The message **Save frequency of covered sensor** or **Save frequency of uncovered sensor** is displayed.



2. Click Confirm to proceed or Cancel to abort.
 - ↳ After confirmation, the average value of multiple measurements is determined and stored.
The values are described and displayed under Service functions → Verification.

Application selection

Path: Settings → Application → Measurement point → Application selection



Input parameters **Application selection** Application configuration Application parameter overview

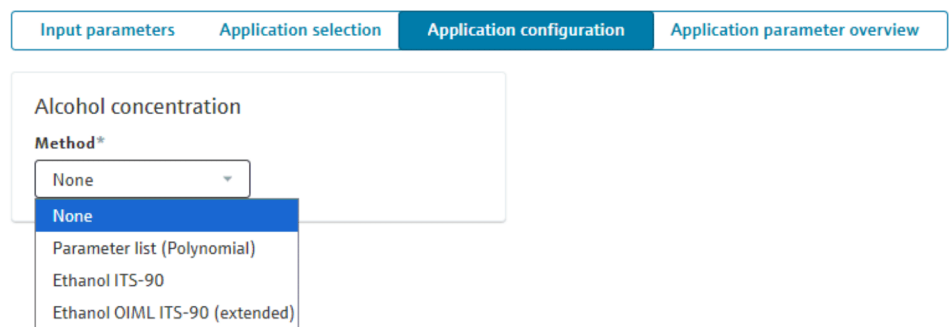
Application selection

- ☒ Alcohol concentration
- ☐ Aqueous electrolyte concentration
- ☐ Empty pipe detection
- ☐ Medium detection
- ☐ Application specific linearization
- ☐ Reference density
- ☐ Relative density
- ☐ Sugar concentration

 16 Application selection

All applications can be selected at the same time in theory. However, it is recommended that only the application that is relevant for the measuring point is selected.

Alcohol concentration



Input parameters Application selection **Application configuration** Application parameter overview

Alcohol concentration

Method*

- None
- Parameter list (Polynomial)
- Ethanol ITS-90
- Ethanol OIML ITS-90 (extended)

 17 Alcohol concentration

 Three preconfigured calculation methods for the concentration of alcohol can be selected from this drop-down list. In addition, user-specific linearization tables can be selected for the alcohol concentration if they were created in the **Linearizations** menu and defined as the alcohol concentration. After selecting the calculation method, save it.

Parameter list

 The preset parameters are based on experience with the previous device, Density Computer FML621, and can be applied directly without any adjustment.

Polynomial with prefilled coefficients and selection of output unit.

Input parameters

Application selection

Application configuration

Application parameter overview

Alcohol concentration

Method* ⓘ

Reference temperature

Parameter list (Polynom)

20 °C

A0 *

-184.6342

A1 *

879.4734

A2 *

-1,558.401

A3 *

1,228.045

A4 *

-364.471

B1 [* 10⁻³] *

-2.7584

B2 [* 10⁻⁶] *

-13.1296

B3 [* 10⁻⁹] *

99.6631

Ethanol ITS-90

Calculation according to OIML method ITS-90

Input parameters

Application selection

Application configuration

Application parameter overview

Alcohol concentration

Method*

Reference temperature

Ethanol ITS-90

20 °C

Ethanol OIML ITS-90 (extended)

An extended method that allows for compensation of the mineral content or pressure.

Mineral content – The mineral content (TDS value) can be entered in the unit ppm after the changeover switch has been set to "active" (blue color).

Input parameters

Application selection

Application configuration

Application parameter overview

Alcohol concentration

Method*

Reference temperature

Ethanol OIML ITS-90 (e)

20 °C

Compensation

Mineral content

Pressure

Active

Inactive

Mineral content

Total dissolved solids (TDS) [ppm] *

0

Aqueous electrolyte concentration

The Laliberté Cooper model is used to calculate the concentration of aqueous electrolytes. The following electrolytes are predefined: FeCl₃, H₂SO₄, H₃PO₄, HCl, HNO₃, KOH, NaCl, NaOH, NH₃, NH₄NO₃, NH₄OH and H₂O₂.



The calculation of the reference density is predefined for this application.

1. Select **Aqueous electrolyte concentration** in the **Application selection** tab.

↳ Measurement point 1

2. Click the **Application configuration** button.

↳ If no electrolyte has been selected, the following tab is displayed:

If an electrolyte has been selected, the following tab is displayed:

► The following tab opens if you click the **Manual** button:

Input parametersApplication selectionApplication configurationApplication parameter overview

Aqueous electrolyte solution

Electrolyte *
Manual

Name *

C0 [kg/m³] *

C1 [kg/m³] *

C2 [kg/m³] *

C3 [1/°C] *

C4 [°C] *

Reference temperature [°C] *

Molar mass [g/mol] *

Temperature t_min [°C] *

Temperature t_max [°C] *

Mass fraction w_max *

Mass fraction w_min *

Mineral content

Total dissolved solids (TDS) [ppm] *

Values can be entered manually.
The mineral content (TDS value) can be entered manually.

-  If there is a linear relationship between concentration and density, a linearization table previously entered can be selected.

 To calculate the electrolytes that are not preconfigured, additional parameters are required. These values must be made available by the customer (contact Endress +Hauser Service).

Empty pipe detection

The density calculator can detect an empty pipe based on limit value monitoring.

1. Select **Empty pipe detection** in the **Application selection** tab.

Input parametersApplication selectionApplication configurationApplication parameter overview

Application selection

☐ Alcohol concentration

☐ Aqueous electrolyte concentration

☒ Empty pipe detection

☐ Medium detection

☐ Application specific linearization

☐ Reference density

☐ Relative density

☐ Sugar concentration

2. Click the **Application configuration** button.

→

Input parameters	Application selection	Application configuration	Application parameter overview
------------------	-----------------------	----------------------------------	--------------------------------

Empty pipe detection

Method *

Frequency

Value for empty pipe detection [Hz] * **Hysteresis [%] ***

10,000 0

☐ Measured value is above the value for empty pipe.

Method → Frequency:

The measured frequency is compared.

Method → Density:

The measured density is compared (if, for example, a separating fluid is used in the pipe).

Value for empty pipe detection [Hz] → Measured value is above the value for empty pipe. / Measured value is below the value for empty pipe.

Enter the frequency that lies below or above the 'empty value' for an empty pipe.

Value for empty pipe detection [kg/m³] → Measured value is above the value for empty pipe. / Measured value is below the value for empty pipe.

Enter the density that lies below or above the 'empty value' for an empty pipe.

Hysteresis (%):

Enter the desired hysteresis.

Medium detection

The density calculator is capable of distinguishing up to four different media within a defined density and temperature range.

1. Select **Medium detection** in the **Application selection** tab.

→

Input parameters	Application selection	Application configuration	Application parameter overview
------------------	------------------------------	---------------------------	--------------------------------

Application selection

☐ Alcohol concentration

☐ Aqueous electrolyte concentration

☐ Empty pipe detection

☒ **Medium detection**

☐ Application specific linearization

☐ Reference density

☐ Relative density

☐ Sugar concentration

- Click the **Application configuration** button.

→

Medium detection

☐ Name of medium A

☐ Name of medium B

☐ Name of medium C

☐ Name of medium D

Hysteresis [%] *

- Select possible media. Depending on the number of media to be detected, activate medium A to D by clicking.
- Specify a unique name for the medium.
 - Specify the associated value range for temperature and density.
The name of the medium entered is output later as a value in the measured value overview.
- Select and configure at least two media.
- Specify **Hysteresis** as a % (this avoids instability during switching).

Application specific linearization

Here, only linearization tables that were previously created under the **Linearization** menu item as "Application-specific linearization" are displayed.

- Select **Application specific linearization** in the **Application selection** tab.

→

Application selection

☐ Alcohol concentration

☐ Aqueous electrolyte concentration

☐ Empty pipe detection

☐ Medium detection

☒ Application specific linearization

☐ Reference density

☐ Relative density

☐ Sugar concentration

2. Click the **Application configuration** button.

The screenshot shows the 'Application configuration' tab selected in the top navigation bar. Below the navigation bar, there is a section titled 'Other concentration' containing a 'Correction curve' dropdown menu. The dropdown menu is open, showing the following options: 'None' (highlighted in blue), 'Test 3D Manu', and 'Test MD'.

- i** If no tables have been defined previously, only **None** is displayed in the **Correction curve** selection field.

Reference density

With the **Reference density**, the **Observed density** is defined in relation to a reference temperature.

1. Select **Reference density** in the **Application selection** tab.

The screenshot shows the 'Application selection' tab selected in the top navigation bar. Below the navigation bar, there is a section titled 'Application selection' containing a list of application types with checkboxes. The 'Reference density' option is checked (indicated by a blue checkmark).

2. Click the **Application configuration** button.

The screenshot shows the 'Application configuration' tab selected in the top navigation bar. Below the navigation bar, there is a section titled 'Reference density' containing a 'Correction curve' dropdown menu. The dropdown menu is open, showing the following options: 'None' (highlighted in blue), 'Aqueous sucrose solution (ICUMSA SPS-4 table 5)', 'Aqueous glucose solution (ICUMSA SPS-4 table 6)', 'Aqueous fructose solution (ICUMSA SPS-4 table 7)', 'Aqueous invert sugar solution (ICUMSA SPS-4 table 8)', 'Ethanol ITS-90', and 'Electrolyte (selection)'.

The following options are available:

- None
- Standardized tables of the ICUMSA for sugar calculation. Optionally, the mineral content can be taken into account by entering the total dissolved solids (TDS) in ppm when calculating the reference density.
- Reference density according to OIML ITS-90
- Reference density of a previously selected electrolyte (in this case, the calculation of aqueous electrolyte solution must also be selected and configured).
- If a reference table has been entered in the **Linearization** menu and the reference density tables have been assigned, this can also be selected here.

Relative density

When the relative density is calculated, the density is calculated relative to a reference medium.

- 1. Select **Relative density** in the **Application selection** tab.

➔

Input parametersApplication selectionApplication configurationApplication parameter overview

Application selection

☐ Alcohol concentration

☐ Aqueous electrolyte concentration

☐ Empty pipe detection

☐ Medium detection

☐ Application specific linearization

☐ Reference density

☒ Relative density

☐ Sugar concentration

- 2. Click the **Application configuration** button.

➔

Input parametersApplication selectionApplication configurationApplication parameter overview

Relative density

Reference selection

None

None

Water (4 °C)

Water (20 °C)

Water (60 °F)

The following options are available:

- None
- Water at various temperatures (4 °C, 20 °C, 63 °F).
- If a reference density linearization table has been entered, this can also be selected here.

Sugar concentration

- 1. Select **Sugar concentration** in the **Application selection** tab.

➔

Input parametersApplication selectionApplication configurationApplication parameter overview

Application selection

☐ Alcohol concentration

☐ Aqueous electrolyte concentration

☐ Empty pipe detection

☐ Medium detection

☐ Application specific linearization

☐ Reference density

☐ Relative density

☒ Sugar concentration

60

Endress+Hauser

2. Click the **Application configuration** button.

3. Select one of the predefined ICUMSA tables or a previously entered linearization table.

Measuring the original wort

The approximation of a water-based solution according to ICUMSA (sucrose/water) is used to measure the original wort. The numerical values for the units %mass, °Plato and °Balling correspond to the numerical value for °Brix when the sucrose/water mixture is selected. The measurement therefore represents the apparent extract, since a complex mixture (sugar/alcohol/water), as formed during the fermentation process, cannot be captured by a single summation parameter such as density, for instance.

Application parameter overview

Path: Settings → Application → Measurement point → Application parameter overview

All data points available through the configuration are displayed in the density calculator's measurement overview.

In addition, these data points can be read out via the available outputs.

Alias ↑	Data point ↑	Application ↑	Unit ↑	Output ↑
Filter	Filter	Filter	Filter	Filter
Observed density	Observed density		kg/m³	false
Sugar concentration	Sugar concentration	Sugar concentration	°Brix	false



If a data point was assigned to a converter register, the output is set to "true".

See the "4-20 mA Converter" chapter

8.6 Integrating certificates

Path: Settings → System → Certificate

Integrating a certificate into the browser enables the browser to check the identity of a website or application clearly. Installing the certificate establishes a trusted, secure connection.

Different certificates are managed in the Certificate menu:

- Internal server certificates
 - Certificates issued by a certification authority (CA)
- Trusted server certificates
- Trusted client certificates

Certificates

Internal server certificates Trusted server certificates Trusted client certificates

Delete Download Add

☐	Name ↑	Description ↑	Issuer ↑	Subject ↑	Expiration date ↑	Used by ↑
	Filter	Filter	Filter	Filter		Filter
☐	Webserver	Default webserver certific...	CN=EH IMS ROOT,OU=IM...	C=DE,ST=Baden-Wuertte...	2026-01-01T00:00:00.0...	HTTP
☐	OPC UA Server	Default OPC UA server cer...	O=Endress \+ Hauser SE ...	O=Endress \+ Hauser SE ...	2035-02-01T02:12:29.0...	OPC_UA

8.6.1 Internal server certificates

Path: Settings → System → Certificates → Internal server certificates

Internal server certificates are certificates stored in the device itself that the device uses to identify itself as the correct device for an incoming connection. Internal server certificates are self-signed and valid for one year, but are automatically renewed once their validity period expires. The user must include the renewed certificate in the browser that is used to ensure that the connection is still recognized as secure.

The device can still be accessed even if the renewed certificate is not integrated. However, the connection is then not considered secure and the browser displays a warning message.

Certificates

Internal server certificates Trusted server certificates Trusted client certificates

Delete Download Add

☐	Name ↑	Description ↑	Issuer ↑	Subject ↑	Expiration date ↑	Used by ↑
	Filter	Filter	Filter	Filter		Filter
☐	Webserver	Default webserver certific...	CN=EH IMS ROOT,OU=IM...	C=DE,ST=Baden-Wuertte...	2026-01-01T00:00:00.0...	HTTP
☐	OPC UA Server	Default OPC UA server cer...	O=Endress \+ Hauser SE ...	O=Endress \+ Hauser SE ...	2035-02-01T02:12:29.0...	OPC_UA

An internal server certificate must be downloaded before it can be integrated into the browsers used.

Downloading an internal server certificate

1. Select certificate.
2. Click the **Download** button.
 - ↳ The certificate is downloaded.
3. Import the downloaded certificate as a trusted certificate into the browser used to access the device.

 The procedure for importing a trusted certificate into a browser differs depending on the browser used and can be changed at any time by the browser provider. For this reason, it is not described in detail here.

Certificates issued by a certification authority (CA)

Certificates issued for the device by a certification authority can be uploaded using the **Add** button. These certificates are generally password-protected.

Adding a new certificate to the device

1. Click the **Add** button.

2. Specify a unique name for the certificate.
3. Enter the password for the certificate. If the uploaded certificate is not password-protected, the password entered is used for proper and safe storage of the certificate in the device.
4. Drag the certificate onto the **File*** field and release the mouse button. Only certificates of file type PEM can be uploaded.
5. Alternatively, click the **Select file** button and select the file.
 - ↳ The size of the file is displayed once it has been uploaded successfully.
6. If this certificate is to be used instead of the self-signed certificate, the status must be switched to **Active**. In this case, the user is responsible for ensuring that the certificate is renewed and correct. If an externally issued certificate expires, connected systems may no longer be able to communicate with the device.

8.6.2 Trusted server certificates

Path: Settings → System → Certificates → Trusted server certificates

To ensure that a TLS-encrypted connection can be established, the corresponding server certificate must be uploaded. In this type of server-client connection, the device should check if the instance to which the connection is to be established is trusted.



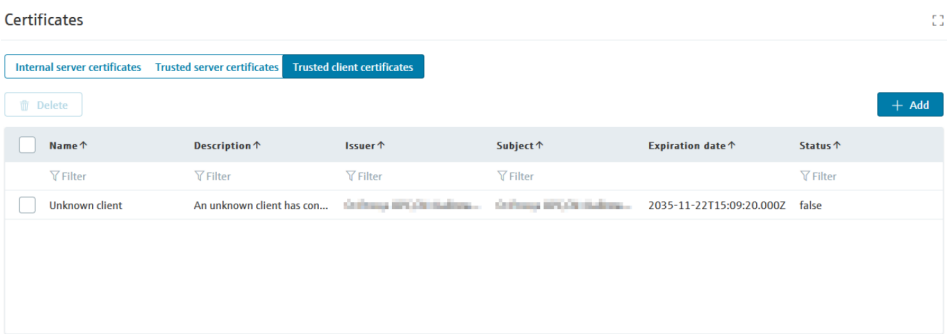
Server certificates must be in the PEM file format.

Adding a trusted server certificate

1. Click the **Add** button.
2. Specify a unique name for the certificate.
3. Upload the server certificate.

8.6.3 Trusted client certificates

Path: Settings → System → Certificates → Trusted client certificates



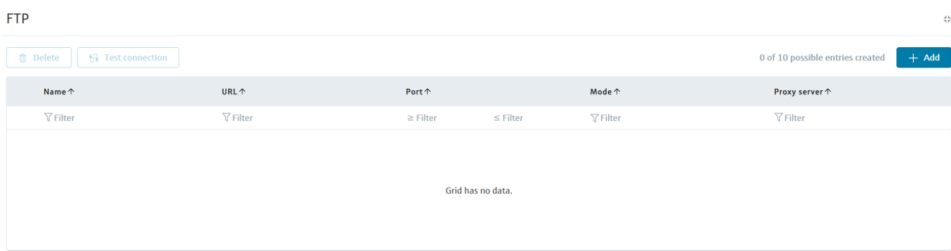
An external OPC UA client can connect to the device once the OPC UA server has been configured and activated. Further information can be found in the "OPC UA" section. Trusted client certificates are required to establish a connection between the device's OPC UA server and an OPC UA client if the connection via the server address is not successful. In this case, the connection must be marked as trusted using the certificate.

- 1. Select **Unknown client**.
- 2. Specify the client in more detail if required.
- 3. Under **Status**, change the option **Rejected** to **Trusted**.
- 4. Save the changes.
 - ↳ The connection can then be established.

8.7 FTP

Path: Settings → System → FTP

Data transmission via FTP can be used, among other things, to store backups on an external FTP server or to restore backups from an external FTP server. Up to 10 FTP servers can be configured.



As soon as an FTP server is configured, it is available for selection in the overview. Using the **Test connection** button, the user can test the connection to the FTP server.

Add FTP Server

1. Click the **Add** button.
↳ The input screen for FTP configuration is displayed.

← Add FTP configuration

2. Enter values in fields marked *.
3. Click **Save** to save the settings.

- **Name**- Name to identify the FTP server in the overview. A unique name makes identification easier. If no name is assigned, the **Name** field stays empty in the overview
- **Mode** - The mode in which the FTP server is operated
Active - Default value
- **URL** - IPv4 address or URL of the FTP server
- **Port** - TCP port of the FTP server
- **Username** - Enter the username if the FTP server has user credentials
- **Password** - Enter the password if the FTP server has user credentials
- **Proxy server** - Activate this switch if a proxy server is configured for communication with the FTP server. See also **Proxy server**
Inactive - Default value

Remove FTP server

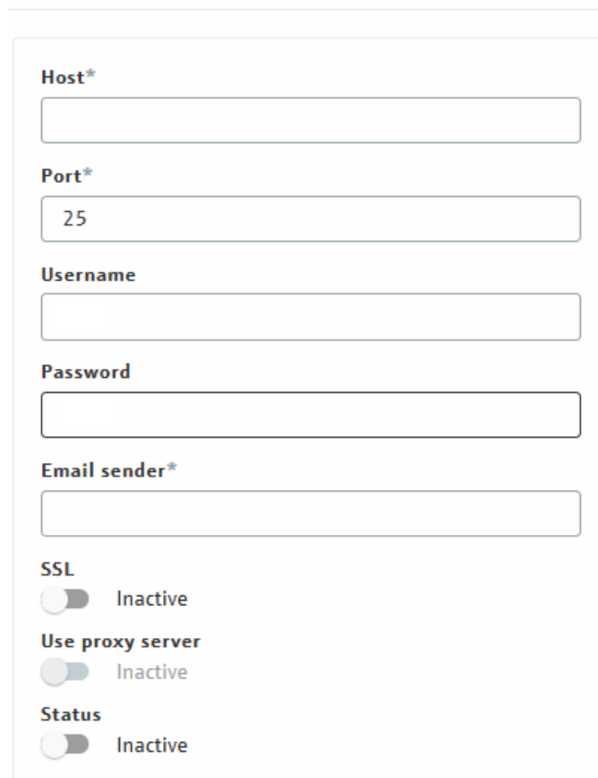
1. Select the check box of the FTP server to be deleted.
2. Click the **Delete** button.
3. Confirm the security prompt to delete.
↳ Clicking the **Delete** button deletes the FTP server.

8.8 SMTP

Path: Settings → **System** menu → SMTP

The SMTP settings must be configured so that the system can send alarm notifications via email, for example.

SMTP



Host*

Port*

25

Username

Password

Email sender*

SSL

Inactive

Use proxy server

Inactive

Status

Inactive

- **Host** – Address of the SMTP server. The server must be accessible from the device.
- **Port** – The TCP port via which the e-mails are sent
- **Username** – Enter the username if the SMTP server requires user credentials
- **Password** – Enter the password if the SMTP server requires user credentials
- **Email sender** – The email address of Density Calculator QML51 to send emails from Density Calculator QML51 to the SMTP server
- **SSL** – If the SMTP server supports encrypted communication and if communication is to be encrypted, this switch can be set to active
Inactive – Default value
- **Use proxy server** – This switch must be set to active if a proxy server is configured (see menu item **Proxy server**) and for communication with the SMTP server
Inactive – Default value

8.9 Proxy server

Path: Settings → **System** menu → Proxy server

Whether a proxy server exists depends on the user's IT environment. The proxy server connects the SMTP server to the internet, via which the device sends e-mails. The proxy server can be activated or deactivated in the SMTP Server menu.

Proxy server

Address*

Port*

Username

Password

- **Address** – The DNS name or the IP address of the proxy server
- **Port** – The port via which the proxy server is accessed.
- **Username** - Enter the username if the proxy server requires user credentials
- **Password** – Enter the password if the proxy server requires user credentials

8.10 Units

Path: Settings → System → Units

System default units can be configured, units can be viewed and new units added.

In the overview list, preconfigured units can be edited (number of decimal places and significant digits of the measured value), and user-specific units can be added.

Under Standard settings, the units for displaying the values can be selected.

Units

Overview

Standard settings

Delete

+ Add

☐	Unit ↑	Description ↑	Type of unit ↑	Category ↑	Decimal places ↑	Leading digits ↑
	▼ Filter	▼ Filter	▼ Filter	▼ Filter	▼ Filter	▼ Filter
☐	%	Percentage	Miscellaneous	System	2	1
☐	%ABV	percent ABV	Alcohol concentration	System	2	1
☐	%Proof	percent proof	Alcohol concentration	System	2	1
☐	%mass	percent mass	Sugar content	System	2	1
☐	%vol	percent volume	Alcohol concentration	System	2	1
☐	GHz	Gigahertz	Frequency	System	3	1
☐	Hz	Hertz	Frequency	System	2	1
☐	K	Kelvin	Temperature	System	2	1
☐	MHz	Megahertz	Frequency	System	3	1
☐	MPa	megapascals	Pressure	System	2	1

- **Unit** - Symbol for unit
- **Description**- Description or designation of the unit
- **Type of unit**- Assignment of units to types to allow quick and easy sorting and identification of units

- **Category** - Categories for units
 - **System**- Predefined units that cannot be deleted
 - **Custom**- User-defined units that can be edited and deleted
- **Decimal places** - Number of decimal places that are displayed with this unit
- **Leading digits** - Number of leading digits displayed for this unit

Edit unit

Decimal places and leading digits can be edited

1. Click the unit in the **Overview** tab to change the unit settings.
 - ↳ The input screen for units is displayed.

← Edit unit

Unit*

GHz

Description*

Gigahertz

Type*

Frequency

Decimal places*

0

Leading digits*

1

2. Enter the number of decimal places and leading digits. Possible number: 0 to 10.

i For predefined units, only the parameters **Decimal places** and **Leading digits** can be modified.

For user-defined units, **Unit** and **Description** can also be modified.

← Edit unit

Unit*

%vol

Description*

Alcohol volume percentage

Type*

miscellaneous

Decimal places*

1

Leading digits*

0

3. Click **Save** to save the settings.

Add a new unit

1. Click the **Add** button.
 - ↳ The input screen for unit is displayed.

← New unit

Unit*
%vol

Description*
Alcohol volume percentage

Type*
miscellaneous ▼

Decimal places*
1

Leading digits*
0

2. Enter values in fields marked *.

- **Unit**- Input box for new unit symbol
- **Description**- Description or designation of the unit The description is mandatory and ensures clarity for later settings
- **Type**- The unit type helps with subsequent identification and sorting. If no suitable unit type is available, select **Miscellaneous**.
- **Decimal places** - Number of decimal places that are displayed with this unit
Possible number: 0 to 10
- **Leading digits** - Number of leading digits that displayed with this unit
Possible number: 0 to 10

3. Click **Save** to save the settings.

 Conversion to a user-specific unit is not possible. The measured value is displayed in the user-specific unit according to the standard settings (e.g. density value corresponding to kg/m³).

Remove a user-defined unit

1. Select the check box of the user-defined unit to be deleted.
2. Click the **Delete** button.
3. Confirm the security prompt to delete.
 - ↳ Clicking the **Delete** button deletes the unit.

The **Standard settings** tab shows the default units for the existing unit types.

Units



Overview

Standard settings

Type of unit	Standard unit	Description
Temperature	°C	Degrees Celsius
Pressure	kPa	kilopascals
Density	kg/m ³	kilograms per cubic meter
Miscellaneous	%	Percentage
Time	s	Seconds
Current	mA	milliAmpere
Relative density	SG	specific gravity
Frequency	Hz	Hertz
Alcohol concentration	%vol	percent volume
Sugar content	°Brix	degrees brix
Concentration	mol/l	mol per litre

Edit default units

1. In the **Standard settings** tab, search for a suitable unit type and select the desired unit from the drop-down list.
2. Click **Save** to save the settings.

8.11 Location

Path: Settings → System → Location

The device can be identified in distributed systems using the location information. Specifying location information is optional and is used primarily in the area of inventory control.

Location

Name*

Street

Number

Zip code

City

State

Country

Latitude

Longitude

Description of the installation location.

Edit location

1. Enter values in fields marked *.
2. Click **Save** to save the settings.

- **Name** - Name of the location
- **Street** - Street name
- **House number**
- **Zip code**
- **City** - Name of city or town
- **State**
- **Country** - Drop-down list with available countries
- **Latitude** - Position information for latitude
- **Longitude** - Position information for longitude
- **Description of the installation location.** - Description of the installation site, e.g. for installations in remote locations.

8.12 Notifications

NOTICE

This function is in preparation, but does not function in the current firmware.

Notifications of exceeded alarm limits are not sent.

- Check the Alarm column in the Overview menu regularly for alarms. The alarms present are displayed there.

Path: Overview

8.13 Email recipients

Path: Settings → Notifications → Recipients

Up to 5 recipients can be configured and managed for email notifications.

Recipients

[Delete](#) [Send test email](#) 1 of 5 entries [Add](#)

Email	Name	Preferred language	Subscribed events
☐ testmail@testmail.com	Test Nutzer	English	Alarm communication error, Alarm limit HI, Alarm limit MHH, Alarm L...

Add a new recipient

1. Click the **Add** button.
 ↳ The input screen for new recipients is displayed.

← New email recipient

Email*

Name*

Preferred language*

English

Send notification for

☐ Select all

☐ Alarm - limit high high (HH)
 ☐ Alarm - limit high (H)
 ☐ Alarm - limit low (L)
 ☐ Alarm - limit low low (LL)
 ☐ Alarm - device communication failure
 ☐ Diagnostic code (DC)

2. Enter the email address of the recipient in the **Email** input box.
3. Enter the name of the recipient in the **Name** input box.
4. Select the desired language for emails from the **Preferred language** drop-down list.
5. In the **Send notification for** section, select one or more events for which the recipient should receive notifications.
6. Click **Save** to save the settings.

As soon as a recipient has been configured, a test email can be sent via the **Send test email** button to check if all the necessary settings, e.g. SMTP server or email address, have been made correctly.

- **Email** - Input box for recipient's email address
- **Name** - Input box for name of recipient
- **Preferred language** - Drop-down list for languages The email template is then created in the selected language
- **Send notification for** - Section with check boxes that allow you to select the events for which the recipient should receive notifications
Select all - Selecting or deselecting this check box also activates or deactivates all other check boxes in this section.

Remove a recipient

1. Select the check box of the recipient to be deleted.
2. Click the **Delete** button.
3. Confirm the security prompt to delete.
 - ↳ Clicking the **Delete** button deletes the recipient.

8.14 System properties

System properties can be called up in the Settings → System → System properties menu.

System properties

System properties		
Editable system properties	Fixed system properties	
System property ↑	Existing setting ↑	Default ↑
▽ Filter	▽ Filter	▽ Filter
Historical data storage interval [min]	5	5
Maximum number of configured alarms per asset	20	20
Maximum number of assets	90	90
Maximum number of connected gateways	6	6
Maximum number of linearizations	180	180
Alarm delay time [s]	10	10
Alarm hysteresis [%]	10	10
Mineral constant of measurement point 1	1,15	1,15
Mineral constant of measurement point 2	1,15	1,15
Accuracy of measurement point 1	2	2
Accuracy of measurement point 2	2	2
Tolerance of covered frequency difference [Hz]	3	3
Tolerance of uncovered frequency difference [Hz]	3	3
Toast notifications for diagnostic codes enabled	true	true

System properties describe system settings that should only be adjusted in special cases. Changing the system properties may restrict system performance and should only be carried out in consultation with the Endress+Hauser service technicians.

9 System integration

9.1 Configuring an output

Path: Settings → Output → Overview

Only measured values are transmitted to a receiver via the outputs. All available outputs are displayed on the **Overview** tab.



More information is provided in the "Output" section.

Overview

Name ↑	Description ↑	Output type ↑	Active ↑
▽ Filter	▽ Filter	▽ Filter	▽ Filter
MODBUS		Modbus TCP	Active
OPC UA		OPC UA	Inactive

- **Name** – Identifier used to display the connection in the overview table
- **Description** – Field for explanations
- **Output type** – Identifier used to display the connection in the overview table
- **Active** – Information on the active/inactive status of a connection

9.2 Modbus TCP

Path: Settings → Output → Overview

The device provides a server that can be activated. Up to 3 external clients can connect to the device if the server is configured and activated.

Activating the Modbus TCP server

1. Click the **Modbus TCP** entry in the overview list to edit the output parameters.

2. Modify the entry in the **Name** field if desired.
3. In the **Port** field, enter the port for this connection if default port 502 is not to be used.

 The toggle switch in the **Status** area is set to **Active** by default.

- **General information** - Area for general information
 - **Name** - Identifier used to display the connection in the overview table. The field is already populated, but the contents can be changed for unique identification of the target system
 - **Description** - Field for explanation of this connection
- **Output details** - Detailed information about the selected data output
 - **Output type** - Internal identifier used to display the connection in the overview table
 - **Port** - Number of the TCP port. Default value: 502
 - **Data transmission** - Information on data transmission
- **Status** - Status information on this connection
 - **Inactive** - The connection is not active
 - **Active** - The default setting for this parameter. The connection is active

 The stored register map is described in Special Documentation (SD). For more information, refer to the "Documentation" section.

9.3 OPC UA

Path: Settings → Output → Overview

The device provides a server that can be activated. Up to 3 external clients can connect to the device when the server is configured and activated.

Activating the OPC UA server

1. Click the **OPC UA** entry in the overview list to edit the output parameters.

← Overview

General information

Name*

OPC UA

Description

Output details

Output type*

OPC UA

Port*

4840

Data transmission

Data is transmitted as live data.

Status

Active Inactive

2. Modify the entry in the **Name** field if desired.
3. In the **Port** field, enter the port for this connection if default port 4840 is not to be used.
4. Click the changeover switch in the **Status** area to change it to **Active**.
 - ➔ The connection is now active.

- **General information** - Area for general information
 - **Name** - Identifier used to display the connection in the overview table. The field is already populated, but the contents can be changed for unique identification of the target system.
 - **Description** - Field for explanation of this connection
- **Output details** - Detailed information about the selected data output
 - **Output type** - Identifier used to display the connection in the overview table
 - **Port** - Number of the TCP port. Default value: 4840
 - **Data transmission** - Information on data transfer
- **Status** - Status information on this connection
 - **Inactive** - The default setting for this parameter The connection is not active
 - **Active** - The connection is active.



The basic structure of the OPC UA server is described in Special Documentation (SD). For more information, refer to the "Documentation" section.

10 Operation

10.1 Device and data point overview

All available devices and data points are displayed in this overview. If the devices have been created correctly and Density Calculator QML51 is activated for polling fieldbus data, the data is retrieved in real time.

Alarm	Device	Data point	Status	Value	Unit	Timestamp
Hi	device-01	Liquid temperature	OK	25	°C	07:08:42 27.01.2025
	device-01	Gauge command	Up	1		07:08:40 27.01.2025
	device-01	Gauge status	Displacer at reference position	1		07:08:40 27.01.2025
	device-01	Observed density	Warning	9.999	kg/m³	07:08:42 27.01.2025
	device-01	Tank level	OK	102	mm	07:08:42 27.01.2025
	device-02	Gauge command	Up	1		07:08:40 27.01.2025
	device-02	Gauge status	Displacer at reference position	1		07:08:40 27.01.2025
	device-02	Liquid temperature	OK	35	°C	07:08:41 27.01.2025
	device-02	Observed density	Warning	9.999	kg/m³	07:08:41 27.01.2025
	device-02	Tank level	OK	22	mm	07:08:41 27.01.2025

- 1 Prioritize sorting of table
- 2 Filter columns
- 3 Filter value range based on 2 criteria simultaneously

Properties of table

- The table is presorted. Sorting can be prioritized. Users can change the type of prioritization by clicking the arrow (1) multiple times. Presorting is configured as follows:
 - Entries with active alarms should be displayed at the top (in ascending order)
 - The rows should be sorted by device (in descending order)
 - The rows should be sorted by data points (in descending order)
- A change in the sorting order cannot be saved as a new default setting
- Columns can be filtered (2). For example, you can display the data points of one device only
- The value range can be filtered according to 2 criteria simultaneously (3). For example, all devices whose product temperature is between 20 and 30 °C can be identified

Parameters and values in overview

- **Alarm** - Active alarms are displayed in the first column
 - **HiHi** - An active high high alarm is present
 - **Hi** - An active high alarm is present
 - **Lo** - An active low alarm is present
 - **LoLo** - An active low low alarm is present
 - **Comm** - Communication is disrupted between the measuring instrument and Density Calculator QML51
- **Data point(s)** - Data point read by the Density Calculator QML51 from the measuring instrument
- **Status** - Status information for the measuring instrument and data point, as well as communication between the Density Calculator QML51 and the measuring instrument
- **Value** - Read value
- **Unit** - Corresponding unit
- **Timestamp** - Timestamp Time when the displayed value was last updated

10.2 Service functions

Path: Service functions → Verification

Liquiphant oscillation frequency verification:

This oscillation frequency of the Liquiphant sensor can change over time, for example as a result of corrosion or buildup.

To detect changes in the oscillation frequency, oscillation frequencies can be recorded and compared.

The oscillation frequency at the time of commissioning is compared to the oscillation frequency after a certain time in operation (in uncovered state).

This comparison can be used to verify a possible deviation in the accuracy of the sensor to the state during commissioning.

The covered/uncovered oscillation frequency should be recorded and stored at the time of commissioning.

Use **Start verification** to record the oscillation frequency at a later point in time. This can detect a change in the oscillation frequency. Density Calculator QML51 automatically compares the initial frequency with the current frequency.

Carry out maintenance work if there is a change in frequency of at least 3 Hz depending on the direction (positive or negative deviation). See the "Maintenance" section of the Operating Instructions for the Liquiphant.

 The oscillation frequency of the uncovered sensor should be recorded during commissioning. If this is performed only after a while in operation, the sensor can already have deviations from the as-delivered state, which can be attempted as a result of abrasion or corrosion, for example. In this case, the verification no longer can determine the deviation from the original oscillation frequency in a uncovered state during commissioning.

 Initial setting of frequency change: 3 Hz

The default value can be adjusted by a service technician in the **System properties** menu item.

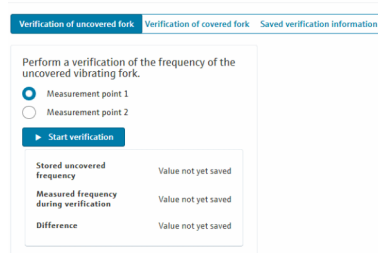
 Empirical data show that under identical ambient conditions (reference medium, freely vibrating), a deviation of 3 Hz can already lead to significant errors in the density calculation and derived quantities.

Therefore, carry out maintenance immediately even in the event of minor deviations.

Start verification

1. Establish reference operating conditions (in accordance with commissioning conditions).
2. Select "uncovered" or "covered" verification.

↳ Verification



Verification of uncovered fork	
Perform a verification of the frequency of the uncovered vibrating fork.	
☒ Measurement point 1	
☐ Measurement point 2	
Start verification	
Stored uncovered frequency	Value not yet saved
Measured frequency during verification	Value not yet saved
Difference	Value not yet saved

3. Select the measurement point at which the verification is to be performed.
4. Start verification → Click button.

↳ The device takes measurements for 10 seconds and compares the average value with the stored commissioning value, issuing a pass or fail message depending on the difference.

5. The stored and the most recent verification values can be displayed via the **Saved verification information** tab:

↳ Verification

Verification of uncovered fork Verification of covered fork **Saved verification information**

Saved verification information of measurement point 1

Stored covered frequency	Value not yet saved
Stored uncovered frequency	Value not yet saved
Frequency deviation of the uncovered vibrating fork between initial commissioning and final verification.	Value not yet saved
Frequency deviation of the covered vibrating fork between initial commissioning and final verification.	Value not yet saved

Saved verification information of measurement point 2

Stored covered frequency	Value not yet saved
Stored uncovered frequency	Value not yet saved
Frequency deviation of the uncovered vibrating fork between initial commissioning and final verification.	Value not yet saved
Frequency deviation of the covered vibrating fork between initial commissioning and final verification.	Value not yet saved

The values for **Frequency deviation of the uncovered vibrating fork between initial commissioning and final verification** and **Frequency deviation of the covered vibrating fork between initial commissioning and final verification**. are overwritten after the verification has been carried out.
The values for **Stored covered frequency** and **Stored uncovered frequency** are the comparative values recorded during commissioning.

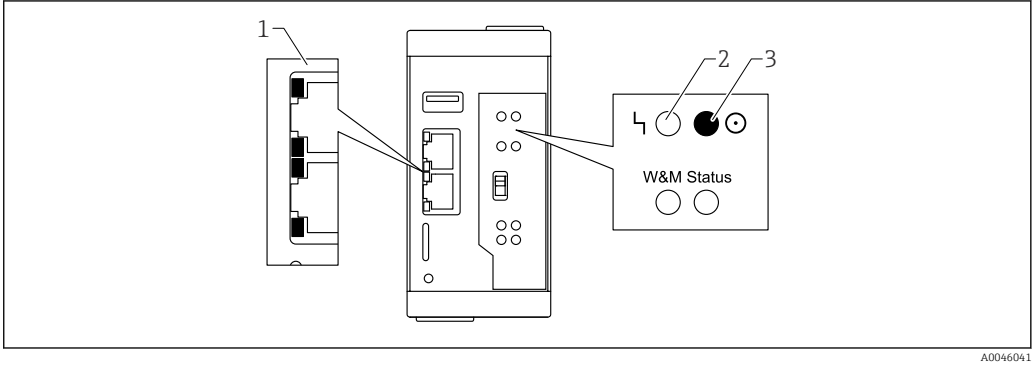
 Recommendation: Record the comparative values again following maintenance of the vibrating fork, thereby overwriting them.

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Endress+Hauser

11 Diagnostics and troubleshooting

11.1 General troubleshooting



? The LEDs (1) on RJ45 connector are not lit

Possible cause	Solution
The Ethernet data connection is interrupted	Check the Ethernet connection 1. Check the cables are not damaged. 2. Check the RJ45 connector is not damaged. 3. Check the power supply.

? The red fault LED (2) is lit

Possible cause	Solution
Ethernet connection LAN 1 not connected to network or computer	Establish an Ethernet connection
Class F error as per NAMUR Recommendation NE 107 has occurred (red symbol)	Check active error messages in the overview 1. Overview: Service functions → Diagnostic code 2. Search for active error message and read the Diagnostic code. 3. Search for the Diagnostic code in the diagnostic list and take the measures described there to rectify the error.

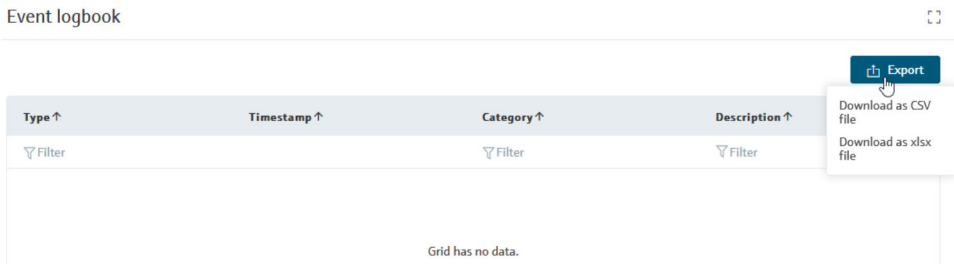
? The green power supply status LED (3) is not lit

Possible cause	Solution
No power	Check the power supply 1. Check the power supply is switched on. 2. Check the power supply is connected correctly. 3. Check the supply voltage is the same as indicated on the nameplate.

11.2 Event logbook

Path: Service functions → Event logbook

Important service messages are displayed and saved in the event logbook, which can help service personnel to identify and solve problems. The columns of the event logbook can be sorted and filtered. The event logbook can be exported as a CSV file and Excel file.



- **Type** – Assignment of an event to a type of category
- **Timestamp** – Timestamp of an event
- **Category** – Assignment of an event to a category
- **Description** – Brief description of an event

11.3 Overview of diagnostic information

11.3.1 Diagnostic codes

Path: Service functions → Diagnostic code

The generated NE 107 diagnostic messages are stored under the menu item Diagnostic code. Up to 1,000 inactive entries are saved; the entries are then overwritten. The oldest entries are deleted when new entries are added (first in – first out).

Diagnostic code					
Status	Source	Code	Description	Start date	End date
Filter	Filter	> Filter < Filter	Filter		
Active	Protocol polling	C506	Protocol polling is not active	05:49:01 PM 28-Apr-2022	
Inactive	External SD card	C384	External SD card not accessible	05:48:48 PM 28-Apr-2022	10:15:11 PM 19-May-2022
Inactive	USB	C385	USB not accessible	05:48:47 PM 28-Apr-2022	10:28:04 PM 19-May-2022
Inactive	RTC	M232	RTC Sync Error	05:48:47 PM 28-Apr-2022	12:00:03 AM 01-Jan-2025
Inactive	Time read	M231	Time read error	05:48:45 PM 28-Apr-2022	12:00:14 AM 01-Jan-2025

The columns of the table can be filtered and sorted. The diagnostic code entries can be saved as part of the backup for a service case. The list of diagnostic codes can be found in the "Diagnostic list" section.

11.4 Diagnostic list

The diagnostic list records the fault states with a diagnostic code, the category according to NAMUR Recommendation NE 107, a brief description and troubleshooting measures.

The diagnostic list is structured according to the format in the following table:

NE107	DC	Text
<Graphic>	<Diagnostic code>	<Short description>
		<Measure 1>
		<Measure n>

Explanations

- **NE107:** Category as per NAMUR Recommendation NE 107. The category is assigned using a graphic.
 -  Meaning: Failure. Code letter: F
 -  Meaning: Function check. Code letter: C
 -  Meaning: Out of specification. Code letter: S
 -  Meaning: Maintenance required. Code letter: M
- **DC:** Diagnostic code
- **Text**
 - In the same line as the diagnostic code: short description of the error
 - In the following lines until the next diagnostic code: measures 1-n for troubleshooting

Diagnostic list

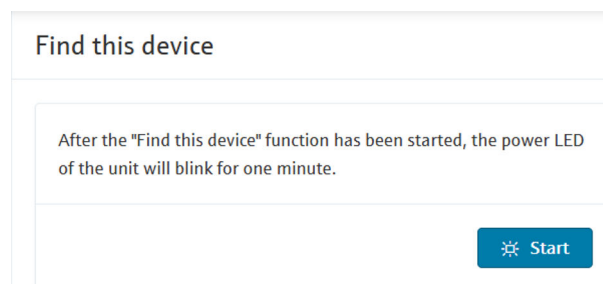
NE107	DC	Text
	506	Protocol polling is not active
		Activate protocol polling
	382	Internal SD card not accessible
		Contact the Service team
		Insert the SD card into the internal card slot
	384	External SD card not accessible
		Insert the SD card into the external card slot
	310	NV memory failure
		Restart device
		Contact the Service team
	311	NV init config failure
		Restart device
		Contact the Service team
	231	Time read error
		Check the system time settings
		Check the settings of the external time server (if used)
	232	RTC Sync Error
		Check Internet connection
		Check date and time setting
		Contact the Service team
	275	IO Board Failure
		Check the connections to the I/O board
		Replace the I/O board
	276	LAN fault
		Check the LAN cable connection
		Check the LAN configuration
		Contact IT
	301	Not enough space in external SD card
		Delete files that are no longer needed
		Use a larger SD card
		Contact the Service team
	305	Low RAM detected
		Close programs that are no longer needed

NE107	DC	Text
		Restart device
		Contact the Service team
	306	High CPU
		Close programs that are no longer needed
		Restart device
		Contact the Service team
	515	Configuration Checksum Error
		Contact the Service team
	316	Software Checksum Error
		Contact the Service team
	302	Not enough space in usb
		Delete files that are no longer needed
		Use a larger USB storage device
	385	USB not accessible
		Check the USB connection
		Restart device
		Format the USB storage device
	302	Not enough space in internal SD card
		Delete files that are no longer needed
		Contact the Service team
	400	Communication faulty
		Check the connection and try again
	441	AIO @ 1-4 current output alarm
		Check the process
		Check the current output settings
	064	Pulse rate out of range
		Check the process conditions
		Check the ambient conditions
		Replace the device
	905	Frequency higher as expected
		Check the sensor
		Reduce abrasion
		Check the installation location
		Perform field calibration
		Contact the Service team
	904	Frequency lower as expected
		Check the sensor
		Clean the sensor
		Contact the Service team
	906	PFM Device error
		Check the PFM device for proper operation
		Restart device
		Contact the Service team

NE107	DC	Text
✖	907	PFM communication error
		Check the PFM device for proper operation
		Restart device
		Contact the Service team
✖	505	Input data missing @ measurement point X
		Check the configuration of the measuring point
		Check the wiring
		Contact the Service team

11.5 Finding the device

The **Find this device** function can be accessed via the menu Service functions → Find this device.



If you click the **Start** button, the green LED (power supply status) of the device flashes for one minute. This signal helps you to find the device quickly in the cabinet.

11.6 Restart

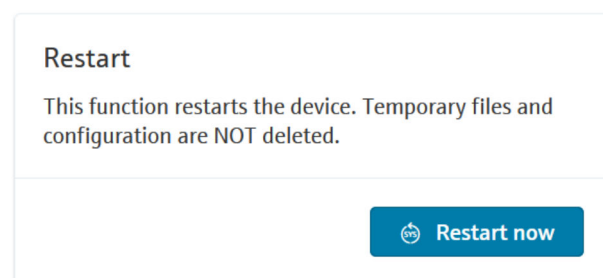
When it reboots, the device is only restarted and all the data and configurations are retained. This includes event logs, diagnostic codes, internal backup files and alarms.

2 methods are available for an easy restart:

- Restart via user interface (GUI)
- Restart using reset button

11.6.1 Restart (GUI)

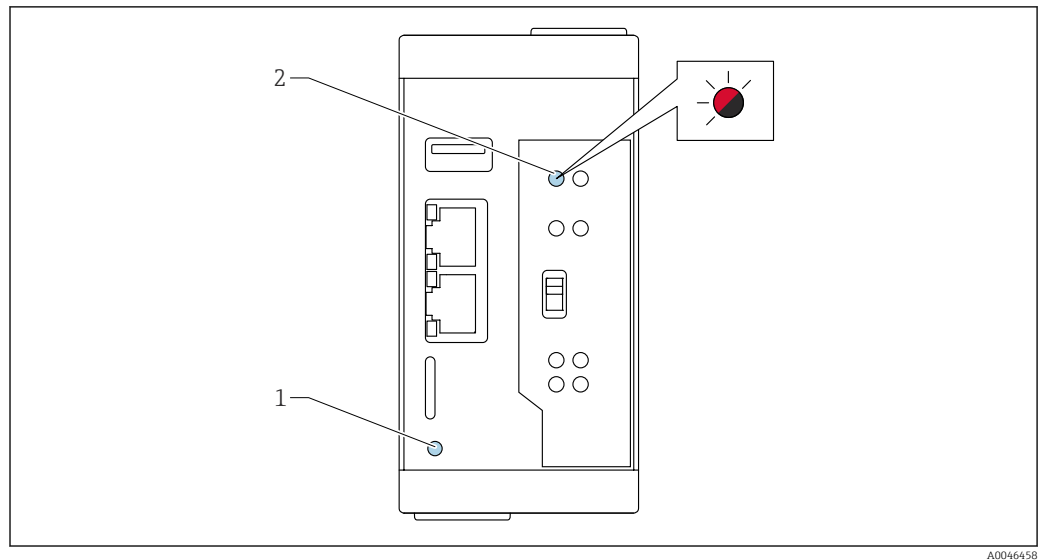
Path: Service functions → Restart and reset



Restarting the device

- Click **Restart** to restart the device.

11.6.2 Restart (Reset button)

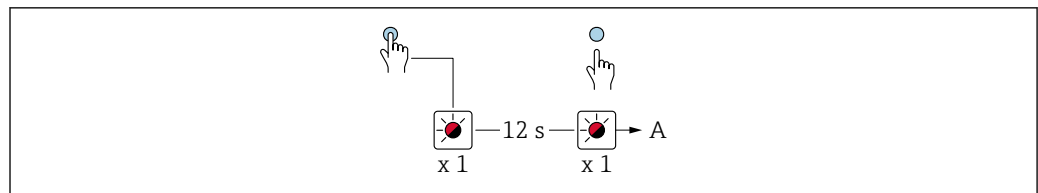


A0046458

- 1 Reset button
2 Red LED

Restarting the device

1. Press down and hold the **reset button** (1) using a pen.
 - ↳ The LED (2) flashes once. Continue holding the button. After approx. 12 s, the LED flashes again.
2. Release the **reset button** immediately.
 - ↳ The device restarts.



A0058685

A Device restart

11.7 Cleanup

Path: Service functions → Restart and reset

Cleanup will clear all temporary data. This includes event logs, diagnostic codes, internal backup files and alarms. Backup files on external data carriers connected to the device are also deleted. Such carriers may include USB sticks or SD cards for example.

i The device does not need to be reconfigured. All of the configured settings are retained.

Cleanup

This function performs a cleanup. The cleanup deletes all temporary data. This includes alarms, event messages, diagnostic codes, internal and external (USB drive and SD card) backup files. All configurations are kept.

 Cleanup

Running cleanup

- Click the **Cleanup** button to execute the function.
 - ↳ All temporary data are deleted and the device is then restarted.

11.8 Resetting the device

There are two methods available to reset the device to factory settings:

- Resetting via the user interface (GUI)
- Resetting using the reset button

11.8.1 Resetting the device (GUI)

Path: Service functions → Restart and reset

Factory reset

Reset back to factory settings. All data and configurations are deleted. After factory reset a reconfiguration of the whole system is required. If available, a backup can be restored.

 Reset

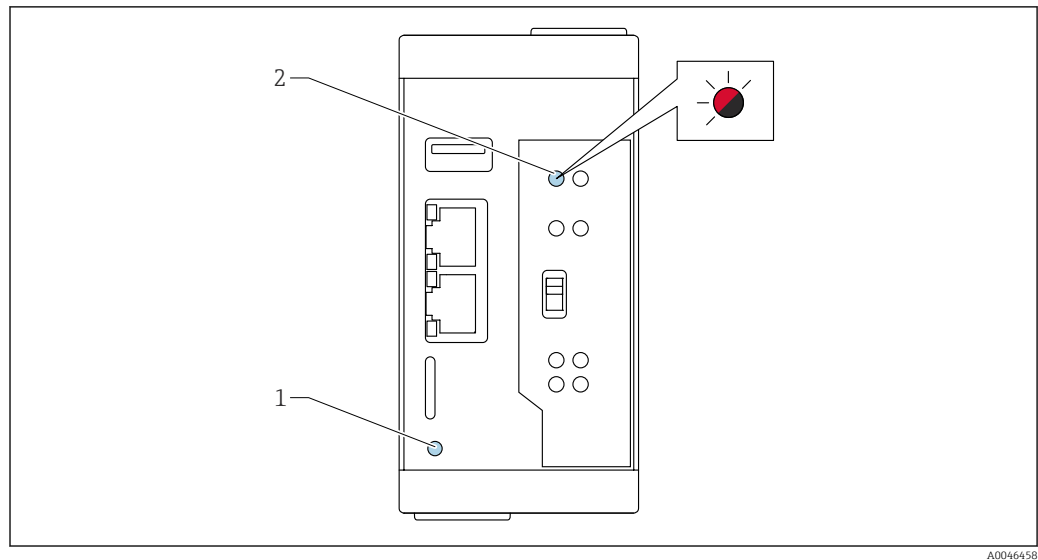
Reset the device to factory settings

- Click **Reset** to reset the device to the factory settings.
 - ↳ All data and configured settings are deleted.



The device must be reconfigured after the reset. If a backup is available, the configuration can be restored from the backup.

11.8.2 Resetting the device (Reset button)

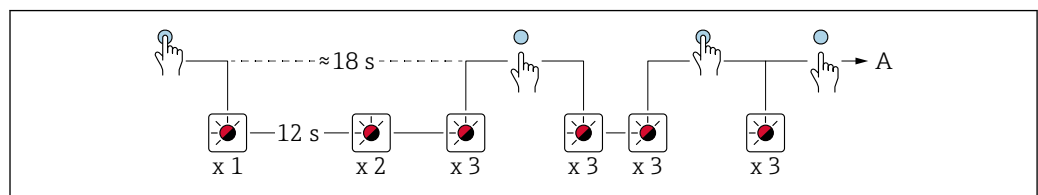


A0046458

- 1 Reset button
2 Red LED

Perform the factory reset

1. Push and hold down the **reset button** (1) until the LED (2) flashes 1 x 3 times. This will take about 18 s.
2. Release the **reset button**.
↳ The red LED flashes 2 x 3 times.
3. Push and hold down the **reset button** again until the LED flashes 3 times. Note: If the **reset button** is not pushed immediately after the LED flashes, the reset procedure is canceled.
4. Release the **reset button**.
↳ The device starts the factory reset.



A0047495

A Factory reset

11.9 Data backup and data recovery

Data backup and recovery are managed via the menu Service functions → Backup and restore.

11.9.1 Data backup

An existing device configuration can be saved with user data, log files, certificates or diagnostic codes.

Prerequisites

- To save a backup to a USB stick or an SD card, an appropriate permitted storage medium must be available and have been detected by the device.
- If the backup is to be saved on an FTP server, an FTP server must first be set up and connection must be possible.

A backup can be protected with a password by the system. The password can be freely selected without restriction. A password-protected backup can only be imported to another system with the associated password.

Backup and restore

BackupRestore

Setup

Target(s)*
☒ Internal
☐ SD card
☐ USB drive
☐ FTP

Protect backup with password
☐ Inactive

Options
☐ Users
☐ Log files
☐ Certificates
☐ Alarm history
☐ Diagnostic code

▶ Start

If a backup is started, the individual steps are displayed as they are completed:

Status

Progress
60%

Steps

☒ Cleanup
☒ Collecting data
☒ Compress file
☒ Sign file
☐ Transfer to target

The following is displayed once a backup is completed successfully:

File

Progress

100%

File

3590ad58989_3590ad58989_202
51009_0924_NXA80_00.04.01-
1491-ksp0663-2019-10-01-ADIN-
PHY.NXA80.bak

Size

127.8 KB

Steps

Cleanup

Collecting data

Compress file

Sign file

Transfer to target

The  button can be used to download the backup to the computer and the  button to delete it from the device again.

11.9.2 Data recovery

If the backup file for data recovery is password-protected, this password must be available and entered in the appropriate place.

Backup and restore

Backup
Restore

Restore

Backup source

☒ Internal

Backup file*

No data

☐ SD card

☐ USB drive

☐ FTP

☐ Upload

Password

Options*

☒ All

☒ Configuration

☒ Network settings

☒ Users

☐ Certificates

☐ Alarm history

☐ Diagnostic code

▶ Start

Backup files can be imported from different sources:

- **Internal** – If there is a backup file on the device, this backup file is found and preselected by the system
- **SD card** or **USB drive** – Backup files can also be loaded from these external storage media
- **FTP** – If an FTP server is to be used as a data source, it must be set up in advance and a connection must be available
- **Upload** – Backups can also be uploaded from a PC connected to the Density Calculator QML51.

Password – Password that was assigned when the backup file was created

The extent to which configuration files are to be restored is variable. Individual areas can be selected, or all of them can be selected at once.

- **Configuration** – All settings related to inputs and outputs
- **Network settings** – If this option is selected, the previous network settings are overwritten. The connection to the device may be lost. Once the backup has been restored, the device must be called up again via the network settings stored in the backup.
- **Users** – User data, such as passwords, is restored
- **Certificates** – Imported certificates are restored
- **Diagnostic code** – A saved log file containing diagnostic codes is restored

11.10 Firmware update

Updated firmware can be installed via the **Firmware update** menu item. Information on the firmware version currently installed is also provided here.

Path: Service functions → Firmware update

The screenshot shows the 'Firmware update' interface. On the left, there is a section titled 'Upload firmware file' with a 'File *' label. Below it is a dashed box containing the text 'Drop file or' and a 'Select file' button. Below the dashed box, it says 'Selected file' and 'No file selected'. At the bottom of this section is a 'File size' field showing a dash '-' and an 'Install' button. On the right, there is a section titled 'Firmware information' with a table showing the 'Installed version' as '01.00.00-RC3-ksp0663-2019-10-01-ADIN-PHY'.

A valid firmware file must be uploaded to the device.

Update firmware

1. Drag a valid firmware file onto the **File*** field and release the mouse button.
2. Alternatively, click the **Select file** button and select the file.
 - ↳ The size of the file is displayed once it has been uploaded successfully.
3. Click the **Install** button.
 - ↳ The uploaded firmware is installed.

11.11 Fieldbus monitor

Path: Service functions → Fieldbus monitor

When this function is active, trained service technicians can access the messages exchanged between the device and other field devices. Analyzing these messages can provide important information when field communication is disrupted.

The fieldbus monitor is set to inactive at the factory. If the fieldbus monitor was activated, it can be accessed via `comms@IPADDRESS` using SSH client software. Password: 4685

The connection via the SSH (secure shell) network protocol is secured and encrypted.

-  Switch the fieldbus monitor off again once message analysis is complete and the fieldbus monitor is no longer required.

Switch on the fieldbus monitor

1. Fieldbus monitor

Status

Inactive

Save

Click the **Status** toggle switch to turn on fieldbus monitoring.

2. Click **Save** to save the setting.

Status - Toggle switch for switching fieldbus monitoring on or off
Default value: Inactive

11.12 About the product

Clicking the **About** button in the bottom left-hand corner of the window opens a page with detailed information on the product.

11.12.1 Product details

The **Product details** tab is the electronic nameplate of the device.

About

Product detailsOpen source licenses

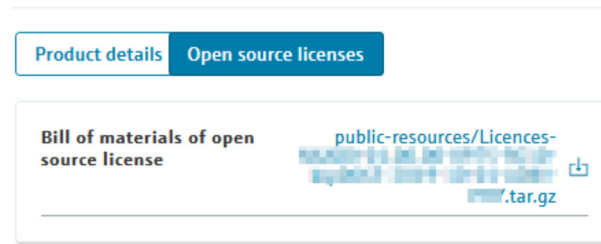
Product	QML51
Order code	QML51- 
Order ident	ABC123- 
Serial number	TB000 
Firmware version	01.00.00-0975-  PHY
Device name	TB000 
ENP version	2.03.01

The following important information about the product is listed here:

- Order code
- Serial number
- Firmware version

11.12.2 Open source software

About



Under the **Open source licenses** tab, you can download a document that lists all licenses and license information for the open-source software used.

11.13 Firmware history

Version 01.00.zz

Original software

12 Maintenance

12.1 Maintenance work

Maintenance tasks relating to the software are described in the following sections:

- Restart
- Clean-up reset
- Resetting the device
- Firmware update

12.1.1 Exterior cleaning

Clean the device with a dry cloth.

NOTICE

Caustic cleaning agents or solvents corrode surfaces

Important information on the housing may become illegible, surfaces become corroded.

- Do not use caustic cleaning agents or solvents.

⚠ CAUTION

Danger from electric voltage when cleaning with water

Risk of electric shock and injury from startle responses.

- Do not clean the device with water.

13 Repair

13.1 General information

13.1.1 Repair concept

The Endress+Hauser repair concept is devised in such a way that repairs can only be carried out through device replacement.

13.1.2 Repair services

Endress+Hauser offers a wide range of services.



Your Endress+Hauser Sales Center can provide detailed information on the services.

13.2 Return

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

1. Refer to the web page for information: <https://www.endress.com>
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

13.3 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 the manufacturer for disposal under the applicable conditions.

14 Accessories

The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.



The accessories can be partially ordered via the "Accessory enclosed" product structure.

14.1 Device Viewer

All the spare parts for the device, along with the order code, are listed in the *Device Viewer* (www.endress.com/deviceviewer).

14.2 Accessories enclosed

RN22 active barrier

- Active barrier, 2-channel for 4 to 20 mA, HART® transparent with 24 V DC and active/passive input and output
- Material number: 71440875
- Order number: 71748585, RN22 active barrier, ATEX
- Order number: 71748586, RN22 active barrier, CSA C/US
- Order number: 71748588, RN22 active barrier, NEPSI

Signal converter Modbus TCP/4 to 20 mA

- Converts Modbus TCP signals to 4 isolated channels into analog 4–20 mA signals. Active and passive outputs. Supply voltage: 18 to 30 V DC
- Material number: 71765893

14.3 Additional products

RNB22 system power supply unit

- System power supply for parallel operation with 100 to 250 V AC input and 24 V DC 2.5 A output as well as static/dynamic boost
- Material number: 71455664

Global Router RUT241 cellular radio and WLAN

- For 4G LTE (Cat4), 3G, 2G. Worldwide, Verizon excluded
- Material number: 71677203

Field housing, R4 182x180x165, 5x M20, PC

- Minitec protective housing. Plastic housing with sight glass cover
- IP66 degree of protection
- Material number: 52010132

15 Technical data

15.1 Ambient temperature range

–20 to 60 °C (–4 to 140 °F)

15.2 Transport and storage temperature

–25 to 85 °C (–13 to 185 °F)

15.3 Humidity

EN 60068-2-30; Db; 0.5 K/min: 5 to 85 %; non-condensing

15.4 Condensation

Not permitted

15.5 Operating height

Up to 2 000 m (6 562 ft) above sea level

15.6 Climate class

IEC 60654-1, Class B2

15.7 Ambient class

Pollution degree: 2

15.8 Degree of protection

IP20 (as per IEC/EN 60529, NEMA 1)

IK06 (as per IEC/EN 61010-1)

15.9 Vibration resistance

EN 60068-2-64 / IEC60068-2-64: 20 to 2 000 Hz, 0.01 g²/Hz

15.10 Shock resistance

IEC60068-2-27:2008, ±15 g; 11 ms

15.11 Impact resistance

1 J

15.12 Electromagnetic compatibility (EMC)

- Interference immunity: as per IEC 61326, industrial environment
- Interference emissions: as per IEC 61326, Class B



Information on connecting shielded cables is provided in Technical Information TI00241F, "EMC test procedures".

15.13 Weight

260 g (0.57 lb)

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