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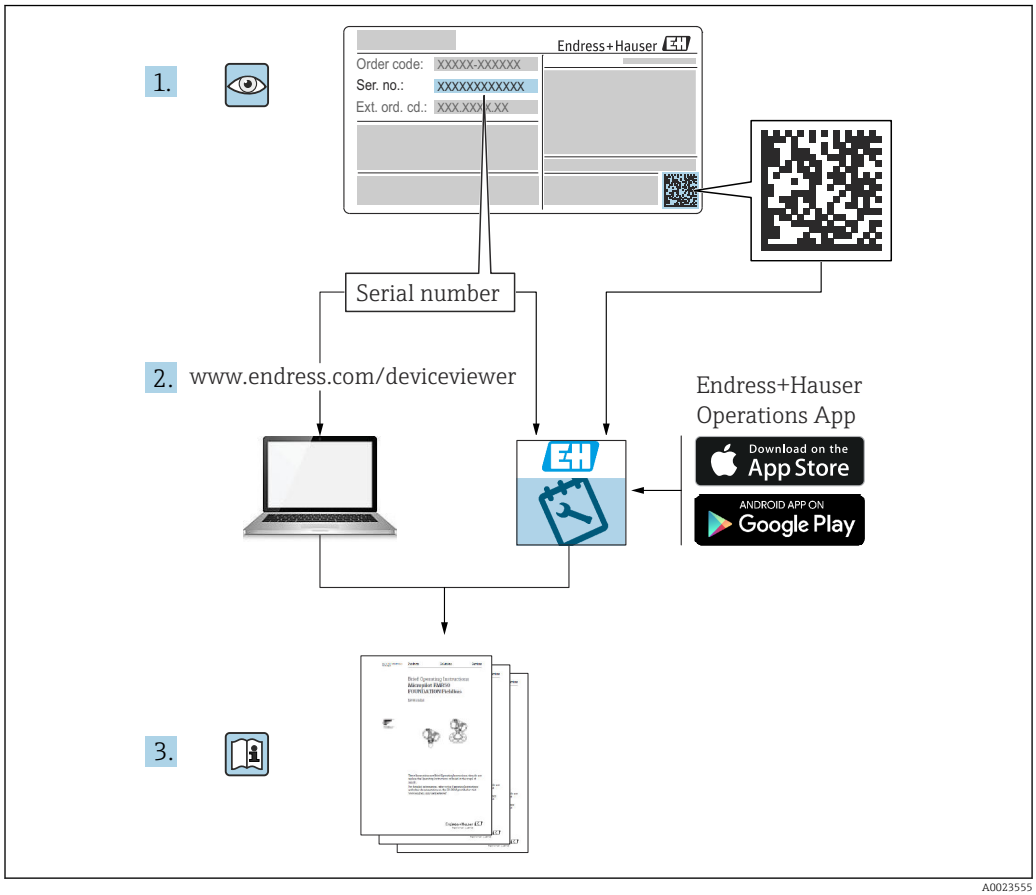
2024-11-01

Operating Instructions
Fermentation Monitor QWX43

Continuous monitoring of key parameters such as alcohol content, extract content and original gravity in beer

Endress+Hauser
People for Process Automation



- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid hazards for 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. Your Endress+Hauser distributor will supply you with current information and updates to this manual.

Table of contents

1 About this document

1.1 Document function

These 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 mounting, 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 dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION

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

NOTICE

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

1.2.2 Electrical symbols

⎓
Direct current

~
Alternating current

≂
Direct and alternating current

⏚ Ground connection
Grounded clamp, which is grounded via a grounding system.

⏚ Protective earth (PE)
Ground terminals, which must be grounded prior to establishing any other connections. The ground terminals are located on the inside and outside of the device.

1.2.3 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

ℹ **Tip**
Indicates additional information


Reference to documentation


Reference to page


Reference to graphic


Visual inspection

1.2.4 Symbols in graphics

1, 2, 3, ...
Item numbers

1., 2., 3.
Series of steps

A, B, C, ...
Views

A-A, B-B, C-C etc.
Sections

 **Hazardous area**
Indicates the hazardous area

 **Safe area (non-hazardous area)**
Indicates the non-hazardous area

1.3 List of abbreviations

Abbreviation	Description
AOI	Add-On Instruction (Rockwell controllers)
IT	Information technology, e.g. company network for information processing and Internet connection
OT	Operational technology, e.g. network for process automation
OUC	Open User Communication: Open User Communication is a method for data transmission via Ethernet (TCP/IP) in Siemens SIMATIC systems

1.4 Documentation

All available documents can be downloaded using:
- the serial number of the device (see cover page for description) or
- the data matrix code of the device (see cover page for description) or
- "Download" area of web page www.endress.com

1.4.1 Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

1.5 Registered trademarks

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

VARIVENT® N
Registered trademark of GEA Group Aktiengesellschaft, Düsseldorf, Germany

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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Follow instructions and comply with conditions

The operating personnel must fulfill the following requirements:

- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

2.2 Designated use

The Fermentation Monitor QWX43 is a measuring instrument for monitoring temperature, density, viscosity and sound velocity. The measuring instrument is specifically designed for monitoring the concentration of beer-specific values such as extract and alcohol.

- Only use the device for liquids
- Improper use can pose dangers
- Ensure that the device is free of defects while it is in operation
- Use the device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or fall below the limit values for the device
- Do not use the device in the hazardous area

2.2.1 Incorrect use

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

Using the Fermentation Monitor in a manner not specified by the manufacturer can compromise the protection offered by the Fermentation Monitor.

2.3 Safety instructions

⚠ WARNING

Incorrect commissioning leads to distorted measurement results or risk of injury due to incorrect installation!

- The device may only be commissioned by authorized and qualified personnel.
- If you do not understand the graphical instructions enclosed, then download the Operating Instructions.

⚠ WARNING

Danger of burns due to heated surfaces!

- Process-specific temperatures of up to 80 °C (176 °F) can occur at the process connection when the device is in operation. Use suitable gloves or allow the device to cool down.

⚠ WARNING

Risk of electric shock if voltage is present!

- If the device is connected to voltage, do not open the device cover and do not touch electrical contacts.

A secure WLAN is recommended on the customer's side for connection to the Internet.

2.4 Occupational safety

For work on and with the device:

- Wear the required protective equipment according to national regulations.

2.5 Operational safety

Risk of injury!

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

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability:

- Only perform repair work on the device if this is expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use original spare parts and accessories from Endress+Hauser only.

2.6 Product safety

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

The measuring device meets general safety standards and legal requirements. Furthermore, it complies with the EC directives which are listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.7 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Product description

3.1 Measuring principle

The Fermentation Monitor QWX43 is a measuring instrument for monitoring temperature, density, viscosity and sound velocity. The device is specifically used for monitoring the concentration of beer-specific values such as extract and alcohol.

The measuring principle is based on a combination of the vibronic principle with an integrated temperature measurement and a sound velocity measurement using ultrasound. The compact device is installed directly in the tank and is powered by a separate supply voltage. The IP66/67-rated housing contains a web server via which the sensor measured values are either sent to a PLC or to the Netilion server platform, irrespective of the version.

Two versions of the Fermentation Monitor QWX43 are available: the "Netilion server platform" version and the version for "Direct integration".

3.1.1 Direct integration version

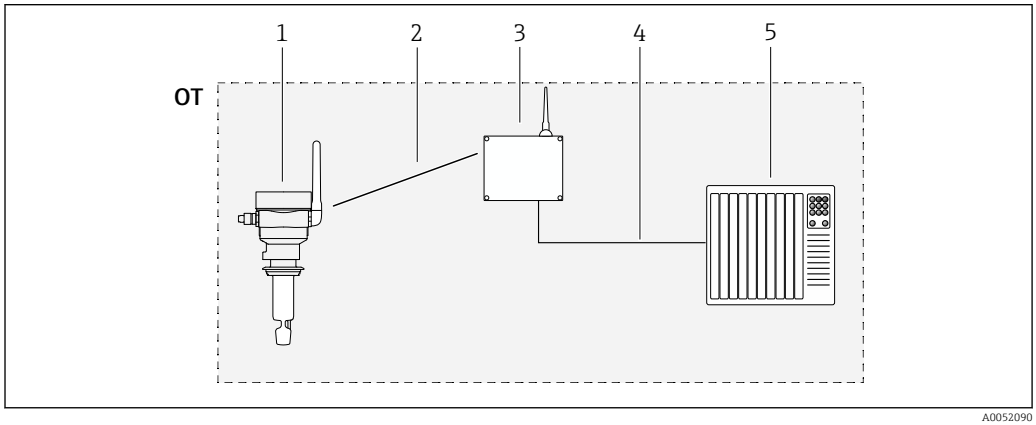
The web server integrated in the housing sends the sensor measured values to a wireless access point outside the Internet, from where they are forwarded to the customer's automation system via a wired connection and the TCP/IP protocol.

3.1.2 Netilion server platform version

The web server integrated in the housing is connected to the Internet and sends the measured values directly to the Endress+Hauser Netilion server platform via the user's Internet interface. The values can be called up and saved via the Endress+Hauser hosted Netilion server platform by means of the Netilion Fermentation app.

3.2 System configuration: Direct integration version

The QWX43 can be Fermentation Monitor connected to the web server and commissioned via a function block in the control system.

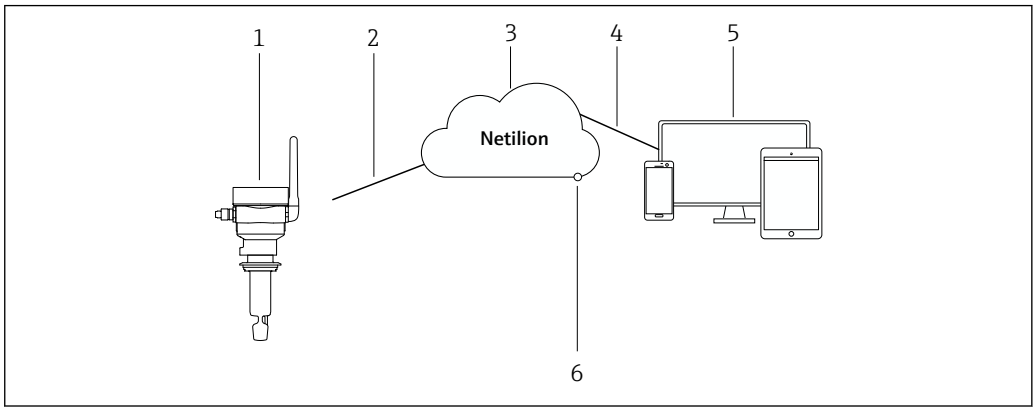


1 System configuration Fermentation Monitor QWX43 – Direct integration

OT Operational Technology, in this context, fieldbus network outside the Internet
1 Fermentation Monitor QWX43
2 WLAN connection (wireless connection)
3 Wireless access point
4 Wired connection: control system (TCP/IP)
5 Automation system

3.3 System design of Netilion server platform version

The Fermentation Monitor QWX43 can be put into operation with the following digital application:
Netilion Fermentation: https://Netilion.endress.com/app/fermentation

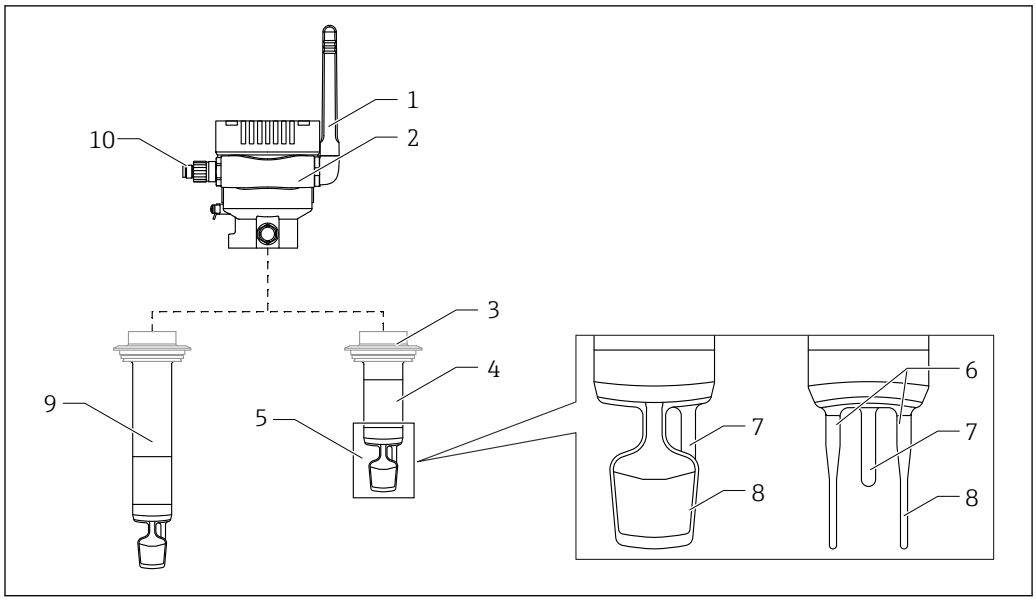


2 *System design of Fermentation Monitor QWX43*

1 *Fermentation Monitor QWX43*
2 *WLAN HTTPS Internet connection (mTLS 1.2)*
3 *Netilion server platform*
4 *https Internet connection*
5 *Netilion Services: browser-based Netilion service app*
6 *Netilion Connect: Application Programming Interface (API)*

Detailed information on the Netilion server platform: https://netilion.endress.com

3.4 Product design



3 Product design

1 Antenna
2 Single-chamber housing with nameplate
3 Process connection
4 Probe design: Compact version, standard length: 142 mm (5.59 inch)
5 Measuring elements
6 Ultrasonic sensor
7 Temperature sensor
8 Tuning fork (vibronic)
9 Probe design: Pipe extension
10 M12 plug to connect the supply voltage

3.5 Communication protocol between the control system and Fermentation Monitor

3.5.1 Protocol structure

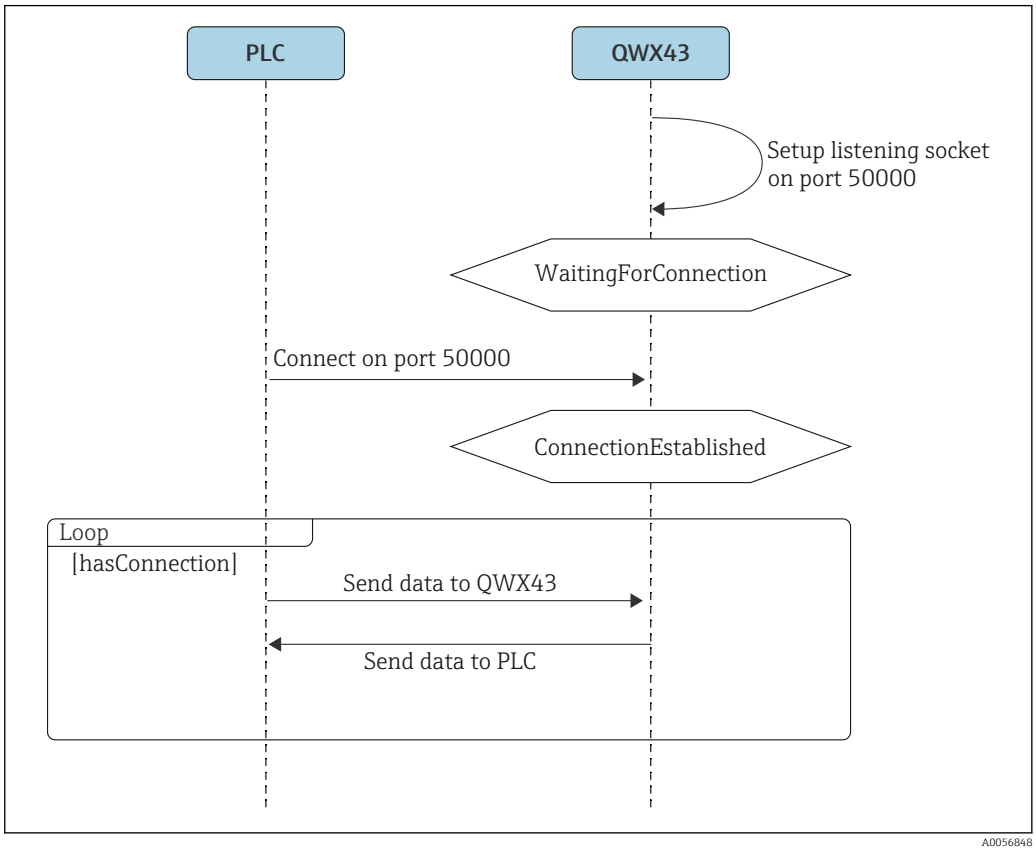
Communication between the control system, such as a Siemens or Rockwell controller, and the firmware of the Fermentation Monitor is via TCP. In addition, a proprietary protocol was defined for the Fermentation Monitor, which is able to write values to the control system and read values from the control system (Open User Communication).

Proprietary protocol structure

Designation	Start of Transfer	Protocol Version	Sender ID	Nr of Parameters	Nr of Bytes	Data	End of Transfer
Size [bytes]	2	2	40	2	2	N	2

Designation	Size [bytes]	Description
Start of Transfer	2	Indicates that new parameters are transmitted. The identification always has the value 0xABCD.
Protocol Version	2	Indicates the protocol version. The version is incremented if there were also changes for the protocol due to a new software version. The version starts with 1.

Designation	Size [bytes]	Description
Sender ID	40	▪ Fermentation Monitor sends data to the control system: Alphanumeric unique serial number of the Fermentation Monitor that writes the data (zero-terminated string, 12 bytes) ▪ Control system sends data to the Fermentation Monitor: OrderNr_SerialNr (nullterminierte Zeichenkette, 36 Bytes) The size of the sender ID is different when sending data and when receiving data.
Nr of Parameters	2	Total number of parameters transmitted per transmission.
Nr of Bytes	2	Total number of bytes of all transmitted parameters.
Data	N	Bytes of the transmitted parameter values (payload).
End of Transfer	3	Indicates the end of the transmission of the parameters. The identification always has the value 0xFEDC.



4 *Communication protocol sequence diagram*

Notes

- As TCP is reliable, no confirmation mechanisms or CRC calculations are added.
- For the transmission of data between the control system and Fermentation Monitor, it is only permitted to connect to port 50000.
- The control system initiates the connection to the firmware of the Fermentation Monitor. The control system consequently acts as the client and the Fermentation Monitor acts as the server. This has the advantage that the static IP address of the Fermentation Monitor can be stored directly in the control system or lodged with the respective client.

- There is a classic client/server architecture between the control system and the Fermentation Monitor.
  Whenever the control system requires new data from the Fermentation Monitor, it sends it a request. This request also includes telemetry data. The Fermentation Monitor immediately responds to this with the measured data.
- The maximum number of requests from the control system is limited to one request per second.
- If the Fermentation Monitor is in an error state, the Fermentation Monitor will communicate this to the control system by having the Fermentation Monitor write a parameter to the control system → 14.
- If the control system is in an error state, the control system will communicate this to the Fermentation Monitor by having the control system write a parameter to the Fermentation Monitor → 15.
- If an existing connection is terminated for any reason, the Fermentation Monitor goes to the "WaitingForConnection" state.
- All parameters and headers are sent in big-endian format. As some older controllers (e.g. S7-300/S7-400) are 32-bit systems, we use the FLOAT data type for floating-point numbers and UINT32/INT32 for whole numbers.

3.5.2 Examples for frames

Fermentation Monitor sends data to the control system

Only a selection of the parameters that are actually sent per request is presented in this example. The number of parameters sent per request depends on the respective protocol version.

Example: The following data should be sent to the control system

Parameter name	Data type	Unit	Value
Real fermentation degree	Float	%	95.6
Apparent fermentation degree	Float	%	95.07935
Density	Float	g/cm³	1.02522
ErrorCode[1]	Enum (2 bytes)	–	0 There is currently no error for the Fermentation Monitor.

Frame for the example

Start of Transfer	Protocol Version	Sender ID	Nr of Parameters	Nr of Bytes	Data	End of Transfer
43981 (0xABCD)	1	S7035925195 (zero-terminated string)	4	14	See the following table.	65244 (0xFEDC)

Data			
95.6 [1]	95.07935 [1]	1.02522 [1]	0

1) Floats in the IEEE754 standard float format

Control system sends data to the Fermentation Monitor

Example: The following data should be sent to the Fermentation Monitor

Parameter name	Data type	Unit	Value
maximumHeadPressureOfTankAbsolute	Float	bar	1.15
ErrorCodePLC	Enum (2 bytes)	–	0 There is currently no error for the control system.

Frame for the example

Start of Transfer	Protocol Version	Sender ID	Nr of Parameters	Nr of Bytes	Data	End of Transfer
43981 (0xABCD)	1	OrderNr_SerialNr (zero-terminated string)	2	6	See the following table.	65244 (0xFEDC)

Data	
1.15 [1)]	0

1) Floats in the IEEE754 standard float format

3.5.3 User data: Byte stream format and parameters

The byte stream begins with the sensor measured data, followed by the calculated process variables as well as parameters for error codes, and ends with the service parameters.

The byte stream uses the following data types:
- Float: For exact numeric data
- UInt16 (16-bit unsigned integers): For error codes and status messages

Parameters that are sent from the Fermentation Monitor to the control system

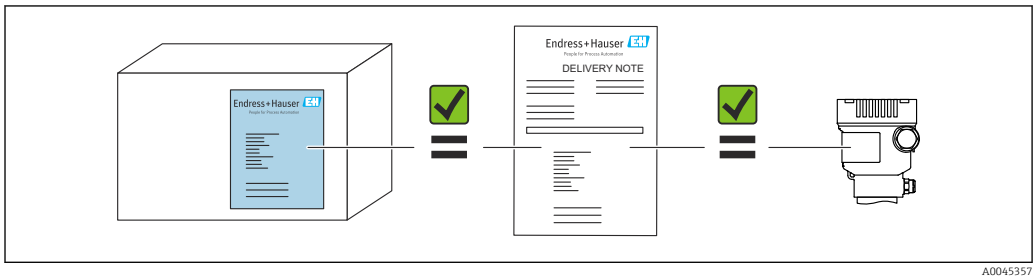
ID	Data type	Parameter	Description
1	Float	temperature	Temperature of the sensor
2	Float	temperatureF	Temperature of the sensor in °F
3	Float	originalGravity	Original gravity
4	Float	realExtract	Real extract
5	Float	apparenExtract	Apparent extract
6	Float	alcoholPercentMass	Alcohol (% w/w)
7	Float	alcoholPercentVolume	Alcohol (%vol)
8	Float	alcoholPercentVolume15C	Alcohol (%vol) (15 °C)
9	Float	specificGravityAt20C	SG (20 °C) (Specific density (20 °C))
10	Float	densityAt20Degrees	Density (20 °C)
11	Float	densityAt15Degrees	Density (15.6 °C)
12	Float	realFermentationDegree	Real fermentation degree
13	Float	apparFermentationDeg	Apparent fermentation degree
14	Float	fermentableSugars	Fermentable sugars
15	Float	nonFermentableSugars	Non-fermentable sugars
16	Float	fermentationSpeed	Fermentation speed
17	Float	viscosityAt20Degrees	Viscosity (20 °C)

ID	Data type	Parameter	Description
18	Float	viscosity	Viscosity
19	Float	speedOfSound	Speed of sound
20	Float	originalGravityMebak	Original gravity with sample preparation adjustment
21	Float	realExtractMebak	Real extract with sample preparation adjustment
22	Float	apparenExtractMebak	Apparent extract with sample preparation adjustment
23	Float	alcoholPercentMassMebak	Alcohol (%w/w) with sample preparation adjustment
24	Float	alcoholPercentVolMebak	Alcohol (%vol) with sample preparation adjustment
25	Float	alcoholVolume15CMebak	Alcohol (%vol) (15 °C) with sample preparation adjustment
26	Float	specificGravity20CMebak	SG (20 °C) with sample preparation adjustment
27	Float	densityAt20DegreesMebak	Density (20 °C) with sample preparation adjustment
28	Float	densityAt15DegreesMebak	Density (15.6 °C) with sample preparation adjustment
29	Float	realFermentationDegMebak	Real fermentation degree with sample preparation adjustment
30	Float	apparFermentationDegMebak	Apparent fermentation degree with sample preparation adjustment
31	Float	TSOriginalGravity	TS original gravity (Total solids)
32	Float	TSRealExtract	TS real extract (Total solids of the real extract)
33	UInt16	errorCode[1]	Error code 1
34	UInt16	errorCode[2]	Error code 2
35	UInt16	errorCode[3]	Error code 3
36	UInt16	errorCode[4]	Error code 4
37	UInt16	errorCode[5]	Error code 5
38	UInt16	errorCode[6]	Error code 6
39	UInt16	errorCode[7]	Error code 7
40	UInt16	errorCode[8]	Error code 8
41	UInt16	errorCode[9]	Error code 9
42	UInt16	errorCode[10]	Error code 10
43	Float	service_Temperature1	Service temperature 1
44	Float	service_Temperature2	Service temperature 2
45	Float	service_SSpeed	'Speed of sound' service
46	Float	service_SSpeedH2O	'Speed of sound in water' service
47	Float	service_dSpeedH2O	'Derived speed of sound' service
48	Float	service_Density45	'Density at 45 °C' service
49	Float	service_Density	'Density' service
50	Float	service_DensityH2O	'Density of water' service
51	Float	service_RelDensity	'Relative density' service
52	Float	service_Viscosity	'Viscosity' service

ID	Data type	Parameter	Description
53	Float	service_TempElectronic	'Electronic temperature' service
54	Float	service_TOfRaw	'ToF raw value' service
55	Float	service_TransFrqc	'Transmission frequency' service
56	UInt16	service_TDCError	'TDC error code' service
57	Float	service_DIVOFrqc	'DIVO frequency' service
58	Float	service_DIVODamping	'DIVO damping' service
59	Float	service_DIVOCapacity	'DIVO capacity' service
60	Float	service_DIVOStatus	'DIVO status' service
61	Float	service_DIVOAmplitude	'DIVO amplitude' service
62	UInt16	service_Uncovered	'Uncovered' service
63	Float	service_concentrationCo2	Concentration CO_2

4 Incoming acceptance and product identification

4.1 Incoming acceptance



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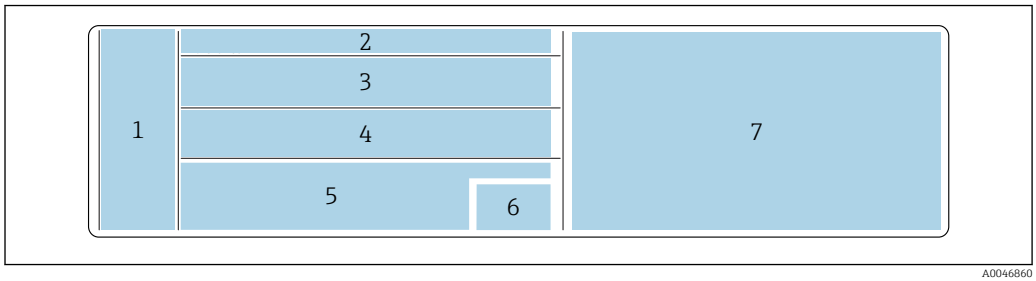
4.2 Product identification

The measuring device can be identified in the following ways:
- Nameplate data
- Extended order code with breakdown of the device features on the delivery note
- Enter the serial number from the nameplate into *Device Viewer* (www.endress.com/deviceviewer): All the information about the measuring device and an overview of the Technical Documentation supplied are displayed.
- Enter the serial number from the nameplate into the *Endress+Hauser Operations app* or use the *Endress+Hauser Operations app* to scan the 2-D matrix code (QR-Code) on the nameplate

4.2.1 Nameplate



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5 *Nameplate specifications*

1 *Manufacturer name, device name, manufacturer address*
2 *Order number, extended order number, serial number*
3 *Technical data*
4 *Technical data*
5 *CE mark and certificates*
6 *Date of manufacture: year-month and 2-D matrix code (QR code)*
7 *Additional approvals*

4.3 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Place of manufacture: See nameplate.

4.4 Storage and transport

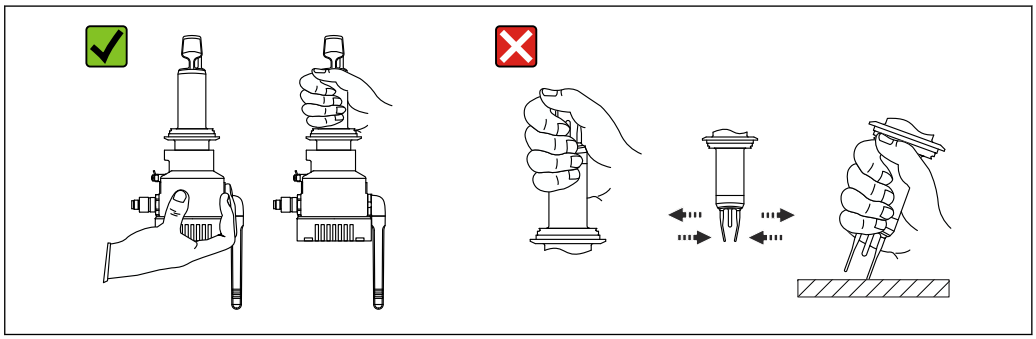
4.4.1 Storage temperature

Store indoors if possible

−20 to +60 °C (−4 to +140 °F)

4.4.2 Transporting the device

- Transport the device to the measuring point in its original or other suitable packaging
- Do not hold or carry the device by the measuring elements during transportation and installation
- Do not bend, shorten, lengthen or dampen the tuning fork and temperature sensor by applying additional weight, for example
- Additional information for devices with pipe extension: Transport the device from the single-chamber housing and pipe extension at the same time



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5 Installation

If the measuring point is difficult to access, we recommend that you commission the device in accordance with the commissioning instructions before installing it in the tank.

5.1 Installation requirements

Recommended mounting locations

- On the side of the tank (horizontal orientation)
- Minimum distance of sensor tip to tank wall: 10 cm (3.94 inch)
- The measuring elements must be fully immersed in the medium

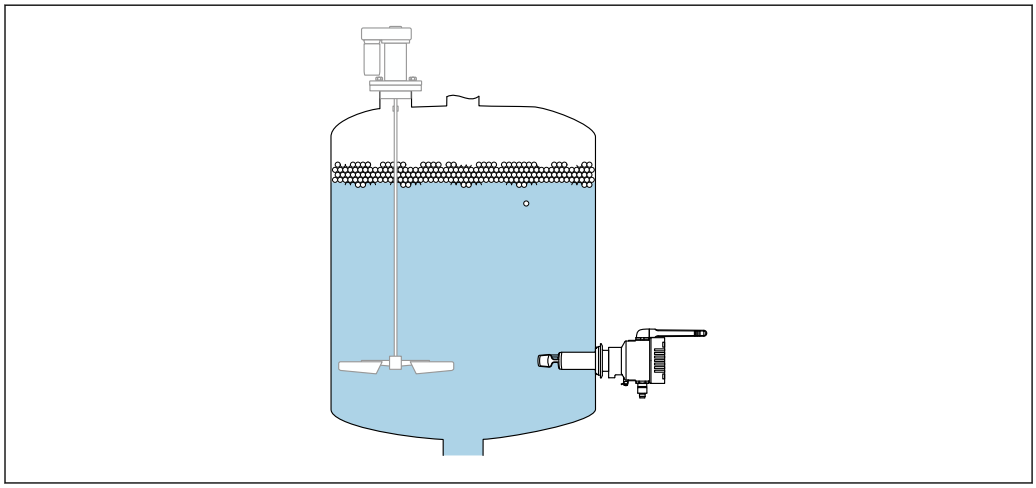
For side installation in conical tanks, we recommend a mounting location that meets the following requirements:

- Approx. 1 m above the tank cone
- At least 2 m of beer column above the measuring elements

An engraved marking on the device neck indicates the correct alignment of the measuring elements for mounting.

Avoid the following mounting locations

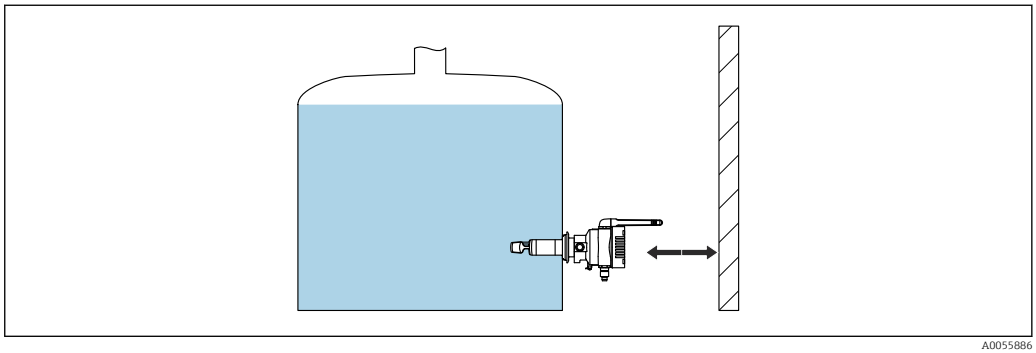
Mounting locations where a buildup of yeast or gas is likely to occur such as at the bottom of the tank or near the filling limit for example



6 *Possible orientation*

5.2 Installation instructions

5.2.1 Take clearance into consideration



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7 *Take clearance into consideration*

Allow sufficient space for mounting and electrical connection.

5.2.2 M12 connector

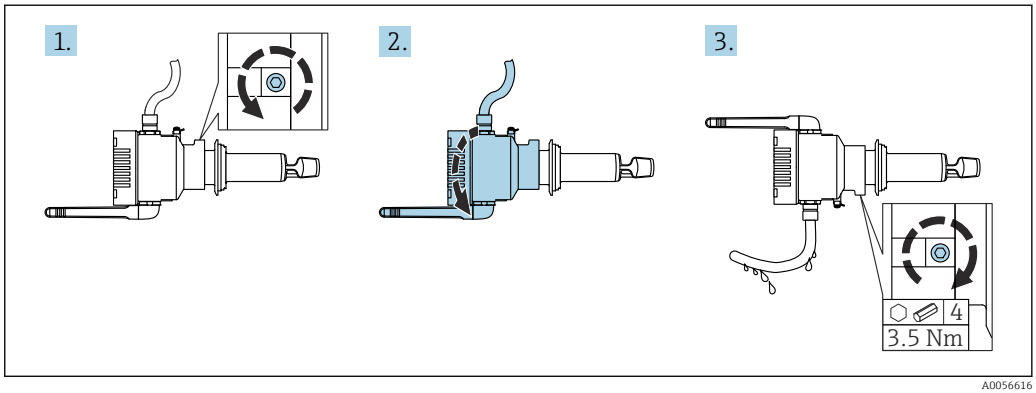
The M12 connector is used to supply power to the device.

Position the connecting cable so that it is pointing downwards to ensure that no moisture can penetrate the connection compartment.

If necessary, create a drip loop or use a weather protection cover.

5.2.3 Aligning the housing

The housing can be rotated after releasing the hexagonal-headed bolt on the device neck. This allows you to align the connection and the antenna.



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8 *Aligning the housing*

5.2.4 Positioning the antenna

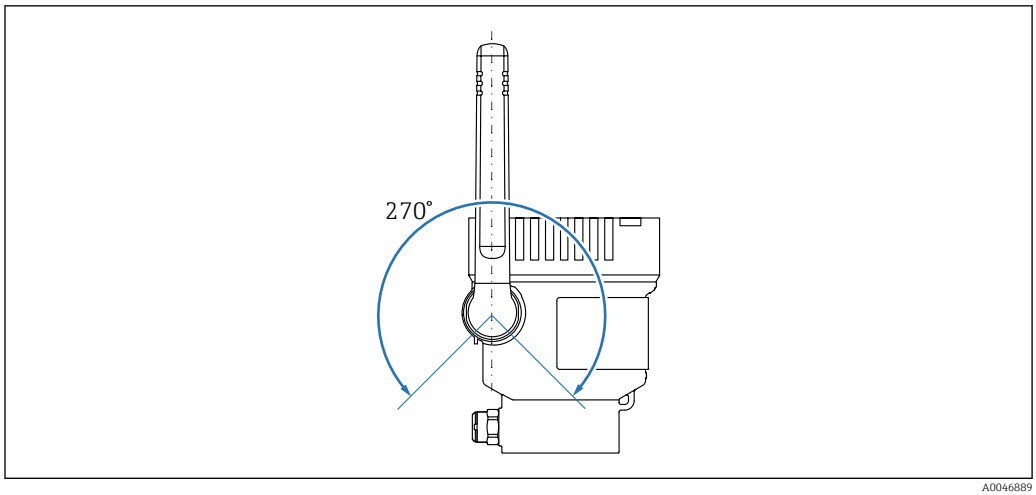
To optimize the transmission quality, position the antenna in such a way that it is not emitting its signal directly on metal. You can rotate the antenna within an angle of 270°.

NOTICE

Angle of rotation of antenna too large!

Damage to internal wiring.

▶ Rotate the antenna within a maximum angle of 270°.



9 *Possible angle of rotation of the antenna*

Remote antenna for Fermentation Monitor QWX43

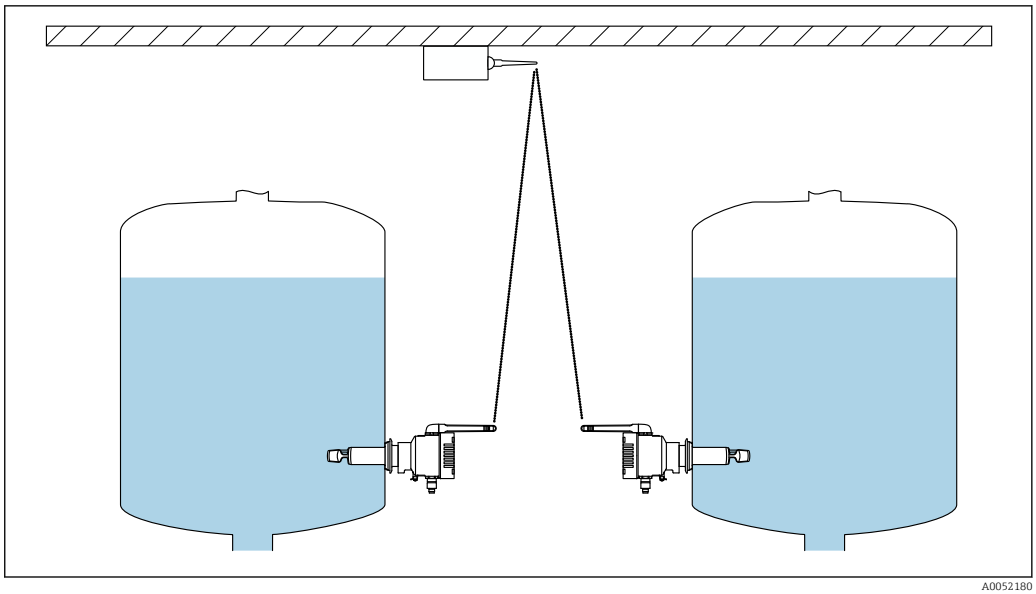
Special version TSP no.: 71641142

Endress+Hauser offers a version with remote antenna for mounting on tanks that are set up outdoors and have a 360° metal shielded mounting location for the device to enable an undisturbed transmission path. Please contact your Endress+Hauser sales representative for further information.

5.2.5 Wireless access point for direct integration version

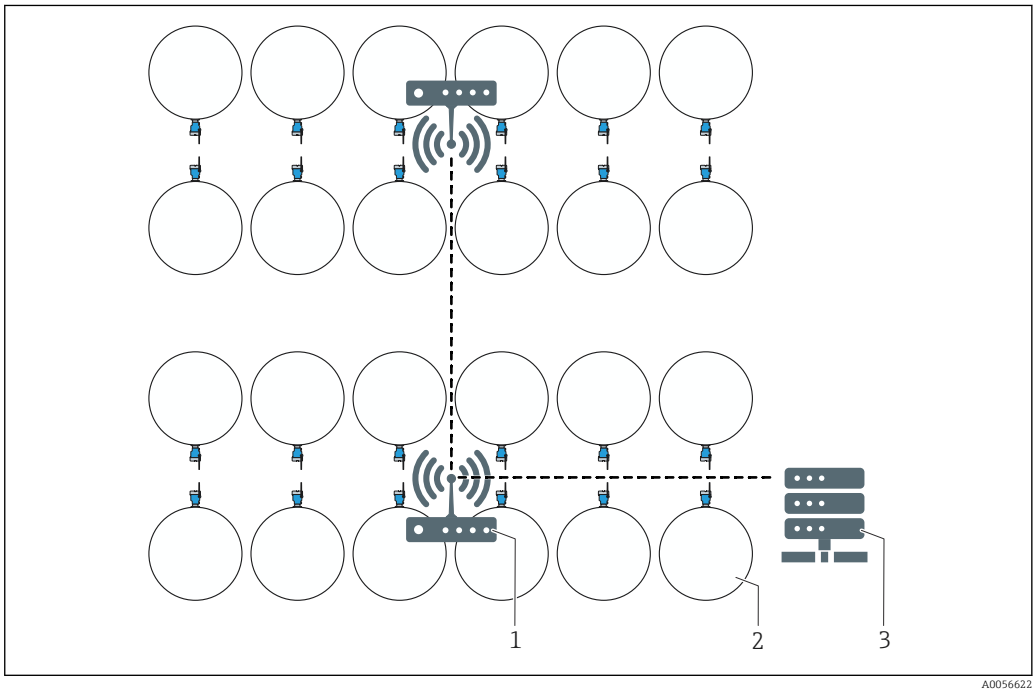
With the Fermentation Monitor, you can order a wireless access point as an accessory. Alternatively, you can also use an existing wireless access point, provided it supports WIFI 2.4 GHz and WPA2-PSK.

Note the following for the mounting location:
- If possible, mount the wireless access point on a ceiling
- If possible, ensure clear, unobstructed visibility between the Fermentation Monitor and the wireless access point
- Maximum distance between the Fermentation Monitor and the wireless access point without additional interference influences: 25 m
- Align the antenna of the Fermentation Monitor and the antenna of the wireless access point parallel to each other.
- If installing outdoors, protect the wireless access point from the effects of the weather, e.g. use a housing



10 *Recommendations for the wireless access point mounting location*

The number of Fermentation Monitorthat can be connected to the control system via a wireless access point depends on the following factors:
- Distance and line of sight to the wireless access point
- Number of network participants with the same frequency



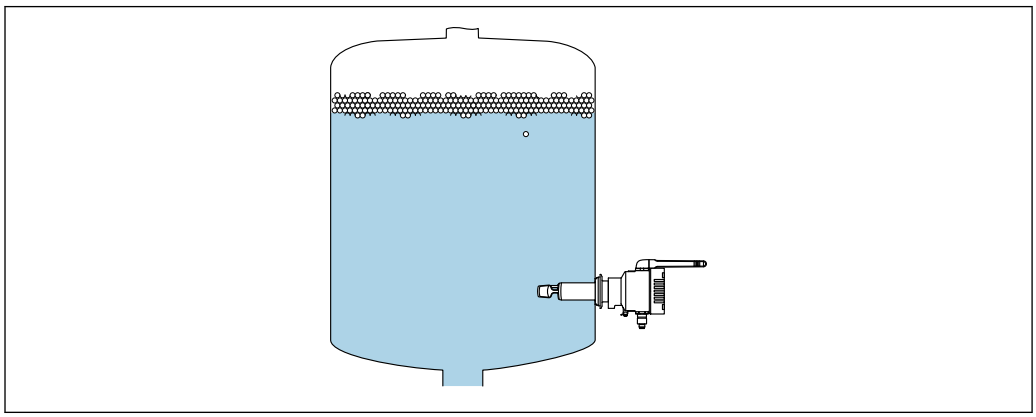
11 *Example: Layout of a network with several tanks and Fermentation Monitor*

1 *Access point*
2 *Tank with Fermentation Monitor, top view*
3 *Hub*

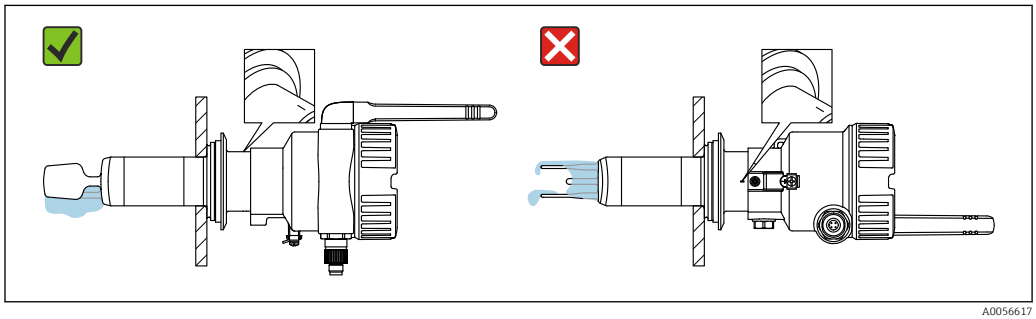
5.3 Installing the measuring instrument

The seal for the process connection is not included in the scope of supply.

1. Push the seal for the process connection over the measuring elements and the sensor tube as far as the process connection.
2. Install the device in the intended position on the tank.
3. Align the vibrating forks of the measuring instrument in accordance with the diagram and the note.



12 *Aligning the vibrating forks*



The fork tines of the vibrating fork must be installed vertically to the tank wall. As orientation for the correct alignment of the tuning fork, there is a line on the device neck below the housing.

4. Secure the device in place using the process connection.
5. Align the antenna if necessary.

5.4 Post-mounting check

❑ Is the device undamaged (visual inspection)?

❑ Does the device comply with the measuring point specifications?

For example:
- Process temperature
- Process pressure
- Ambient temperature
- Measuring range

❑ Are the measuring point number and labeling correct (visual inspection)?

❑ Is the device adequately protected from wet conditions and direct sunlight?

❑ Is the device properly secured?

6 Electrical connection

6.1 Supply voltage

Recommended supply voltage: 24 V DC

Permitted supply voltage: 20 to 35 V DC

The power unit must provide safe electrical separation and be tested to ensure it meets safety requirements (e.g., PELV, SELV, Class 2).

A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.

6.2 Power consumption

2.4 W

6.3 Current consumption

100 mA at 24 V DC

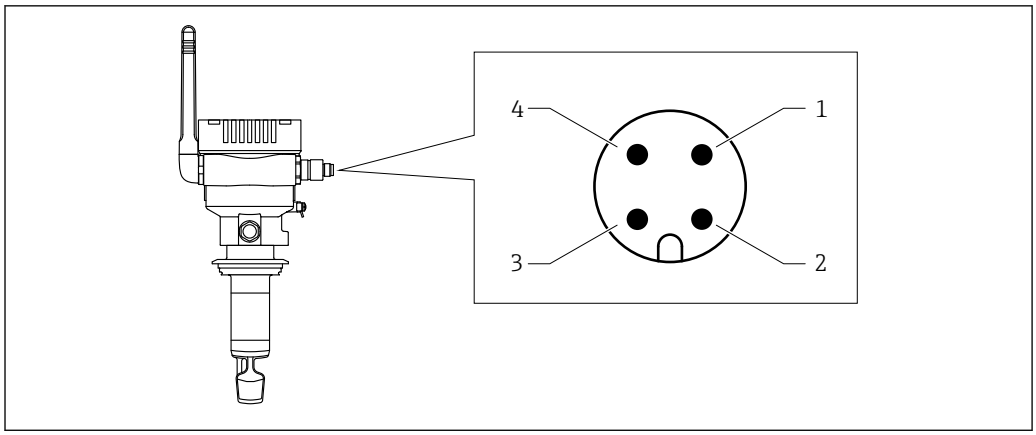
6.4 Connecting the measuring instrument

The device is powered via the M12 plug.

NOTICE

Non-compatible wiring of the customer connecting cable
Device malfunction
- ▶ Ensure that the wiring of the M12 socket of the connecting cable matches the PIN assignment of the M12 plug on the device.
- ▶ Order a suitable connecting cable with plug-in jack with the device .

You can order a connecting cable with plug-in jack with the device. Accessories: Technical Information TI01628F



13 *PIN assignment of M12 plug, M12 plug mounted on the device*

1 *Minus (–), blue*
2 *N.C.*
3 *Plus (+), brown*
4 *Shielding*

Position the connecting cable so that it is pointing downwards to ensure that no moisture can penetrate the connection compartment.

If necessary, create a drip loop or use a weather protection cover.

6.5 Overvoltage protection

Overvoltage protection must be installed on the customer side in the following cases:
- The power supply line to the Fermentation Monitor is longer than 30 meters
- The power supply line to the Fermentation Monitor goes outside the building
- Other devices are connected to the supply unit for the Fermentation Monitor in parallel

Install the overvoltage protection as close as possible to the Fermentation Monitor.

You can use the Endress+Hauser HAW569 or HAW562 modules, for example, for overvoltage protection.

The proposed overvoltage protection is included with the Fermentation Monitor QWX43 when delivered.

6.6 Post-connection check

❑ Are the device and cable undamaged (visual check)?

❑ Does the cable used comply with the requirements?

❑ Is the connected cable strain-relieved?

❑ Is the M12 plug on the device screwed onto the M12 socket of the cable?

❑ Does the supply voltage match the specifications on the nameplate?

❑ If supply voltage is present, is the green LED lit or flashing?

❑ Is the housing cover installed and securely fastened?

7 Operation options

7.1 Direct integration

The device does not have a display. It has LEDs that provide feedback signals. Operating keys are available for maintenance work.

All read and write parameters are provided via a data module/function block for the automation system for further processing.

Protocol-specific data: → 69

Detailed information and files: www.endress.com (Product page > Documents > Software)

7.2 Netilion server platform

The device does not have a display. It has LEDs that provide feedback signals. Operating keys are available for maintenance work.

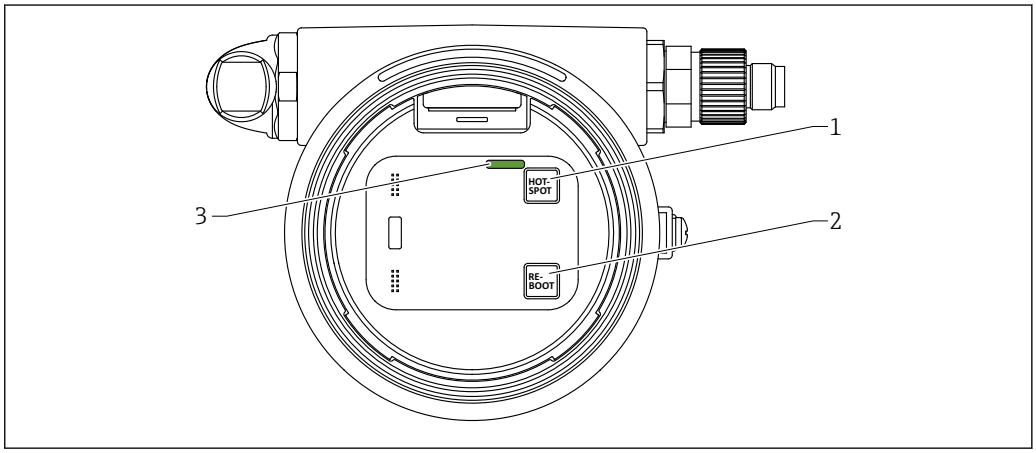
Once the device is supplied with voltage and logged onto the Endress+Hauser Netilion server platform via WLAN, the measured data are transmitted immediately to Netilion. The device is connected to the Endress+Hauser Netilion server platform via the customer's WLAN. You can configure and operate the device using the Netilion Fermentation app.

- Detailed information on the Netilion server platform: https://netilion.endress.com
- Detailed information on Netilion Fermentation: https://Netilion.endress.com/app/fermentation
- Netilion Help & Learning (Troubleshooting, Tips & Tutorials, Getting Started: https://help.netilion.endress.com

7.3 LEDs on the device

LEDs: → 58

7.4 Operating keys on the device



14 *Operating keys and LED*

1 *HOT-SPOT button*
2 *RE-BOOT button*
3 *LED*

Button	Description
HOT-SPOT	Put Fermentation Monitor into hotspot mode. The network settings are reset to the factory setting. → 60 If you press the HOT-SPOT button for longer than 10 seconds, the password for accessing the Fermentation Monitor is reset to the factory setting (serial number).
RE-BOOT	Manually perform restart for the Fermentation Monitor → 61 All the device settings are retained.

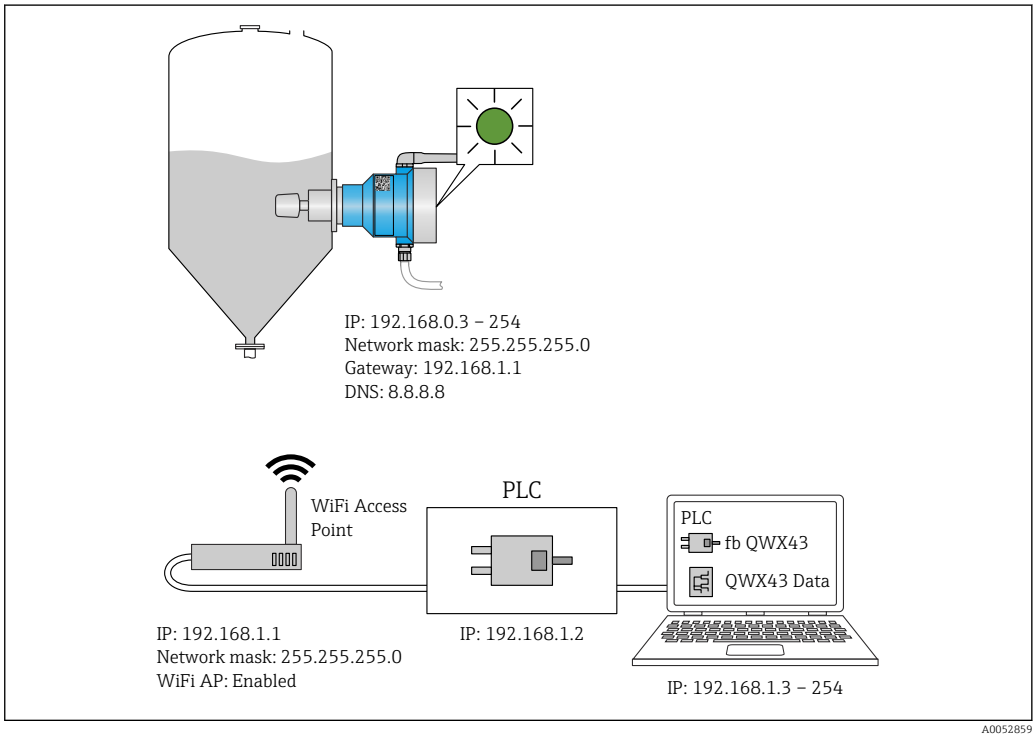
8 Commissioning the direct integration version

8.1 Planning network integration

For bidirectional communication and data transmission between the Fermentation Monitor and a control system such as the Siemens S7 controllers or Rockwell controllers, the Fermentation Monitor must be integrated into the existing OT network.

Network integration includes the following steps:
- Configuring the wireless access point → 29
- Planning, configuring and documenting IP addresses → 30
- Enabling port for communication → 30
- Configuring routing between different network segments → 30
- Considering safety aspects

The Fermentation Monitor is connected to the existing OT network via a wireless access point. Depending on the requirements of the existing OT network, the connection between the wireless access point and the OT network can be set up either wirelessly or via a network cable.



15 *Example of network configuration with fixed IP allocation*

8.1.1 Configuring and installing the wireless access point

When configuring the wireless access point, pay attention to the following:
- Configure the wireless access point as an access point.
- The wireless access point and Fermentation Monitor must be in the same network.
- Configure the wireless access point such that the control system can directly access the Fermentation Monitor.
- Configure the wireless access point according to the existing network requirements, including network parameters such as SSID, encryption settings and channel selection.

The Fermentation Monitor currently supports the WPA2-PSK encryption standard and only supports 2.4 GHz networks.

When installing the wireless access point, pay attention to the following:
For good signal quality, follow the installation instructions for the wireless access point
→ 🖹 22.

8.1.2 Planning, configuring and documenting IP addresses

Each Fermentation Monitor must have a unique IP address within a network. This allows for clear identification and communication between the Fermentation Monitor and the control system.

IP address requirements:
- The IP address of the Fermentation Monitor must be in the same IP address range as the OT network.
- The IP address for the Fermentation Monitor must be unique.
- Allocate the planned IP address to the Fermentation Monitor provided. This can be carried out while the WLAN for the Fermentation Monitor is being configured.
- DHCP is supported. We recommend assigning a fixed IP to the MAC addresses
→ 🖹 30.

Document the IP address of the Fermentation Monitor for future reference and troubleshooting.

8.1.3 Enabling port for communication

For communication with the Fermentation Monitor TCP/IP input port 50000 must be enabled in your network configuration within the firewall.

The TCP/IP input port 50000 cannot be modified. The other ports are dynamically assigned.

8.1.4 Configuring the network routing during network segmentation (VLANs)

Configure the router or switch to manage data communication between network segments according to the plan. In doing so, ensure that data communication at the TCP/IP port 50000 is allowed between the network segments.

8.2 Configuring the WLAN for the Fermentation Monitor

The Fermentation Monitor QWX43 provides a WLAN (hotspot) for integration with the wireless access point. You can connect the Fermentation Monitor to the wireless access point via smartphone/tablet/PC/Notebook as follows:

1. Search for the hotspot using the WLAN search function of the smartphone, for example.
2. Select the WLAN of the Fermentation Monitor QWX43. The designation of the WLAN of the Fermentation Monitor is: EH_QWX43_*serial number
3. Enter the password **EH_QWX43**.
4. In your Internet browser, open the page http://10.10.0.1/.
5. For the connection to the Fermentation Monitor, first enter the serial number of the Fermentation Monitor into the **Password** field.
6. Then enter a new password for the Fermentation Monitor into the **Password** field.

If you want to reset your password to the initial password, you must press the HOTSPOT button on the electronic insert of the Fermentation Monitor for at least 10 seconds.

7. Check whether the **PLC** option is set under the "Setup Wizard" tab for "Operation Mode".
8. Under **Wireless Networks**, select the desired wireless access point.
9. Enter the password for the wireless access point.
10. For **Configure IPv4**, select the option **Static**.
11. Enter the required network information.
12. Enter the IP address for the Fermentation Monitor.
    ↳ The connection is established and the IP is displayed.
13. Click on **Confirm and Exit**.
    ↳ The Fermentation Monitor is connected to the control system.

After allocating the IP address, test the network connection of the Fermentation Monitor, for example using a ping test from your PC in the network to the IP address of the Fermentation Monitor.

8.2.1 Notes on the firewall configuration

Check the following points of your firewall configuration.

Port
443

Protocols
- Protocol: mTLS
- The firewall must allow TLS and mTLS protocols.
- The firewall must support and allow the corresponding protocol versions, such as TLS 1.2 or TLS 1.3.

Certificate whitelist
- Some firewalls may contain a list of trusted certificate authorities (CAs) that are approved for data exchange.
  The certificates, which are used for the mTLS connections and issued by a CA, must be included in the firewall's whitelist. If the certificates are not included, update the certificate whitelist.
  The server SSL certificates for the connected asset APIs are currently managed by the Amazon CA (Certificate Authority). Root and intermediate certificates from the CA are available at https://www.amazontrust.com/repository/
- Deep Packet Inspection (DPI)
  Some firewalls have DPI features that inspect the encrypted data communication and block data packages categorized as unsafe. The DPI functions of the firewall must not block mTLS connections.

Access rules
Check the firewall's access rules to ensure that the firewall allows data communication between the participating systems. The rules must cover the port, all relevant IP addresses and IP ranges.

Logging and monitoring
Activate the firewall's logging and monitoring functions to make it easier to identify potential problems with mTLS connections. Analyze log files for suspicious activities or recurring error messages in order to get information about possible configuration problems.

For more information and assistance on the firewall used: Refer to documentation or firewall technical support

8.2.2 Descriptions of signal strength quality

Once you access the configuration interface of the Fermentation Monitor, all available networks are displayed under **Wireless Networks** with the current signal quality.

Signal strength	Expected quality	Indicator
> −30 dBm	Maximum signal strength This signal strength can be expected close to WLAN routers or a wireless access point.	
> −50 dBm	Excellent signal strength Anything up to this signal strength can be considered as excellent.	
> −60 dBm	Reliable signal strength Signal strength is still good.	
> −67 dBm	Minimum signal strength required for various services This signal strength is necessary for all services that require smooth and reliable data communication.	
> −70 dBm	Low signal strength The signal strength is sufficient for most cases.	
> −80 dBm	Minimum signal strength required for establishing a connection Not recommended	
> −90 dBm	Unusable signal strength This signal is not strong enough to establish a connection or access services.	

8.3 Setting up the Fermentation Monitor function block for the control system (Siemens PLCs)

The communication protocol between the controller and the Fermentation Monitor is always TCP/IP. This protocol is transmitted wirelessly up to the wireless access point and then via the Ethernet line up to the controller. A function block reads out the data in the controller.

8.3.1 Introduction and overview of QWX43 function module

In order to integrate the Fermentation Monitor into Siemens S7 controllers, Endress+Hauser developed the QWX43 function module. The function module meets the requirements of the S1500/S1200, S300 and S400 controllers.

The function module performs the following tasks:
- Open User Communication via TCP/IP
- Configurable interface for the Fermentation Monitor
- Easy integration into existing systems

Open User Communication via TCP/IP
The function module from Endress+Hauser for the Fermentation Monitor uses the TCP/IP connection to exchange data between the S7 controller and the Fermentation Monitor. This means that the Fermentation Monitor can send and receive data in real time, thus enabling efficient and precise monitoring of fermentation and/or control.

Parameterizable interface of the Fermentation Monitor
The function module contains an interface that was specially designed for the Fermentation Monitor and enables easy and intuitive interaction with the Fermentation Monitor. Working directly from the S7 controller, you can call up fermentation parameters, change CO2 settings and call up detailed device information.

Easy integration into existing systems
You can easily integrate the function module into existing S7 controllers. To do so, you must integrate the function block into your project and call up the corresponding function block with the data module.

8.3.2 Prerequisites for integration

- WiFi access point:
  2.4 GHz with WPA2-PSK encryption
- Siemens S7 controllers with Ethernet:
  - CPU S7-1200/1500 series with the corresponding (CP) modules. You can also use the integrated Profinet Interfaces.
  - CPU S7-300/400 series with the corresponding (CP) modules including CP 341, CP 342, CP 343 and CP 443
- Supported version of Automation Framework:
  - Siemens STEP 7: Version 5.5 and higher
  - TIA Portal: Version 15.0 and higher
- Particular features of the connection configuration:
  - CPU S7-300/400 series:
    To establish a connection, a CPU stop must be performed in order to update the connection table
  - CPU S7-1200/1500 series:
    These controllers support dynamic connection updates. A CPU stop is therefore not necessary.
- Network routing and input port
  For communication with the Fermentation Monitor, TCP/IP input port 50000 must be enabled within the firewall and the router.

8.3.3 Setting up the function block for the control system

You must set up a function block for each Fermentation Monitor.

Videos on commissioning with Siemens S7 controllers: YouTube > Search "QWX43 Siemens S7"

1. Download the function block from the Endress+Hauser download area (www.endress.com > Downloads > Software).

When downloading and installing the function block, make sure that the Fermentation Monitor QWX43 is compatible with the software version. For software version 04.02, for example, download the function block that is identified for this software version.

2. Import the function block into the control system.
3. Integrate the Fermentation Monitor into the control system via the TIA Portal or Simatic. To do this, create a project and create the function block for the Fermentation Monitor within this project.
4. In the function block, configure the **Input** parameters → 🖹 34.
5. For the **sensorData** parameter block, define and assign the destination in the relevant data module → 🖹 35.

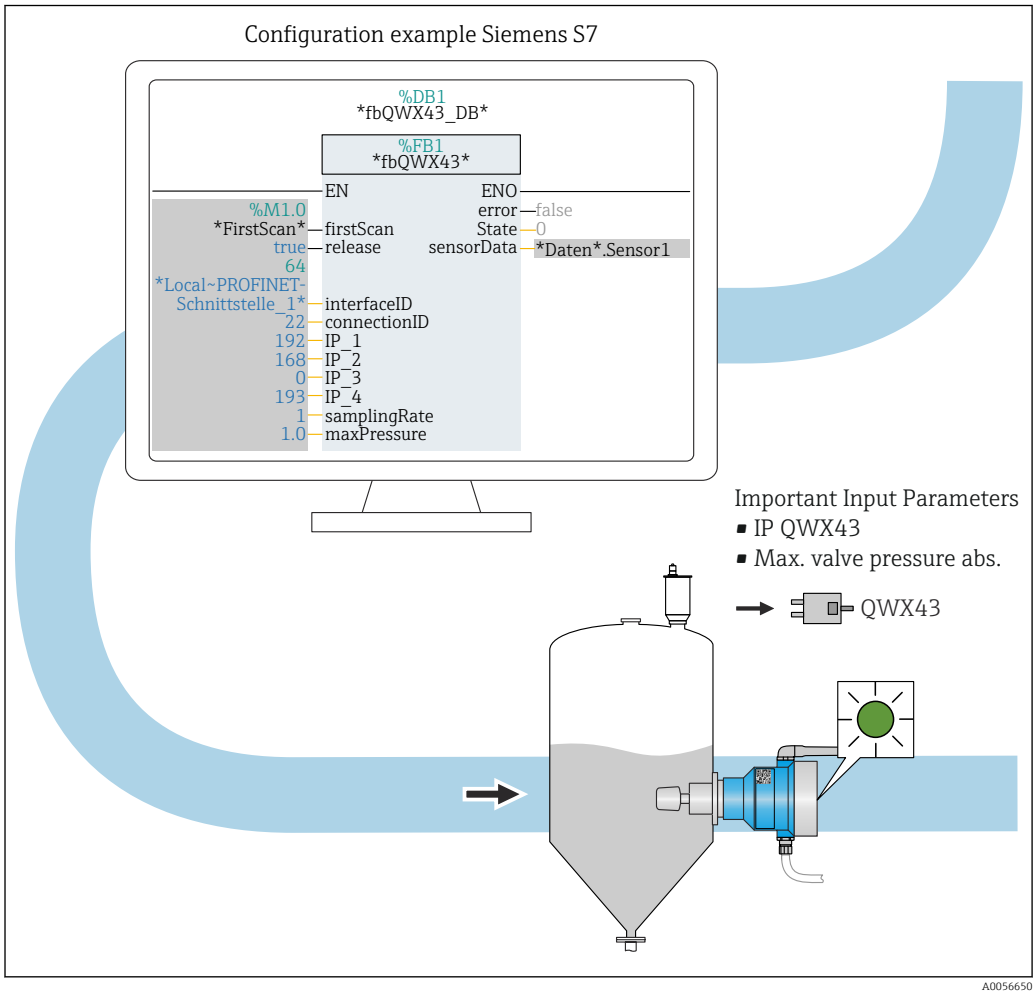
Once the control system receives current data from the Fermentation Monitor, the function block sets the **timeStamp** parameter.

8.4 Description of function block Fermentation Monitor (Siemens PLCs)

8.4.1 Input parameters

Description of the Input parameters

Parameter name	Data type	Description
interfaceID	HW_ANY	Physical Ethernet hardware interface ID that is connected to the Fermentation Monitor.
connectionID	CONN_OUC	Reference connection ID that is assigned to the Fermentation Monitor. The reference connection ID must be unique for each Fermentation Monitor.
IP_1	Byte	First byte of the IPv4 address for the Fermentation Monitor. First byte of links.
IP_2	Byte	Second byte of the IPv4 address for the Fermentation Monitor.
IP_3	Byte	Third byte of the IPv4 address for the Fermentation Monitor.
IP_4	Byte	Fourth byte of the IPv4 address for the Fermentation Monitor.
maximumHeadPressureOfTankAbsolute	Real	Maximum head pressure in the tank. Absolute pressure in bar.



8.4.2 Output parameters

Description of Output parameters

Parameter name	Data type	Value	Control system parameter name	Description
error	Bool	▪ False: Function block is in a normal state → 35, "Normal states" table ▪ True: Function block is in an error state → 35, "Error state" table		
State	Integer	103	STATE_ERR_Version	The telegram versions of the Fermentation Monitor and the function block do not match.

Normal states

Value	Control system parameter name	Description
0	STATE_WAIT	Waiting for the next sequence in order to request new data from the Fermentation Monitor.
1	STATE_CONNECT	Connection to the Fermentation Monitor via the IPv4 address provided
2	STATE_SEND	Sending a request to the Fermentation Monitor for new data
3	STATE_RECEIVE	Waiting for new data from Fermentation Monitor.

Fault conditions

Value	Control system parameter name	Description
100	STATE_ERR_CONFIG	Error in the IPv4 configuration parameters
101	STATE_ERR_CONNECTION	No connection to the Fermentation Monitor or timeout Timeout: Longer than 30 seconds without a response from the Fermentation Monitor.
102	STATE_ERR_TELEGRAM	Errors in the data received from the Fermentation Monitor

8.4.3 sensorData parameter block

Note Fermentation Monitor limiting behavior. → 45

Parameters for the sensorData (output) parameter block

Process variable	Control system parameter name	Unit	Notes
Viscosity	viscosity	mPa·s	Viscosity, not temperature-compensated
Temperature	temperature	°C	Temperature, measured with the temperature sensor on the probe of the Fermentation Monitor → 12
Temperature	temperatureF	°F	Temperature of the medium in °F
Speed of sound	speedOfSound	m/s	Speed of sound measured with the ultrasonic sensor on the probe of the Fermentation Monitor → 12

Process variable	Control system parameter name	Unit	Notes
Density (20 °C)	densityAt20Degrees	g/cm³	Density, standardized to 20 °C
Density (15.6 °C)	densityAt15Degrees	g/cm³	Density, standardized to 15.6 °C
SG (20 °C) [1] (Specific density (20 °C))	specificGravityAt20Degrees	–	Specific density, calculated from the density of the medium and the density of water at 20 °C
Viscosity (20 °C)	viscosityAt20Degrees	mPa·s	Viscosity, temperature-compensated and standardized to 20 °C
Original gravity	originalGravity	°Plato [2]	Original gravity calculated back from alcohol and extract content
Real extract	realExtract	%w/w [3]	Real extract calculated from the combination of ultrasonic and density measurement
Apparent extract	apparentExtract	%w/w [3]	Apparent extract based on density measurement and conversion according to Balling
Alcohol (% w/w)	alcoholPercentMass	%mass	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 20 °C
Alcohol (%vol)	alcoholPercentVolume	%vol	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 20 °C
Alcohol (%vol) (15 °C) [1]	alcoholPercentVolume15C	%vol	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 15.6 °C
Real fermentation degree	realFermentationDegree	%	Real fermentation degree based on the measured real extract
Apparent fermentation degree	apparFermentationDeg	%	Apparent fermentation degree based on the measured apparent extract
Fermentable sugars	fermentableSugars	%w/w [3]	Proportion of fermentable sugars (maltotriose, maltose, glucose, fructose, etc.) out of the original gravity, displayed from 1 %vol alcohol during the fermentation process
Non-fermentable sugars	nonfermentableSugars	%w/w [3]	Proportion of non-fermentable sugars (dextrins) out of the original gravity, displayed from 1 %vol alcohol during the fermentation process

Process variable	Control system parameter name	Unit	Notes
Concentration CO_2	service_concentrationCO2	%mass	With the direct integration version, this process variable is made available to the PLC as a service parameter. The value is not representative of the actual CO_2 concentration in the beer. Calculated from the equilibrium pressure depending on the tank head pressure and medium temperature
Fermentation speed	fermentationSpeed	%vol/h	Calculated from the rate of alcohol production per hour
Density (20 °C)_MEBAK	densityAt20DegreesMebak	g/cm^3	Density, standardized to 20 °C, corrected with sample preparation adjustment [4]
Density (15.6 °C)_MEBAK	densityAt15DegreesMebak	g/cm^3	Density, standardized to 15.6 °C, corrected with sample preparation adjustment [4]
SG (20 °C)_MEBAK (Specific density (20 °C)_MEBAK)	specificDensity20CMebak	–	Specific density calculated from the density of the medium and the density of water at 20 °C, corrected with sample preparation adjustment
Original gravity_MEBAK	originalGravityMebak	°Plato [2]	Original gravity calculated back from alcohol and extract content and corrected with sample preparation adjustment
Real extract_MEBAK	realExtractMebak	%w/w [3]	Real extract calculated from the combination of ultrasonic and density measurement, corrected with sample preparation adjustment [4]
Apparent extract_MEBAK	apparentExtractMebak	%w/w [3]	Apparent extract based on density measurement and conversion according to Balling, corrected with sample preparation adjustment [4]
Alcohol (%w/w)_MEBAK	alcoholPercentMassMebak	%mass	Alcohol content standardized to 20 °C, calculated from the combination of ultrasonic and density measurement, corrected with sample preparation adjustment [4]
Alcohol (%vol)_MEBAK	alcoholPercentVolMebak	%vol	Alcohol content standardized to 20 °C, calculated from the combination of ultrasonic and density measurement, corrected with sample preparation adjustment [4]
Alcohol (%vol) (15 °C)_MEBAK [1]	alcoholVolume15CMebak	%vol	Alcohol content, calculated from the combination of ultrasonic and density measurement standardized to 15.6 °C, corrected with sample preparation adjustment [4]

Process variable	Control system parameter name	Unit	Notes
Real fermentation degree_MEBAK	realFermentationDegMebak	%	Real fermentation degree based on the measured real extract, corrected with sample preparation adjustment [4]
Apparent fermentation degree_MEBAK	apparFermentationDegMebak	%	Apparent fermentation degree based on the measured apparent extract, corrected with sample preparation adjustment
TS original gravity	TSOriginalGravity	%mass	Total solids, gravimetrically measured, that are left behind after drying of the wort at 120 °C in the oven. Represents all substances in the wort except alcohol and water.
TS real extract	TSRealExtract	%mass	Total solids of the real extract, gravimetrically measured, that are left behind after drying of the wort at 120 °C in the oven. Represents all substances in the wort except alcohol and water.
–	sensorUncovered	mPa·s	A measuring element that is not covered indicates the start of a batch

1) From software version 4.2 and function block version 5.0 or AOI version 5.0
2) °Plato: Equivalent to the density of a sucrose solution of the same concentration at 20 °C
3) The unit %w/w corresponds to the unit °Plato. The unit was adapted with software version 4.2.
4) MEBAK stipulates a certain type of laboratory sample preparation, especially filtering, that physically changes the sample. These changes are taken into account by the "Sample preparation adjustment" of the measured values within the sensor, to ensure comparability of laboratory measured values with the measurements in the tank.

The sensorData parameter block also includes the following service parameters. These service parameters help Endress+Hauser with troubleshooting.

- service_Temperature1
- service_Temperature2
- service_SSpeed
- service_SSpeedH2O
- service_dSSpeed
- service_Density45
- service_Density
- service_DensityH2O
- service_RelDensity
- service_Viscosity
- service_TempElectronic
- service_TOfRaw
- service_TransFrqc
- service_TDCError
- service_DIVOFrqc
- service_DIVODamping
- service_DIVOCapacity
- service_DIVOStatus
- service_Uncovered
- service_DIVOAmplitude

8.5 Setting up the Fermentation Monitor Add-On Instruction (AOI) for the control system (Rockwell PLCs)

The communication protocol between the controller and the Fermentation Monitor is always TCP/IP. This protocol is transmitted wirelessly up to the wireless access point and then via the Ethernet line up to the controller. A function block reads out the data in the controller.

8.5.1 Introduction and overview of Add-On Instruction (AOI) QWX43

In order to integrate the Fermentation Monitor into Rockwell Automation controllers, Endress+Hauser developed Add-On Instruction (AOI) QWX43. This AOI is compatible with the controllers of the CompactLogix 5370/5380 and ControlLogix 5580 series.

The AOI performs the following tasks:
- Open socket communication via TCP/IP
- Configurable interface for the Fermentation Monitor
- Easy integration into existing systems

Open socket communication via TCP/IP
The AOI from Endress+Hauser for the Fermentation Monitor uses the TCP/IP connection to exchange data between the Rockwell controller and the Fermentation Monitor. This means that the Fermentation Monitor can send and receive data in real time, thus enabling efficient and precise monitoring of fermentation and/or control.

Parameterizable interface of the Fermentation Monitor
The AOI contains an interface that was specially designed for the Fermentation Monitor and enables easy and intuitive interaction with the Fermentation Monitor. Working directly from the Rockwell controller, you can call up fermentation parameters, change CO_2 settings and call up detailed device information.

Easy integration into existing systems
You can easily integrate the AOI into existing Rockwell controllers. To do so, you must integrate the AOI into your project and call up the corresponding function block with the data module.

8.5.2 Prerequisites for integration

- WiFi access point:
  2.4 GHz with WPA2-PSK encryption
- Rockwell Automation controllers with Ethernet:
  - CompactLogix 5370/5380 series with the built-in Ethernet interfaces
  - ControlLogix 5580 series with the built-in Ethernet interfaces or with additional Ethernet cards supporting the open socket function
  - ControlLogix 5560/5570/5580 series with additional Ethernet cards supporting the open socket function
- Supported versions of the automation software:
  - RSLogix 5000: From version 18.00.00
  - Studio 5000: From version 21.00.04
- Particular features of the connection configuration:
  CompactLogix and ControlLogix series
  These controllers support dynamic connection updates. A CPU stop is therefore not necessary.
- Network routing and input port
  For communication with the Fermentation Monitor, TCP/IP input port 50000 must be enabled within the firewall and the router.

8.5.3 Setting up the Add-On Instruction (AOI) for the control system

You must set up an AOI for each Fermentation Monitor.

Videos on commissioning with Rockwell controllers: YouTube > Search "QWX43 Rockwell"

▶ Download the Add-On Instruction (AOI) from the Endress+Hauser download area (www.endress.com > Downloads > Software).

When downloading and installing the AOI, make sure that Fermentation Monitor QWX43 is compatible with the software version. For software version 04.02, for example, download the AOI that is identified for this software version (www.endress.com > Downloads > Software).

1. Integrate Fermentation Monitor into the control system via the automation software. To do this, create a project and create the AOI for the Fermentation Monitor within this project. If necessary, create a communication module (I/O Configuration).
2. Import AOI into the control system (Import Rung > QWX43_Rung.L5X).
3. Configure the **Input** parameters in the AOI → 40.
4. For the **sensorData** parameter block, define and assign the destination in the relevant data module.

Once the control system receives current data from the Fermentation Monitor, the AOI sets the **timeStamp** parameter.

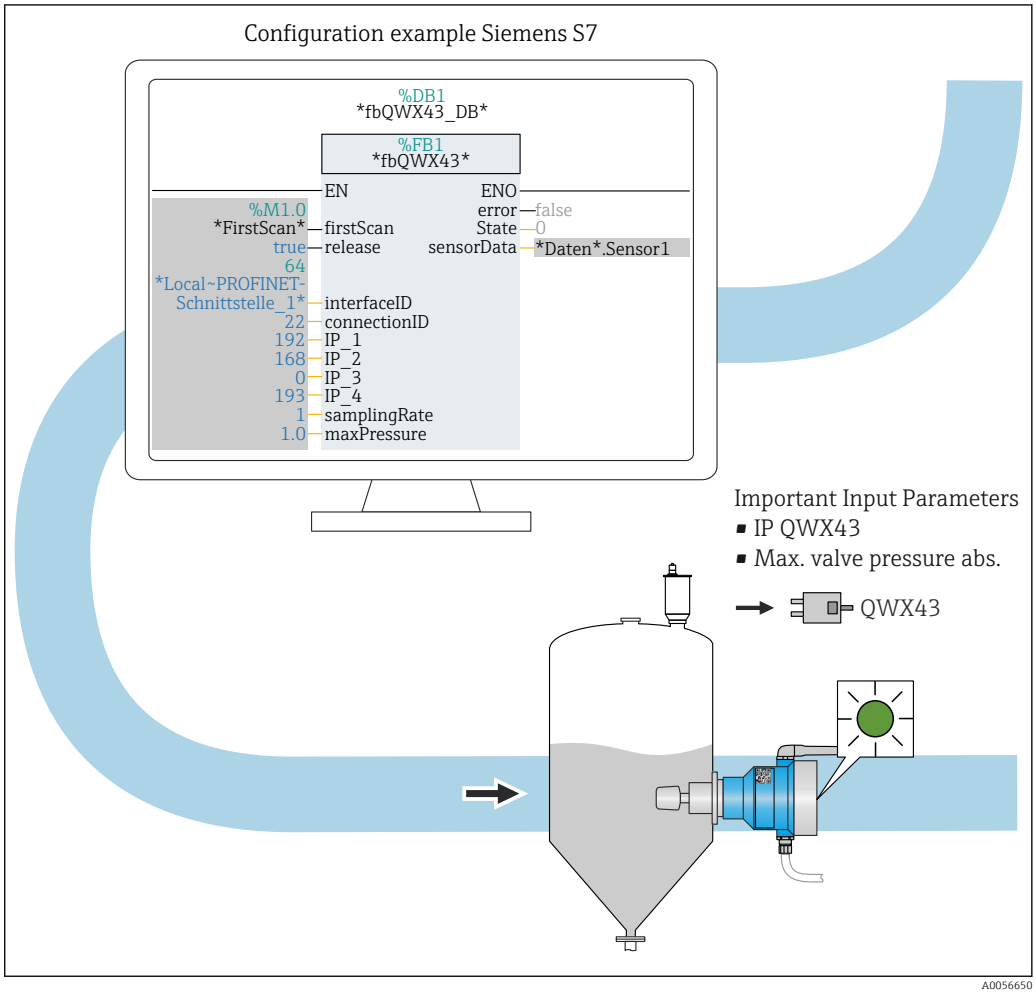
8.6 Fermentation Monitor Add-On Instruction (AOI) description (Rockwell PLCs)

8.6.1 Input parameters

Description of the Input parameters

Parameter name	Data type	Description
Cfg_ComModuleSingleUse	Bool	If you only use the communication module for this open socket communication, you can set this parameter to "1". Otherwise, the parameter must be set to "0".
Inp_Release	Bool	To activate the AOI, you must set this parameter to "1".
SKT_DATA_Client.Connect_Source.DestAddr	String	Contains the IP and port address of the QWX43 in the "192.168.1.127?port=50000" format. The port is always 50000.
SKT_MSG_Client_Create.Path	String	Path to the communication module. Depending on whether it is an external Ethernet card or an Ethernet interface that is integrated into the CPU, this is configured via the "'Communication + Browse" tab" submenu or as a string such as $01$01. This information is configured in the MSG tag of SKT_MSG_Client_Create. The path is then copied to all other MSG instructions in the AOI. For further details, see Add-On Instruction.

Parameter name	Data type	Description
SKT_DATA_Client.Create_Source.Addr.Addr	String	If dual IP is active, used IP address of the controller (option of CompactLogix)
Wrk_SendHeader.SenderID	String	This is a string that contains the sender ID of the PLC (maximum 36 characters). This parameter can only be written within the Add-On Instruction, and can be optionally configured.



8.6.2 Output parameters

Parameter	Data type	Description
Sts_State	Integer	Shows the current status of the instruction: ▪ 0: Service ▪ 1: Connect ▪ 2: Send ▪ 3: Receive ▪ 100: Configuration error ▪ 101: Connection error ▪ 102: Telegram error ▪ 103: Version error
Sts_Error	Bool	Shows "1" in the event of an error of the AOI

Normal states

Value	Control system parameter name	Description
0	STATE_WAIT	Waiting for the next sequence in order to request new data from the Fermentation Monitor.
1	STATE_CONNECT	Connection to the Fermentation Monitor via the IPv4 address provided.
2	STATE_SEND	Sending a request to the Fermentation Monitor for new data.
3	STATE_RECEIVE	Waiting for new data from Fermentation Monitor.

Error states

Value	Control system parameter name	Description
100	STATE_ERR_CONFIG	Error in the IPv4 configuration parameters.
101	STATE_ERR_CONNECTION	No connection to the Fermentation Monitor or timeout. Timeout: Longer than 30 seconds without a response from the Fermentation Monitor.
102	STATE_ERR_TELEGRAM	Error in the data received from the Fermentation Monitor.

8.6.3 sensorData parameter block

Note Fermentation Monitor limiting behavior. → 🖹 45

Parameters for the sensorData (output) parameter block

Process variable	Control system parameter name	Unit	Notes
Viscosity	viscosity	mPa·s	Viscosity, not temperature-compensated
Temperature	temperature	°C	Temperature, measured with the temperature sensor on the probe of the Fermentation Monitor → 🖹 12
Temperature	temperatureF	°F	Temperature of the medium in °F
Speed of sound	speedOfSound	m/s	Speed of sound measured with the ultrasonic sensor on the probe of the Fermentation Monitor → 🖹 12
Density (20 °C)	densityAt20Degrees	g/cm^3	Density, standardized to 20 °C
Density (15.6 °C)	densityAt15Degrees	g/cm^3	Density, standardized to 15.6 °C
SG (20 °C) [1] (Specific density (20 °C))	specificGravityAt20Degrees	–	Specific density, calculated from the density of the medium and the density of water at 20 °C
Viscosity (20 °C)	viscosityAt20Degrees	mPa·s	Viscosity, temperature-compensated and standardized to 20 °C
Original gravity	originalGravity	°Plato [2]	Original gravity calculated back from alcohol and extract content

Process variable	Control system parameter name	Unit	Notes
Real extract	realExtract	%w/w [3]	Real extract calculated from the combination of ultrasonic and density measurement
Apparent extract	apparentExtract	%w/w [3]	Apparent extract based on density measurement and conversion according to Balling
Alcohol (% w/w)	alcoholPercentMass	%mass	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 20 °C
Alcohol (%vol)	alcoholPercentVolume	%vol	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 20 °C
Alcohol (%vol) (15 °C) [1]	alcoholPercentVolume15C	%vol	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 15.6 °C
Real fermentation degree	realFermentationDegree	%	Real fermentation degree based on the measured real extract
Apparent fermentation degree	apparFermentationDeg	%	Apparent fermentation degree based on the measured apparent extract
Fermentable sugars	fermentableSugars	%w/w [3]	Proportion of fermentable sugars (maltotriose, maltose, glucose, fructose, etc.) out of the original gravity, displayed from 1 %vol alcohol during the fermentation process
Non-fermentable sugars	nonfermentableSugars	%w/w [3]	Proportion of non-fermentable sugars (dextrins) out of the original gravity, displayed from 1 %vol alcohol during the fermentation process
Concentration CO_2	service_concentrationCO2	%mass	With the direct integration version, this process variable is made available to the PLC as a service parameter. The value is not representative of the actual CO_2 concentration in the beer. Calculated from the equilibrium pressure depending on the tank head pressure and medium temperature
Fermentation speed	fermentationSpeed	%vol/h	Calculated from the rate of alcohol production per hour
Density (20 °C)_MEBAK	densityAt20DegreesMebak	g/cm^3	Density, standardized to 20 °C, corrected with sample preparation adjustment [4]
Density (15.6 °C)_MEBAK	densityAt15DegreesMebak	g/cm^3	Density, standardized to 15.6 °C, corrected with sample preparation adjustment [4]

Process variable	Control system parameter name	Unit	Notes
SG (20 °C)_MEBAK (Specific density (20 °C)_MEBAK)	specificDensity20CMebak	–	Specific density calculated from the density of the medium and the density of water at 20 °C, corrected with sample preparation adjustment
Original gravity_MEBAK	originalGravityMebak	°Plato [2)]	Original gravity calculated back from alcohol and extract content and corrected with sample preparation adjustment
Real extract_MEBAK	realExtractMebak	%w/w [3)]	Real extract calculated from the combination of ultrasonic and density measurement, corrected with sample preparation adjustment [4)]
Apparent extract_MEBAK	apparentExtractMebak	%w/w [3)]	Apparent extract based on density measurement and conversion according to Balling, corrected with sample preparation adjustment [4)]
Alcohol (%w/w)_MEBAK	alcoholPercentMassMebak	%mass	Alcohol content standardized to 20 °C, calculated from the combination of ultrasonic and density measurement, corrected with sample preparation adjustment [4)]
Alcohol (%vol)_MEBAK	alcoholPercentVolMebak	%vol	Alcohol content standardized to 20 °C, calculated from the combination of ultrasonic and density measurement, corrected with sample preparation adjustment [4)]
Alcohol (%vol) (15 °C)_MEBAK [1)]	alcoholVolume15CMebak	%vol	Alcohol content, calculated from the combination of ultrasonic and density measurement standardized to 15.6 °C, corrected with sample preparation adjustment [4)]
Real fermentation degree_MEBAK	realFermentationDegMebak	%	Real fermentation degree based on the measured real extract, corrected with sample preparation adjustment [4)]
Apparent fermentation degree_MEBAK	apparFermentationDegMebak	%	Apparent fermentation degree based on the measured apparent extract, corrected with sample preparation adjustment
TS original gravity	TSOriginalGravity	%mass	Total solids, gravimetrically measured, that are left behind after drying of the wort at 120 °C in the oven. Represents all substances in the wort except alcohol and water.

Process variable	Control system parameter name	Unit	Notes
TS real extract	TSRealExtract	%mass	Total solids of the real extract, gravimetrically measured, that are left behind after drying of the wort at 120 °C in the oven. Represents all substances in the wort except alcohol and water.
–	sensorUncovered	mPa·s	A measuring element that is not covered indicates the start of a batch

1) From software version 4.2 and function block version 5.0 or AOI version 5.0
2) °Plato: Equivalent to the density of a sucrose solution of the same concentration at 20 °C
3) The unit %w/w corresponds to the unit °Plato. The unit was adapted with software version 4.2.
4) MEBAK stipulates a certain type of laboratory sample preparation, especially filtering, that physically changes the sample. These changes are taken into account by the "Sample preparation adjustment" of the measured values within the sensor, to ensure comparability of laboratory measured values with the measurements in the tank.

The sensorData parameter block also includes the following service parameters. These service parameters help Endress+Hauser with troubleshooting.

- service_Temperature1
- service_Temperature2
- service_SSpeed
- service_SSpeedH2O
- service_dSSpeed
- service_Density45
- service_Density
- service_DensityH2O
- service_RelDensity
- service_Viscosity
- service_TempElectronic
- service_TOfRaw
- service_TransFrqc
- service_TDCError
- service_DIVOFrqc
- service_DIVODamping
- service_DIVOCapacity
- service_DIVOStatus
- service_Uncovered
- service_DIVOAmplitude

8.7 Limiting behavior of the Fermentation Monitor

In rare cases, the algorithms and the sensor equipment of the Fermentation Monitor can generate invalid values such as NaN (Not a Number) or Inf (Infinity). To facilitate further processing of these values and ensure data integrity, a substitute value method is implemented.

If the Fermentation Monitor detects an invalid value, this value is replaced by the substitute value **-99999**. This value is outside the permitted value range of the data block and therefore indicates an error in the data generation.

In the case of parameters that are identified as service parameters, invalid values such as NaN or Inf are **not** replaced by a substitute value.

In addition to the substitute value method, error and diagnostic codes are set .

8.8 Function check

❑ Was the Fermentation Monitor correctly created in the control system? Are the Output Parameter immediately transferred to the data module?

❑ When the tank in which the Fermentation Monitor is installed is full: Are all measured and calculated parameters transferred?

If the tank is empty, the error **S802** with the source identifier **232**, the measured temperature and the time stamp of the measurement are transmitted .

9 Commissioning the Netilion server platform version

9.1 Commissioning requirements

The following conditions must be met to ensure successful commissioning of the device:
- It must be possible to receive the customer WLAN at the measuring point
- The firewall must not block https communication

Detailed information on firewall configuration: → 49

9.2 Creating a Netilion account

You must first create a Netilion account in order to be able to create the Fermentation Monitor QWX43 as an asset in Netilion.

1. Call up the following web page: https://Netilion.endress.com/app/fermentation
2. Click on **Registration**.
3. Complete the form.
4. Click on **Sign up**.
   ↳ You will receive an e-mail confirmation.
5. Click on **Verify Account** to verify the account.
6. Enter the e-mail address and password.

9.3 Booking Fermentation Monitor digital service

If the Netilion Fermentation digital service has not yet been booked, you must create a subscription for Netilion Fermentation and the required Fermentation Monitor QWX43 number.

1. Log into Netilion.
   ↳ The "ID" page is displayed.
2. Select the **Netilion Services** page under the **Subscriptions** menu.
3. Click on **+Create**.
4. Select **Fermentation** for Service Subscription.
   ↳ The **Fermentation Monitor Plans** page is displayed
5. Enter the number of your Fermentation Monitor QWX43 in the **Connectivity** field.
6. Click the **Get Started** button.
7. Perform further steps as per the wizard.

9.4 Creating and configuring an asset for Fermentation Monitor

Prerequisite
- You are logged into Netilion
- The Netilion Fermentation digital service is booked.

1. Select the **Asset** page on the **Fermentation Monitor** page.
2. Click on **+Create**.
   ↳ The **Create Asset** page is displayed.

3. Enter the serial number of the Fermentation Monitor. The serial number can be found on the nameplate.
4. Click on **Save and create Tank**.
   ↳ The **Create Tank** page is displayed.
5. Either assign an existing tank to the Fermentation Monitor or create a new tank → 📄 50.

When creating a tank, note that the tank head pressure must be specified as absolute pressure in the **Maximum head pressure of tank** field.

9.5 Configuring the WLAN for the Fermentation Monitor

The Fermentation Monitor QWX43 provides a WLAN (hotspot) for integration into the WLAN of the system on site. You can integrate the Fermentation Monitor into the WLAN of the system on site via smartphone/tablet/PC/Notebook as follows:

1. Search for the hotspot using the WLAN search function of the smartphone, for example.
2. Select the WLAN of the Fermentation Monitor QWX43. The designation of the WLAN of the Fermentation Monitor is: EH_QWX43_*serial number
3. Enter the password **EH_QWX43**.
4. In your Internet browser, open the page http://10.10.0.1/. Establishing the connection to the Internet browser can take up to a minute.
5. For the connection to the Fermentation Monitor, first enter the serial number of the Fermentation Monitor into the **Password** field.
6. Then enter a new password for the Fermentation Monitor into the **Password** field.

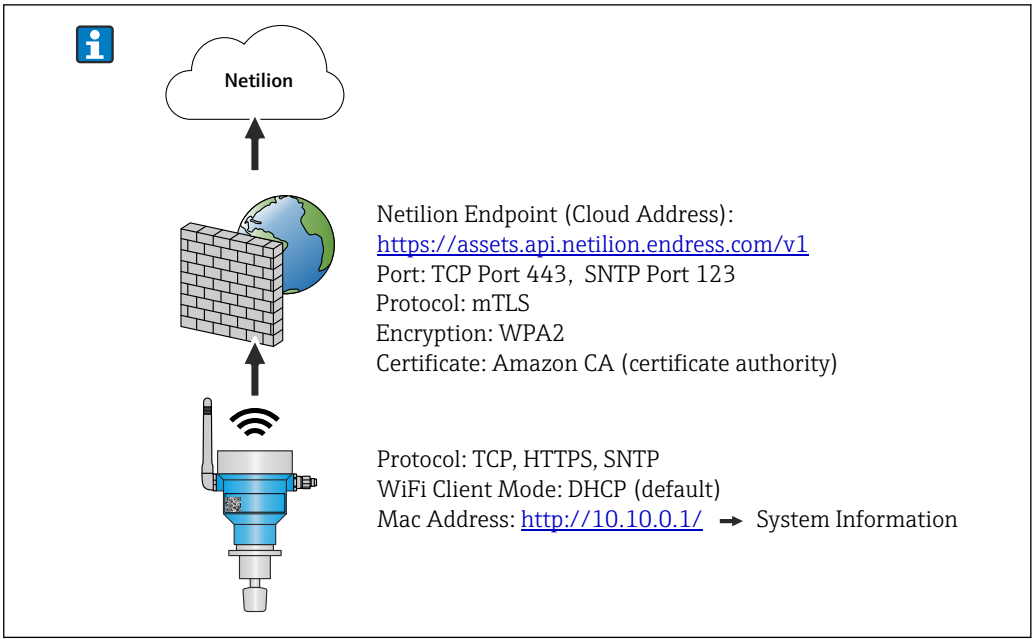
If you want to reset your password to the initial password, you must press the HOTSPOT button on the electronic insert of the Fermentation Monitor for at least 10 seconds.

7. Check whether the **Netilion Cloud** option is set under the "Setup Wizard" tab for "Operation Mode".
8. Under **Wireless Networks**, select the WLAN into which the Fermentation Monitor is to be integrated.
9. Enter the password for the WLAN.
10. Click on **Confirm and Exit**.
    ↳ Once the Fermentation Monitor is connected to the Netilion server platform, the Fermentation Monitor automatically starts transmitting measured values.
11. Log into Netilion.
12. Check whether the measured values are transmitted from the Fermentation Monitor to the Netilion server platform. The green LED on the Fermentation Monitor is lit and the status on the "Asset Details" page is green for the Fermentation Monitor. In addition, the yellow LED flashes approx. once a minute if the Fermentation Monitor data is being transmitted to the Netilion server platform.

For communication with the Netilion server platform, you can retain the "DHCP" factory setting for the Fermentation Monitor.

If you want to assign a static IP to the Fermentation Monitor, you must deactivate DHCP and set the required network IP settings in accordance with the user interface.

9.5.1 Notes on the firewall configuration



Check the following points of your firewall configuration

Port
443

Protocols
- Protocol: mTLS
- The firewall must allow TLS and mTLS protocols.
- The firewall must support and allow the corresponding protocol versions, such as TLS 1.2 or TLS 1.3.

Certificate whitelist
- Some firewalls may contain a list of trusted certificate authorities (CAs) that are approved for data exchange.
  The certificates, which are used for the mTLS connections and issued by a CA, must be included in the firewall's whitelist. If the certificates are not included, update the certificate whitelist.
  The server SSL certificates for the connected asset APIs are currently managed by the Amazon CA (Certificate Authority). Root and intermediate certificates from the CA are available at https://www.amazontrust.com/repository/
- Deep Packet Inspection (DPI)
  Some firewalls have DPI functions that inspect the encrypted data communication and block data packages categorized as unsafe. The DPI functions of the firewall must not block mTLS connections.

Access rules
Check the firewall's access rules to ensure that the firewall allows data communication between the participating systems. The rules must cover the port, all relevant IP addresses and IP ranges.

Logging and monitoring
Activate the firewall's logging and monitoring functions to make it easier to identify potential problems with mTLS connections. Analyze log files for suspicious activities or recurring error messages in order to get information about possible configuration problems.

For more information on and assistance with the firewall used: Refer to documentation or firewall technical support

9.5.2 Descriptions of signal strength quality

Once you access the configuration interface of the Fermentation Monitor, all available networks are displayed under **Wireless Networks** with the current signal quality.

Signal strength	Expected quality	Indicator
> −30 dBm	Maximum signal strength This signal strength can be expected close to WLAN routers or a wireless access point.	
> −50 dBm	Excellent signal strength Anything up to this signal strength can be considered as excellent.	
> −60 dBm	Reliable signal strength Signal strength is still good.	
> −67 dBm	Minimum signal strength required for various services This signal strength is necessary for all services that require smooth and reliable data communication.	
> −70 dBm	Low signal strength The signal strength is sufficient for most cases.	
> −80 dBm	Minimum signal strength required for establishing a connection Not recommended	
> −90 dBm	Unusable signal strength This signal is not strong enough to establish a connection or access services.	

9.6 Creating a tank

1. Select the **Tank** page in Netilion Fermentation.
2. Click on **+Create**.
   ↳ The **Create Tank** page is displayed.
3. Enter a name.
4. Enter a description if required.
5. Enter the maximum tank head pressure as an absolute pressure. The tank head pressure is the pressure to which the spunding valve is set.
6. Click on **Save**.
   ↳ The **Tank Details** page is displayed.
7. Assign asset **Fermentation Monitor QWX43**.
8. Assign the required process variable to the four primary values PV, SV, TV and QV.
9. Configure the **Automatic Batch Start/Stop Recognition** function → 56
10. If necessary, configure users and access rights.

Primary values and further process values (process variables)

All process values are consistently transmitted to the Netilion server platform and saved. The difference between the primary values and other process values is in how they are displayed.

The primary values are clearly presented in an overview on the **Batch Details** page. If you click on **More Information**, all of the other process values are displayed for selection .

The other process values are shown one after another on the **Asset Details** page .

Proceed as follows if you wish to define a different process variable as primary value. Please note that you can only ever define four primary values. You require write permission.

1. On the **Tank** page, select the tank to which you have assigned the Fermentation Monitor.
   ↳ The **Tank Details** page is displayed.
2. Click on **Edit**.
   ↳ The **Edit Tank** page is displayed.
3. Assign the desired process variable for the primary value.
4. Click on **Save**.

9.7 Creating a recipe (beer type)

1. Select the **Recipe** page in Netilion Fermentation.
2. Click on **+Create**.
   ↳ The **Create Recipe** page is displayed.
3. Enter a name.
4. Select or enter a designation for **Type**.
5. If necessary, enter a description for the recipe or the process, upload image and enter the ingredients.
   ↳ The **Recipe Details** page is displayed.
6. Configure alarm settings for the recipe (beer type) → 57.
7. If necessary, configure users and access rights.

9.8 Creating a batch

If you configured the "Automatic Batch Start/Stop Recognition" function when creating the tank, you do not need to create a batch → 56.

1. Select the **Batch** page in Netilion Fermentation.
2. Click on **+Create**.
   ↳ The **Create Batch** page is displayed.
3. Enter a name.
4. Enter a description if required.
5. Enter the starting time for the batch.
6. Assign recipe if required.
7. Assign tank.

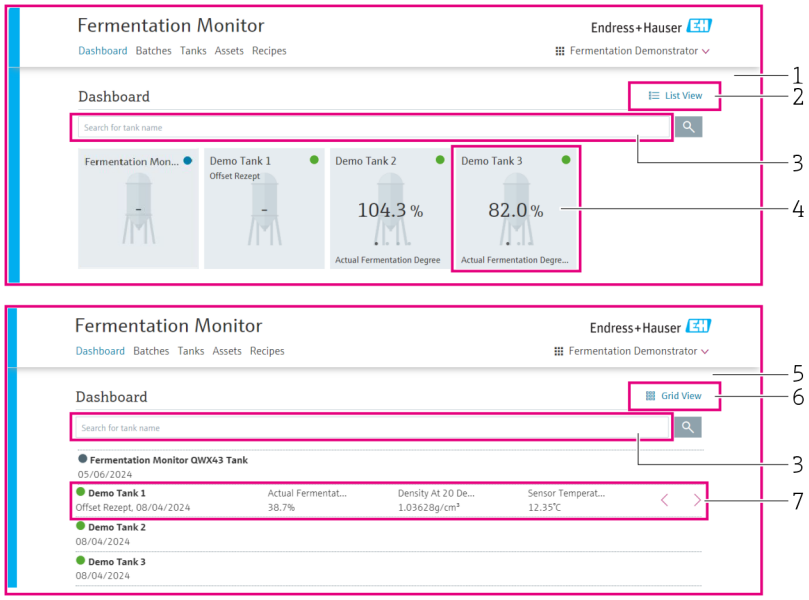
10 Operation (Netilion Fermentation)

10.1 Netilion Fermentation description

10.1.1 "Dashboard" page

You can select from the following displays for the **Dashboard** page:
- Graphical view (Grid View) of the tanks
- List View of the tanks

In addition, you can enter the name of the tank in the search box to call up the tank.



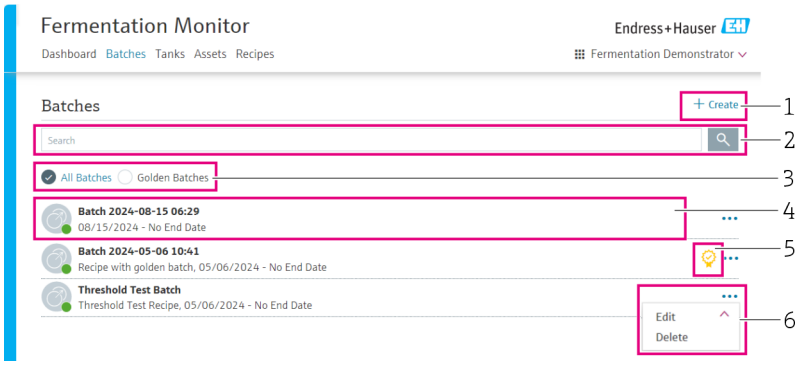
16 Dashboard in Grid View and List View

1 *Grid View*
2 *Button to switch to List View*
3 *Search box*
4 *Information on tank. Click on the tile to switch to the "Tank Details" page*
5 *List View*
6 *Button to switch to Grid View*
7 *Tank name, assigned recipe and information on process values. Use the arrows to navigate between all of the process values. Click into the line to change to the "Tank Details" page.*

10.1.2 "Batch" and "Batch Details" pages

"Batch" page

You have the following options with the **Batch** page:
- Display all batches already created
- Edit or delete an existing batch
- Display additional details relating to a batch
- Set up a new batch
- Search for a batch
- Filter view by "Golden Batches"



17 *Example for "Batch" page*

1 *Set up a new batch*
2 *Search for a batch*
3 *Filter view by "Golden Batches"*
4 *Example of a batch. Click into the line to change to the "Batch Details" page.*
5 *Indicates a Golden Batch*
6 *Menu to edit or delete a batch*

"Batch Details" page

You have the following options with the **Batch Details** page:
- Change parameter configuration for a batch or delete the batch
- Display general information for a batch
- Display all current measured and historical primary values of the batch
- Optional display of current measured and historical process values of the batch
- Activate and deactivate "Sample preparation adjustment", which also allows you to switch between the "History" and "History Adjusted" diagrams
- Export data that is displayed in the "History" diagram as a CSV file
- Call up the **Asset Details** page for the assigned Fermentation Monitor

Further information on the "Batch Details" page: → 55

The "Batch Details" and "Tank Details" pages are identical in function up to the "General information" and "Assigned Batches" areas.

10.1.3 "Tank" and "Tank Details" pages

"Tank" page

You have the following options with the **Tank** page:
- Display all tanks already created
- Edit or delete existing tanks
- Display additional details relating to a tank
- Create a new tank
- Search for a tank
- Filter view by "Unassigned tanks"

Further information on the "Tank" page: → 53

The "Tank" and "Batch" pages are identical in terms of function.

"Tank Details" page

You have the following options with the **Tank Details** page:
- Change parameter configuration for the tank or delete the tank
- Display general information about a tank
- Display all current measured and historical primary values of the batch
- Optional display of current measured and historical process values of the batch

- Activate and deactivate "Sample preparation adjustment", which also allows you to switch between the "History" and "History Adjusted" diagrams
- Export data that is displayed in the "History" diagram as a CSV file
- Call up the **Asset Details** page for the assigned Fermentation Monitor

18 *Example for "Tank Details" page*

1 *Change parameter configuration or delete object*
2 *General information and status*
3 *"More information" button: Display further information*
4 *Activate or deactivate "Sample preparation adjustment"*
5 *Display the last valid value for the primary values in each case*
6 *Export data that is displayed in the "History" or "History Adjusted" area as a CSV file*
7 *Select the period for the "History" or "History Adjusted" diagram*
8 *"History" or "History Adjusted" diagram. If "Sample preparation adjustment" is deactivated, the area is called "History". If "Sample preparation adjustment" is activated, the area is called "History Adjusted".*
9 *Enable/disable the display of a primary value in the diagram. If the display of a primary value is disabled, the button appears in gray.*
10 *If there is a Golden Batch, activate and deactivate the display of the measured values of the Golden Batch*
11 *"More information" button: Area with buttons for further process variables. To display the history of a process variable in the diagram, proceed as follows: Click on a primary value to deactivate it for the diagram. Then click on the desired process variable in order to activate it for the diagram. A maximum of four primary values and process variables can be presented in the diagram.*
12 *Display the last valid value for the "Fermentable sugars", "Non-fermentable sugars" and "Fermentation speed" process variables in each case.*
13 *Assigned batch or batches. Click into the line to change to the "Batch Details" page. Furthermore, you can create additional batches and assign them to the tank via "+Create".*
13 *Assigned Fermentation Monitor. Click into the line to change to the "Asset Details" page.*

10.1.4 "Asset" and "Asset Details" pages

"Asset" page

Devices such as the Fermentation Monitor, for example, are identified as an asset in Netilion Fermentation.

You have the following options with the **Asset** page:
- Display all assets already created
- Edit or delete existing assets
- Display additional details relating to an asset
- Create a new asset
- Search for an asset
- Filter view by "Unassigned assets"
- Display the current status with the corresponding status symbol

"Asset Details" page

You have the following options with the **Asset Details** page:
- Edit or delete asset
- Change parameter configuration for the recipe or delete the recipe
- Display the serial number, product name and manufacturer
- Current status of the asset
- Display all current measured process values
- Change units for process variable
- Display history for all process values
- Call up the **Tank Details** page for the assigned tank

10.1.5 "Recipe" and "Recipe Details" pages

"Recipe" page

You have the following options with the **Recipe** page:
- Display all recipes already created
- Edit or delete existing recipes
- Display additional details relating to a recipe
- Create a new recipe
- Search for a recipe

"Recipe Details" page

You have the following options with the **Recipe Details** page:
- Change parameter configuration for the recipe or delete the recipe
- Define limit values for the recipe
- Display general information about a recipe
- Current status of the recipe
- Display all assigned batches
- Call up the **Batch Details** page for an assigned batch

10.2 Automatic Batch Start/Stop Recognition

The "Automatic Batch Start/Stop Recognition" function automatically detects when a new batch starts and when this batch has been completed. Enabling this function ensures that production data is not lost, or that production data is not assigned to the incorrect batch. You can call up the batch-related production data via the **Batch** page.

Configure the Automatic Batch Start/Stop Recognition function

1. Select the **Tank** page.

2. Click on the required tank in the list.
   ↳ The **Tank Details** page is displayed.
3. Click on **Edit**.
4. Enable the **Batch Start/Stop Recognition** option.
5. Specify the starting time for the batch. Enable the **On Tank gets filled** option.
6. Specify the finishing time for the batch. Enable either the **On Tank is empty** or **On Temperature is below** option.
7. Where applicable, enter the limit temperature.

10.3 Configuring alerts for process events

If you wish to be informed about specific process events automatically, via e-mail for example, you can define thresholds for every recipe. You can change the thresholds subsequently.

Configure thresholds

1. Select the **Recipe** page.
2. Click on the required recipe in the list.
   ↳ The **Recipe Details** page is displayed.
3. Click on **Thresholds**.
4. Click on **+Create**.
   ↳ The **Create Threshold** page is displayed.
5. Enter a description for the threshold, e.g. "Turn on cooling".
6. Select the measured value that should trigger the alert.
7. Enter the threshold.
8. Enter the tolerance for the threshold.
9. Enable the **Notification** option if an e-mail message should be sent when the threshold is reached.

11 Diagnosis and troubleshooting

11.1 General troubleshooting

If there is a diagnostic event in the device, this is processed as follows:
- Display via LEDs on the device:
  - Trouble-free operation: Green LED lit permanently
  - Alarm or warning: The red LED flashes or is lit permanently
- "Direct integration" version: The device sends a diagnostic code to the corresponding data module function block in the control system. The diagnostic code can be read out.
- "Netilion server platform" version: In Netilion Fermentation, the status signal is signaled together with the corresponding symbol for event behavior on the **Tank Details** page.
  - Failure (F)
  - Function check (C)
  - Out of specification (S)
  - Maintenance required (M)

11.2 Diagnostic information via LEDs

LED	Lighting mode	Description
Green	Lit permanently	Device is operational. Supply voltage connected. Device is started up. Device is measuring. Device is connected to the Netilion server platform or the control system.
Green	Flashing	Device is in hotspot mode. Hotspot mode: → 🖹 48
Yellow	Lit permanently	Client such as smartphone, for example, is connected to the device in hotspot mode. This connection is necessary in order to access the web server of the Fermentation Monitor and to establish a connection to the WLAN of the system on site or wireless access point. Hotspot mode: → 🖹 48
Yellow	Flashing	Wait mode ▪ Connection is being established to the Netilion server platform or to the control system ▪ Connection is being established to the client in hotspot mode ▪ Values are transferred to the Netilion server platform or to the control system
Red	Lit permanently	Other errors: → 🖹 58
Red	Flashing	Sensor error

11.3 Diagnostic codes

Diagnostic number [1]	Short text	Remedial measures	Status signal	LED	Source identifier [2]
041 [3]	Sensor defective	Replace device. Contact the Service Team.	F	Red LED flashing	300–304
083	Memory card defective	Contact the Service Team	F	Red LED lit permanently	500–599
168	Deposits detected	Clean tuning fork	M	No specific display from the LEDs. Green LED lit permanently.	900–999

Diagnostic number [1]	Short text	Remedial measures	Status signal	LED	Source identifier [2]
169	Frequency deviation detected	Clean tuning fork Contact the Service Team for recalibration	M	No specific display from the LEDs. Green LED lit permanently.	327
171	Temperature sensor defective	Replace device. Contact the Service Team.	F	Red LED flashing	320
172	Density/viscosity sensor defective	Replace device. Contact the Service Team.	F	Red LED flashing	321
173	Ultrasonic sensor defective	Replace device. Contact the Service Team.	F	Red LED flashing	322
241	Firmware faulty.	1. Check for software update 2. Contact the Service Team	F	Red LED lit permanently	1015–1099
243	Firmware update required	Update firmware → 63	F	Red LED lit permanently	410
270	Main electronics faulty	Replace device. Contact the Service Team.	F	Red LED flashing	100–199
271	Main electronics faulty	Replace device. Contact the Service Team.	F	Red LED lit permanently	200–299
331	Firmware update incorrect	Repeat firmware update → 63	F	Red LED lit permanently	400–409
374	Sensor electronics error	Replace device. Contact the Service Team.	F	Red LED flashing	310–319
375	Cloud error: Algorithms cannot be executed	Contact the Service Team	F	No specific display from the LEDs. Green LED lit permanently.	1200–1299
400	Communication error: Device cannot establish connection to the cloud or PLC	Check network settings Check firewall settings Check function block in the controller Start hotspot mode manually → 60	F	Red LED lit permanently	600–699
430	Connection error: Device cannot dial into the customer WLAN or access point	Start hotspot mode manually → 60 Check access data	F	Red LED lit permanently	700–799
802	Sensor uncovered	Check process	S	No specific display from the LEDs. Green LED lit permanently.	323
804	Sensor out of specification	Check process	S	No specific display from the LEDs. Green LED lit permanently.	324
805	Calculation error: Input parameters of the algorithms outside the specification	Check input parameters Contact the Service Team	S	No specific display from the LEDs. Green LED lit permanently.	1100–1199
836	Temperature outside specification	Check process	S	No specific display from the LEDs. Green LED lit permanently.	325
843	Medium with too many suspended particles or bubbles	Check installation Contact the Service Team	S	No specific display from the LEDs. Green LED lit permanently.	326

Diagnostic number [1]	Short text	Remedial measures	Status signal	LED	Source identifier [2]
948 [3]	Signal quality weak	Clean tuning fork Check process for bubble formation	M	No specific display from the LEDs. Green LED lit permanently.	800–809
980	Protocol versions for device and PLC do not match	Perform firmware update Update function block in the controller Contact the Service Team	F	Red LED lit permanently	1300–1399

1) This number is displayed on the Netilion interface.
2) This error code is transmitted to the control system.
3) Only for Netilion server platform version Fermentation Monitor with a production date before 06/2023

11.4 Alcohol content – Response at low temperatures

If the beer is cooled to < 5 °C, a large portion of the solids suspended or dissolved in the beer drop to the bottom, and the medium in the tank changes. This change influences the density and sound velocity measurement, and the calculated alcohol content can thus drop either during or after cooling.

Since a calibration of the measuring instrument is not possible at < 5 °C in water, the function is extrapolated in the algorithms used at temperatures < 5 °C. This can result in slight deviations in the calculated alcohol content at < 5 °C depending on the beer type.

You can achieve good comparability of the alcohol content of the finished beer and the beer during fermentation in the tank by considering the measured value at approx. 5 °C.

11.5 Device behavior after supply voltage failure

If the device is disconnected from the supply voltage, not all values that are required for the correct calculation of the parameters, e.g. CO_2 compensation, are temporarily saved.

For a fermentation degree > 60%, this means that the measured values and process values can have an offset after voltage recovery.

If a new batch is started, this offset no longer exists.

11.6 Diagnostic information

If the device encounters a problem connecting to the WLAN, it switches to hotspot mode. The green LED flashes.

To be able to read out diagnostic information, you must access the web server of the device. This access can be either in hotspot mode or via the network if the IP of the Fermentation Monitor is known.
- Netilion server platform version: → 📄 48
- Direct integration version: → 📄 30

To be able to read out diagnostic information, you must connect to the Fermentation Monitor's WLAN.

The last fault messages are displayed on the **Connection Issues** tab.

11.7 Restoring hotspot mode

If you press the HOT-SPOT button for longer than 10 seconds, the password for accessing the Fermentation Monitor is reset to the factory setting (serial number).

11.7.1 Netilion server platform version

As standard, data is transmitted from the device to the Endress+Hauser Netilion server platform via the WLAN of the system on site. The green LED is lit permanently if a WLAN connection exists.

The device automatically changes to hotspot mode if there are connection problems with the WLAN of the system on site. If an automatic change is not possible, the yellow LED flashes for longer than 5 minutes and/or the red LED is lit permanently. In this case, you must start hotspot mode manually.

Start hotspot mode manually

1. Unscrew the housing cover.
2. Press the HOT-SPOT button on the electronic insert until the green LED flashes.
3. Tighten the housing cover.
4. Reconnect the device to the WLAN of the system on site → 48.

11.7.2 Direct integration version

As standard, the data is transmitted from the device to the control system. The green LED is lit permanently if a WLAN connection exists.

The device automatically changes to hotspot mode if there are connection problems with the wireless access point. If an automatic change is not possible, the yellow LED flashes for longer than 5 minutes and/or the red LED is lit permanently. In this case, you must start hotspot mode manually.

Start hotspot mode manually

1. Unscrew the housing cover.
2. Press the HOT-SPOT button on the electronic insert until the green LED flashes.
3. Tighten the housing cover.
4. Reconnect the device to the wireless access point → 30.

11.8 Resetting the device password

You need a password to be able to connect to the Fermentation Monitor via the web server. The initial password is the serial number of the Fermentation Monitor and must be changed during commissioning.

Procedure if you want to reset the password to the initial password

- Press the HOT-SPOT button on the electronic insert of the Fermentation Monitor for at least 10 seconds.

11.9 Restarting the device

Manually restart the device

1. Unscrew the housing cover.
2. Press the RE-BOOT button on the electronic insert.
   - The device is restarted. All device settings, such as the WLAN configuration, are retained.
     The device automatically connects to the WLAN of the system on site or wireless access point.
3. Tighten the housing cover.

11.10 Firmware history

V01.00.zz (10.2021)
- Valid as of document version: 01.21
- Changes: None; 1st version

V02.00.zz (06.2023)
- Valid as of document version: 02.23
- Changes: New direct integration version

V03.00.zz (09.2023)
- Document version 02.23 valid
- Changes: Internal improvements, not relevant for Operating Instructions

V04.01.zz (08.2024)
- Document version 02.23 valid
- Changes: Updates to safety-related functions

V04.02.zz (10.2024)
- Valid as of document version: 03.24
- Changes: Measuring parameters added, changed or adjusted

12 Maintenance

No specific maintenance work is required.

12.1 Maintenance tasks

It is not permitted to use the device with abrasive media. Material deposits on the sensor head can lead to malfunction and impair correct operation. However, a food-grade cleaning is possible while the device is installed and is recommended, e.g. CIP (Cleaning in Place).

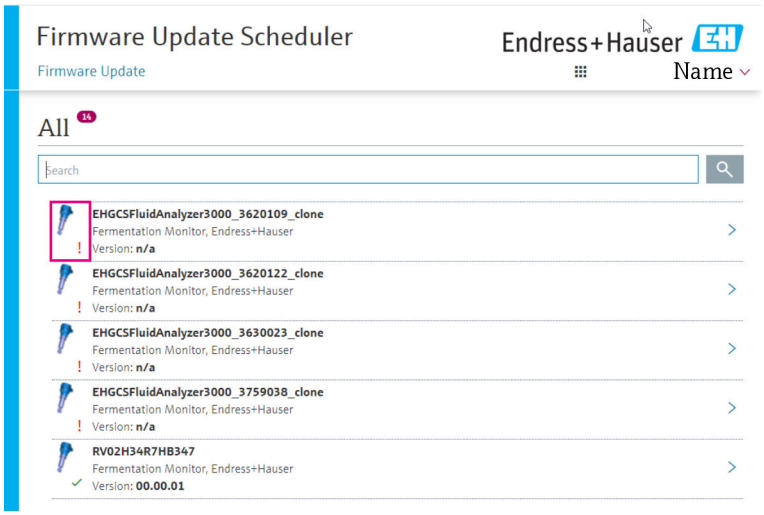
12.2 Updating the firmware

You have the following options for performing a firmware update:
- Online via the Netilion server platform → 63
- Offline via the web server of the Fermentation Monitor → 64

12.2.1 Performing a firmware update via the Netilion server platform

To ensure that you can perform a firmware update via Netilion for the direct integration version, you must set the Fermentation Monitor to hotspot mode → 61. Then select the **Cloud** option for **Operation Mode**. After you have performed the firmware update, you must set the Fermentation Monitor back to hotspot mode. Then select the **PLC** option for **Operation Mode**.

1. Log into Netilion.
2. Call up **Firmware Update Scheduler**. https://netilion.endress.com/app/fus or **Administration** menu (path: Name > Administration)
   ↳ The **Firmware Update Scheduler** page is displayed. An update is available for devices marked with a red exclamation mark.
3. Click on the device for which an update is to be performed.



The **Asset Details** page is displayed.

4. Select the required firmware version in the **Firmware version to be installed** field.
5. Select the date and time in the **Update at** field.
6. Click on the **Schedule Update** button.
   ↳ The yellow LED on the device flashes during the update.

If the update was successful, a green tick is displayed in the Status field.

12.2.2 Performing a firmware update without the Netilion server platform

With this version, you perform the firmware update via the web server of the Fermentation Monitor.

Contact Endress+Hauser Service for further information.

13 Repair

13.1 General information

13.1.1 Repair concept

The device may only be repaired by Endress+Hauser Service.

For more information contact the Service Department at Endress+Hauser.

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/support/return-material
   ↳ Select the region.
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 Technical data

14.1 Input

14.1.1 Measured variable

Measured process variables

- Viscosity in mPa·s
- Density in g/cm³
- Temperature in °C
- Sound velocity in m/s

Calculated process variables

Process variable	Unit	Notes
Temperature	°F	Temperature of medium in °F
Density (20 °C)	g/cm³	Density, standardized to 20 °C
Density (15.6 °C)	g/cm³	Density, standardized to 15.6 °C
SG (20 °C) [1] (Specific density (20 °C))	–	Specific density calculated from the density of the medium and the density of water at 20 °C
Viscosity (20 °C)	mPa·s	Viscosity, temperature-compensated and standardized to 20 °C
Original gravity	°Plato [2]	Original gravity back-calculated from the alcohol and extract content
Real extract	%w/w [3]	Real extract, calculated from the combination of ultrasonic and density measurement
Apparent extract	%w/w [3]	Apparent extract based on density measurement and conversion according to Balling formula
Alcohol (% w/w)	%mass	Alcoholic content calculated from the combination of ultrasonic and density measurement, standardized to 20 °C
Alcohol (%vol)	%vol	Alcoholic content calculated from the combination of ultrasonic and density measurement, standardized to 20 °C
Alcohol (%vol) (15 °C) [1]	%vol	Alcoholic content calculated from the combination of ultrasonic and density measurement, standardized to 15.6 °C
Real fermentation degree	%	Real fermentation degree based on the measured actual extract
Apparent fermentation degree	%	Apparent fermentation degree based on the measured apparent extract
Fermentable sugars	%w/w [3]	Percentage of fermentable sugars (Maltotriose, maltose, glucose, fructose, etc.) from the original wort shown from 1 %vol alcohol during the fermentation process
Non-fermentable sugars	%w/w [3]	Percentage of non-fermentable sugars (dextrin) from the original wort shown from 1 %vol alcohol during the fermentation process

Process variable	Unit	Notes
Concentration CO_2	%mass	In the case of the direct integration version, this process variable is made available to the PLC as a service parameter. The value is not representative of the actual CO_2 concentration in the beer. Calculated from the equilibrium pressure depending on the tank top pressure and medium temperature
Fermentation speed	%vol/h	Calculated from the rate of alcohol production per hour
Density (20 °C)_MEBAK	g/cm^3	Density, standardized to 20 °C, corrected based on the MEBAK correction [4)]
Density (15.6 °C)_MEBAK	g/cm^3	Density, standardized to 15.6 °C, corrected based on the MEBAK correction [4)]
SG (20 °C)_MEBAK (Specific density (20 °C)_MEBAK)	–	Specific density calculated from the density of the medium and that of the water at 20 °C, corrected based on the MEBAK correction
Original gravity_MEBAK	°Plato [2)]	Original gravity back-calculated from the alcohol and extract content and corrected based on the MEBAK correction
Real extract_MEBAK	%w/w [3)]	Real extract, calculated from the combination of ultrasonic and density measurement, corrected based on the MEBAK correction [4)]
Apparent extract_MEBAK	%w/w [3)]	Apparent extract based on density measurement and conversion according to Balling formula, corrected based on the MEBAK correction [4)]
Alcohol (%w/w)_MEBAK	%mass	Alcohol content standardized to 20 °C, calculated from the combination of ultrasonic and density measurement, corrected based on the MEBAK correction [4)]
Alcohol (%vol)_MEBAK	%vol	Alcohol content standardized to 20 °C, calculated from the combination of ultrasonic and density measurement, corrected based on the MEBAK correction [4)]
Alcohol (%vol) (15 °C)_MEBAK [1)]	%vol	Alcohol content calculated from the combination of ultrasonic and density measurement, standardized to 15.6 °C, corrected based on the MEBAK correction [4)]
Real fermentation degree_MEBAK	%	Real fermentation degree, based on the measured real extract, corrected based on the MEBAK correction [4)]
Apparent fermentation degree_MEBAK	%	Apparent fermentation degree, based on the measured apparent extract, corrected based on the MEBAK correction

Process variable	Unit	Notes
TS original gravity	%mass	Total solids measured gravimetrically that remain in the oven after drying the wort at 120 °C. Represents all the substances in the wort apart from alcohol and water.
TS real extract	%mass	Total solids of the real extract measured gravimetrically that remain in the oven after drying the wort at 120 °C. Represents all the substances in the wort apart from alcohol and water.

1) From software version 4.2
2) °Plato: Equivalent to the density of a correspondingly concentrated sucrose solution at 20 °C
3) The unit %w/w corresponds to the unit °Plato. The unit was adapted with software version 4.2.
4) MEBAK allows for a specific type of laboratory sample preparation, in particular filtering, which physically changes the sample. These changes are taken into account using the "MEBAK correction" of the measured values within the sensor to ensure comparability of laboratory measured values with the measurements in the tank.

14.1.2 Measuring range

Measured process variables

- Viscosity: 0 to 20 mPa·s
- Density: 0.95 to 1.15 g/cm³
- Temperature for fermentation: −5 to +35 °C (+23 to +95 °F)
- Sound velocity: 1200 to 1800 m/s

Calculated process variables

- Original gravity/extract: up to 32 °Plato
- Alcohol: Up to 12 %mass

If 32 °Plato and/or 12 %mass or 15 %vol alcohol are exceeded, no measured value is output.

14.2 Output

14.2.1 Output signal

Direct integration

A web server is integrated in the Fermentation Monitor. The Fermentation Monitor is configured using this web server and is thus connected to a wireless access point or integrated into the customer network of the automation system.

- Wireless connection (WLAN 2.4 GHz): TCP/IP
- Encryption: WPA2-PSK
- Wired connection to a TCP/IP control system (LAN 10/100 Mbit/s Ethernet)
  The following control systems are supported:
  - Siemens S7
  - Rockwell CompactLogix
  - Rockwell ControlLogix
- Transmission rate: 1/min

Netilion server platform

A web server is integrated in the Fermentation Monitor. This web server is used to connect the Fermentation Monitor to the Endress+Hauser Netilion server platform via the customer WLAN.

- WLAN: 2.4 GHz
- Encryption: WPA2-PSK
- Ports: TCP Port 443, SNTP Port 123
- Protocol: mTLS (protocol versions: TLS 1.2/TLS 1.3)
- Transmission rate: 1/min

In the event of a network failure, the measured data are stored in the device for a maximum of one week.

14.2.2 Signal on alarm

Direct integration

- LED signaling directly on the device
- Diagnostic messages via error bits within the data module to the control system

Netilion server platform

- LED signaling directly on the device
- Diagnostic messages via Netilion Fermentation

14.2.3 Protocol-specific data

Direct integration

The Fermentation Monitor QWX43 uses:
- Direct connection protocol: TCP/IP
- Application layer protocol: TCP/IP-based Open User Communication (OUC)
- Function blocks for Siemens PLCs and Add-on Instructions (AOIs) for Rockwell PLCs

Function blocks for Siemens S7 PLCs:
- SIMATIC S7-300 and S7-400, compatible with STEP V5.5 and higher
- SIMATIC S7-1500, compatible with TIA Portal V15-V17
- SIMATIC S7-1500, compatible with TIA Portal V18 and higher

Add-On Instructions (AOIs) for Rockwell PLCs:
Rockwell CompactLogix 5370/5380 and ControlLogix 5580, compatible with RSLogix 5000 V18.00.00 and higher and Studio 5000 V21.00.04 and higher

Detailed information and files: www.endress.com (Product page > Documents > Software)

Netilion server platform

The Fermentation Monitor QWX43 uses:
- Internet protocol TCP/IP and the secure transport layer TLS (v1.2)
- Application layer protocol: HTTPS

14.2.4 Information on wireless connection

- Wireless technology: Wi-Fi 2.4 GHz
- Frequency channels: 1 to 13
- Frequency range: 2 401 to 2 483 MHz
- Bandwidth: 20 MHz
- Wi-Fi standard: IEEE 802.11 b/g/n
- Antenna type, external antenna: 2 dBi Gain
- Max. output power: +18.7 dBm(FCC MPE measurement/calculation)

14.3 Environment

14.3.1 Ambient temperature range

–20 to +60 °C (–4 to +140 °F)

The device is also suitable for outdoor operation.

Outdoor operation in strong sunlight:
- Mount the device in the shade.
- Avoid direct sunlight, particularly in warmer climactic regions.
- Use a weather protection cover.

14.3.2 Storage temperature

Store indoors if possible

–20 to +60 °C (–4 to +140 °F)

14.3.3 Operating height

As per IEC 61010-1 Ed.3:
2 000 m (6 562 ft) above sea level

14.3.4 Humidity

Operate up to 100%. Do not open in a condensing atmosphere.

14.3.5 Climate class

As per IEC 60068-2-38 test Z/AD

14.3.6 Degree of protection

IP66/67, NEMA Type 4X

IP66/67
- Complete protection against contact and complete protection against dust (dust-proof)
- Protected against powerful water jets or protected against temporary immersion in water

NEMA Type 4X
Indoor or outdoor installation, protects against windblown dust and rain, splashing water, water jets and corrosion

14.3.7 Shock and vibration resistant

Vibration resistance according to EN60068-2-64 and shock resistance according to DIN EN60068-2-27

14.3.8 Mechanical stress

NOTICE

Mechanical deformation of the fork tines or shocks to the fork tines
Device malfunction, e.g. impacting the measurement accuracy
- ▶ Protect the fork tines against mechanical deformation.
- ▶ Avoid impact on the fork tines.

14.3.9 Internal cleaning

CIP cleaning

Suitable for CIP cleaning with a constant temperature of 110 °C (230 °F) maximum

14.3.10 Electromagnetic compatibility (EMC)

As per IEC/EN 61326 series

Overvoltage category II

Maximum deviation under interference influence: < 1 % of measuring range

Overvoltage protection must be installed at the customer site in the following cases:
- The power supply line to the Fermentation Monitor is longer than 30 meters.
- The power supply line to the Fermentation Monitor leaves the building.
- Other consumers are connected in parallel to the power supply unit for the Fermentation Monitor.

Install the overvoltage protection as close to the Fermentation Monitor as possible.

You can install Endress+Hauser surge arresters HAW569 or HAW562, for example, as an overvoltage protection.

14.4 Process

14.4.1 Process temperature range

−10 to +110 °C (+14 to +230 °F)

14.4.2 Process pressure range

0 to 16 bar (0 to 232.1 psi) depending on the selected process connection and possible certificate-related restrictions (e.g. CRN)

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