TI01628F/00/EN/02.23-00
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2023-03-01

Technical Information
Fermentation Monitor QWX43

Continuous measurement of density, viscosity, temperature and concentration for liquids

Application

Multi-sensor technology with density, sound velocity, viscosity and temperature measurement for liquids. Compact device for continuous monitoring of processes such as fermentation in breweries.

- Maximum accuracy for density, ultrasonic, viscosity and temperature measurement
- Installation in tanks with IP66/67 housing protection
- Hygienic sensor made of 316L, constructed in accordance with 3A and EHEDG specifications
- Sensor lengths up to 2 m (6.6 ft)
- Ideal alternative to costly laboratory measurements in the brewery sector
- Customer interface via Endress+Hauser Netilion server platform or direct integration into existing control system

Your benefits

- Minute-by-minute updating of key parameters in fermentation process – enables continuous monitoring
- No on-site presence required - accurate and repeatable measurements instead of hydrometer measurements and laboratory analysis
- Information can be accessed anytime and anywhere – via smartphone, tablet, PC or control system
- Automatic notifications, for example when desired fermentation levels are reached – for more efficient cooling and green beer transfer, among other things
- Comparison of values from previous batches – enables data-based process improvements
- Automatic creation, storage and download of batches and values – reduces the effort involved in documentation and filing and replaces manual batch tracking

Endress+Hauser
People for Process Automation

Table of contents

Document information

Symbols

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.

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.

Symbols for certain types of Information

Permitted
Procedures, processes or actions that are permitted

Preferred
Procedures, processes or actions that are preferred

Forbidden
Procedures, processes or actions that are forbidden

Tip
Indicates additional information

Reference to documentation

Reference to page

Reference to graphic

Visual inspection

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

Function and system design

Measuring principle

The Fermentation Monitor QWX43 is a measuring device for monitoring temperature, density, viscosity and sound velocity. It is specifically intended for monitoring the concentration of sugar, alcohol and the brewing process during the fermentation of beer, for example.

The measurement method 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 the Netilion server platform or a wireless access point (WAP), depending on the QWX43 version.

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

Netilion server platform version

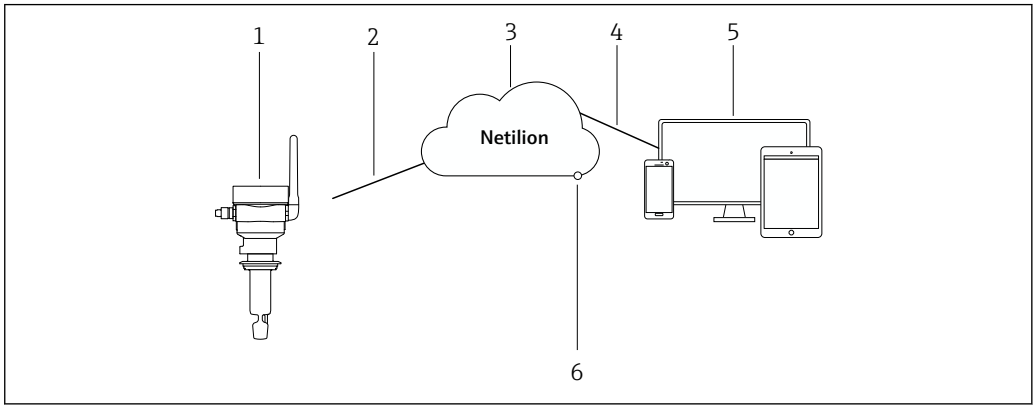
The web server integrated in the housing sends the sensor measured values directly to the Endress+Hauser Netilion server platform. The values can be called up and saved via Netilion Value.

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.

System configuration: Netilion server platform version

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



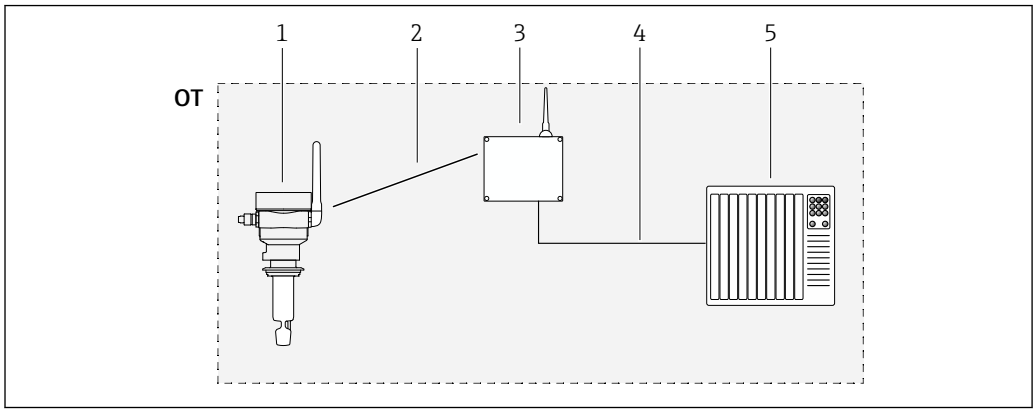
1 *System design Fermentation Monitor QWX43*

1 *Fermentation Monitor QWX43*
2 *WLAN https Internet connection*
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 Netilion server platform: https://netilion.endress.com

System configuration: direct integration version

The Fermentation Monitor QWX43 can be connected via the web server and put into operation by means of a function block in the control system.



2 System configuration: Fermentation Monitor QWX43 – direct integration

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

Input

Measured variable

Measured process variables

- Viscosity
- Density
- Temperature
- Sound velocity

Calculated process variables

Process variable	Unit	Notes
Density (20 °C)	g/cm³	Density, standardized to 20 °C
Density (15.6 °C)	g/cm³	Density, standardized to 15.6 °C
Viscos. (20 °C) (Viscosity (20 °C))	mPa·s	Viscosity, temperature-compensated and standardized to 20 °C
TS original gravity	%mass	Percentage of total solids in the original gravity after drying at 120 °C
Original gravity	°Plato	Converted from the values of the total solids calculated
TS real extract	%mass	Percentage of total solids in the currently available extract after drying at 120 °C
Real. extract	°Plato	Extract currently present, converted from the values of the total solids calculated
Appar. extract	°Plato	Based on density measurement and conversion according to Balling formula
Residual extract (Balling)	°Plato	Predicted residual extract based on density measurement and conversion according to Balling formula
Alcohol (%w/w)	%mass	Alcohol content calculated from the combination of ultrasonic and density measurement
Alcohol (%vol)	%vol	Alcohol content calculated from the combination of ultrasonic and density measurement
Alcohol (Balling)	%vol	Alcohol content based on density measurement and conversion according to Balling formula
Real. ferm %	%	Based on the values of the total solids of original gravity and extract
Appar. ferm. %	%	Based on the values from the Balling formula
Fermentable sugars	%mass	Percentage of short-chain sugars, e.g. maltose, determined from the original gravity before fermentation
Non-fermentable sugars	%mass	Percentage of long-chain sugars, e.g. dextrine, determined from the original gravity before fermentation
Conc. CO2 (Concentration CO_2)	%mass	Calculated from the equilibrium pressure depending on the tank top pressure and medium temperature
Fermentation speed	%vol/h	Calculated from the rate of alcohol formation per hour
Density (20 °C)_MEBAK	g/cm³	Density, standardized to 20 °C and corrected to laboratory values with MEBAK Fit

Process variable	Unit	Notes
Density (15.6 °C)_MEBAK	g/cm³	Density, standardized to 15.6 °C and corrected to laboratory values with MEBAK Fit
Original gravity_MEBAK	°Plato	Converted from the values of the total solids calculated and corrected to laboratory values with MEBAK Fit
Real. Extract_MEBAK	°Plato	Extract currently present, converted from the values of the total solids calculated and corrected to laboratory values with MEBAK Fit
Appar. Extract_MEBAK	°Plato	Based on density measurement and conversion according to Balling formula and corrected to laboratory values with MEBAK Fit
Residual extract (Balling)_MEBAK	°Plato	Predetermined residual extract, based on density measurement and conversion according to Balling formula and corrected to laboratory values with MEBAK Fit
Alcohol (%w/w)_MEBAK	%mass	Alcohol content, calculated from the combination of ultrasonic and density measurement and corrected to laboratory values with MEBAK Fit
Alcohol (%vol)_MEBAK	%vol	Alcohol content, calculated from the combination of ultrasonic and density measurement and corrected to laboratory values with MEBAK Fit
Alcohol (Balling)_MEBAK	%vol	Alcohol content, based on density measurement and conversion according to Balling formula and corrected to laboratory values with MEBAK Fit
Real. ferm %_MEBAK	%	Based on the values of the total solids of original gravity and extract and corrected to laboratory values with MEBAK Fit
Appar. ferm. %_MEBAK	%	Based on values from the Balling formula and corrected to laboratory values with MEBAK Fit

Measuring range

Measured process variables

- Viscosity: 0 to 1 000 mPa·s
- Density: 0.3 to 2.0 g/cm³
- Temperature for fermentation: −5 to +35 °C (+23 to +95 °F)
  Higher measured value deviations are possible outside the temperature range for fermentation.
- Sound velocity: 800 to 2 200 m/s
- Measured values also visible in the gas phase, with the exception of sound velocity

Calculated process variables

- Original gravity / extract: up to 32 °Plato
  Higher measured value deviations are possible between 20 and 32 °Plato.
- Alcohol: up to 12 %mass

No measured value is output if 32 °Plato and/or 12 %mass is/are exceeded.

Output

Output signal

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's WLAN.

- WLAN: 2.4 GHz
- Transmission rate: 1/min

In the event of a network failure, the measured data are saved in the device for a maximum period of 1 week.

Direct integration

A web server is integrated in the Fermentation Monitor. This web server is used to configure the Fermentation Monitor and connect it to a wireless access point or integrate it into the customer's automation system network.

- Wireless connection (WLAN 2.4 GHz): TC/ IP
- Wired connection with the control system, e.g. Siemens S7: TCP/IP (LAN 10/100 Mbps Ethernet)
- Transmission rate: 1/min

Signal on alarm

Netilion server platform

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

Direct integration

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

Protocol-specific data

Netilion server platform

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

Direct integration

The Fermentation Monitor QWX43 uses:
- Direct connection protocol: TCP/IP
- Application layer protocol: TCP/IP-based Open User Communication (OUC)
- Device description file / function block
  For Siemens S7 CPUs: S7 library compatible with TIA Portal/SIMATIC STEP 7

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

Power supply

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.

Power consumption

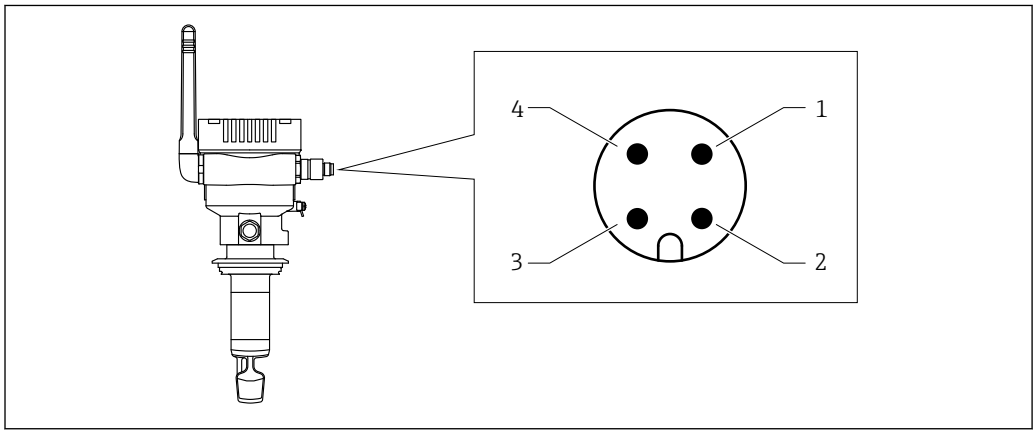
2.4 W

Current consumption

100 mA at 24 V DC

Electrical connection

The device is powered via the M12 plug.



3 Electrical connection via M12 plug and PIN assignment

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

You can order a connecting cable with plug-in jack with the device → 24.

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.

Potential equalization

Potential equalization is not mandatory.

If necessary, connect the grounding of the cable / protective ground to PIN 4 of the M12 socket.

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
- Additional 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 overvoltage protection for example.

Performance characteristics

Response time

20 s

Reference operating conditions

- Distilled water, degased: +10 °C (+50 °F)
- Density: 999.7 kg/m³

Measured value resolution

- Viscosity: 0.01 mPa·s
- Density: 0.0001 g/cm³
- Temperature: 0.01 °C
- Sound velocity: 0.05 m/s

Measured error

As per DIN EN IEC 62828-1. The measured error satisfies ± 2 sigma.

Under reference operating conditions

- Viscosity: 0.02 mPa·s
- Density: 0.0001 g/cm³
- Temperature: 0.08 °C
- Sound velocity: 0.23 m/s

Resulting measured error

- Extract: 0.02 %mass
- Extract: 0.02 °Plato
- Alcohol: 0.02 %vol

Repeatability

As per DIN EN IEC 62828-1. The repeatability satisfies ± 2 sigma.

Under reference operating conditions

- Viscosity: 0.01 mPa·s
- Density: 0.00006 g/cm³
- Temperature: 0.05 °C
- Sound velocity: 0.06 m/s

Resulting measured error

- Extract: 0.01 %mass
- Extract: 0.01 °Plato
- Alcohol: 0.01 %vol

Measurement uncertainty

Under reference operating conditions

- Viscosity: 0.02 mPa·s
- Density: 0.00008 g/cm³
- Temperature: 0.07 °C
- Sound velocity: 0.14 m/s

Resulting measuring uncertainty

- Extract: 0.02 %mass
- Extract: 0.02 °Plato
- Alcohol: 0.02 %vol

Design fundamentals

The measured process density is primarily used to calculate process variables that are referred to as "apparent" variables. For example, the process density can be used in the "Balling formula" to calculate the alcohol content (according to Balling).

Balling formula:
P = ((A * 2.0665 + Wr) * 100%) / (100 + A * 1.0665)

- P: original gravity
- Wr: actual residual gravity in %mass
- A: alcohol content in %mass

Vibration effects

Mount the device in such a way that the device is not exposed to any vibrations. Vibrations affect the accuracy of the measured value.

Mounting

Mounting location

Recommended mounting locations

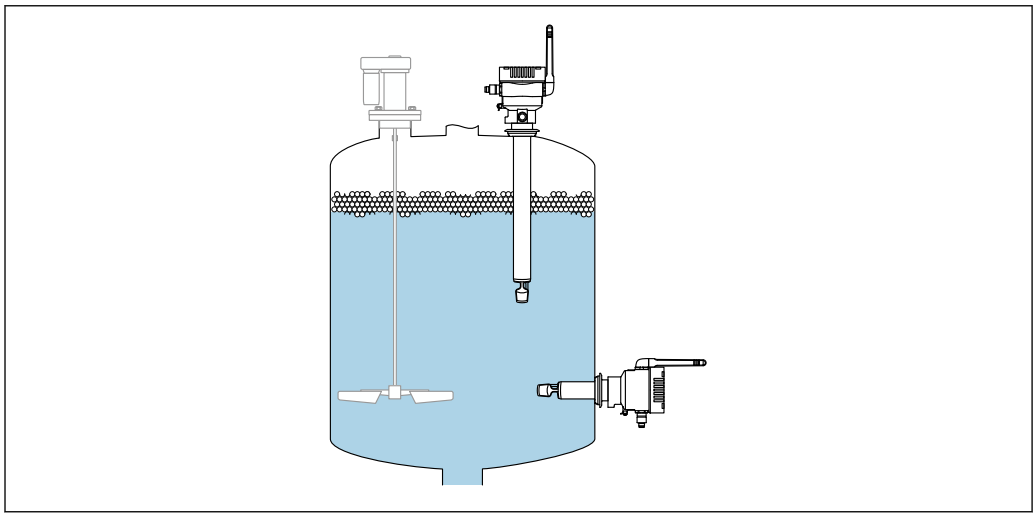
- Compact version: On the side of the tank (horizontal orientation)
- Devices with pipe extension: From above (vertical orientation)
- Minimum distance of sensor tip to tank wall: 10 cm (3.94 inch)
- The measuring elements must be fully immersed in the medium
- The measuring elements should be in the bottom third of the tank but above the cone for optimized measurement during fermentation
- Tanks with agitators: Align the tuning fork in the direction of flow parallel to the tank wall

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

Pipes

- The device can be mounted in a pipe from a pipe diameter of 200 mm (7.87 in) to a flow velocity of ≤2 m/s
- We do not recommend that the device be installed in pipes as the pipe wall is likely to cause feedback effects on the measuring signal
- Please contact your Endress+Hauser representative for further information



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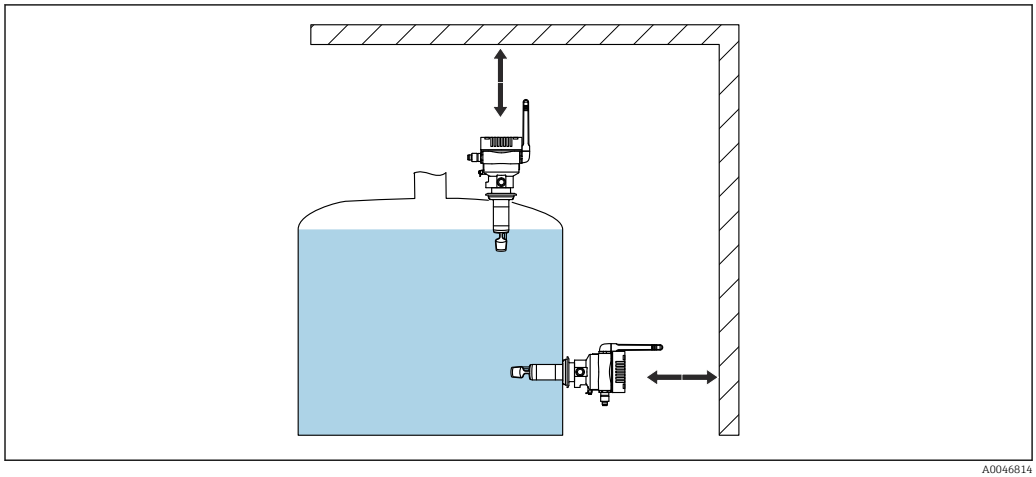
4 Possible orientation

Installation instructions

Take clearance into consideration



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5 Take clearance into consideration

Allow sufficient space for mounting and electrical connection.

M12 plug

The M12 plug of the device must be pointing downwards.

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.

Positioning the antenna

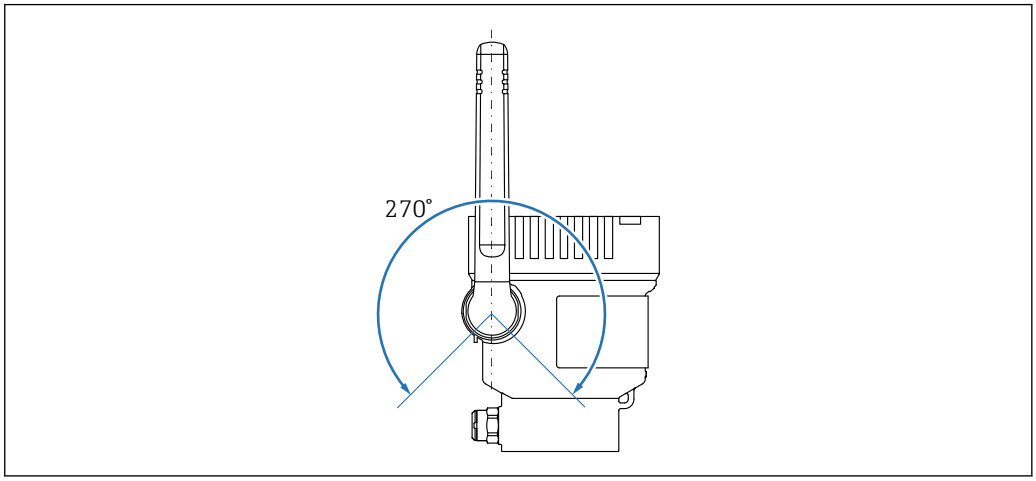
To optimize the transmission quality, position the antenna in such a way that it is not emitting its signal directly on metal. You can rotate the antenna within an angle of 270°.

NOTICE

Angle of rotation of antenna too large!

Damage to internal wiring.

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

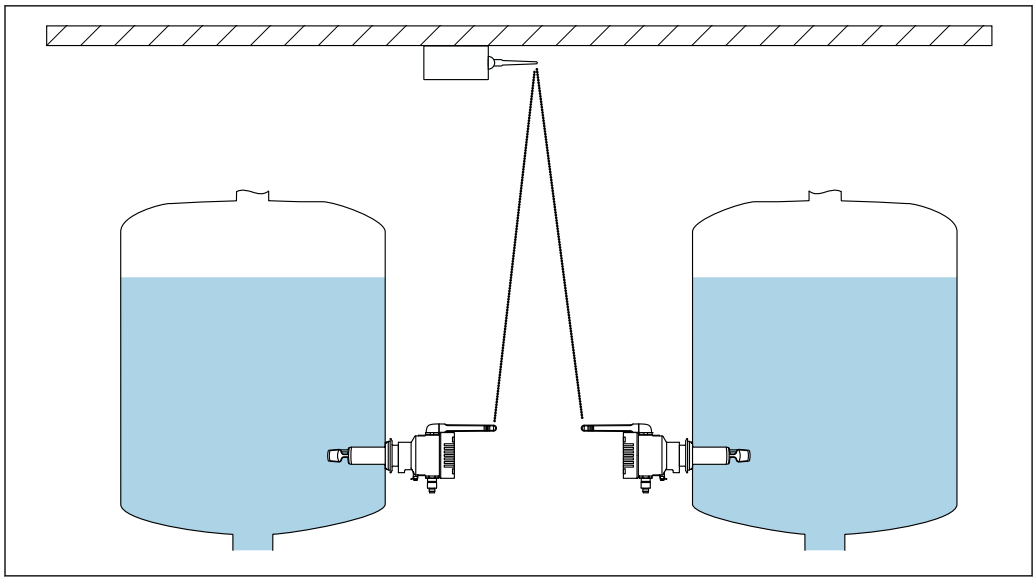


6 *Possible angle of rotation of the antenna*

Wireless access point for direct integration version

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
- If installing outdoors, protect the wireless access point from the effects of the weather, e.g. use a housing



7 Recommendations for the wireless access point mounting location

Environment

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.
Storage temperature	Store indoors if possible −20 to +60 °C (−4 to +140 °F)
Operating height	As per IEC 61010-1 Ed.3: 2 000 m (6 562 ft) above sea level
Humidity	Operate up to 100%. Do not open in a condensing atmosphere.
Climate class	As per IEC 60068-2-38 test Z/AD
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
Shock and vibration resistant	Vibration resistance according to EN60068-2-64 and shock resistance according to DIN EN60068-2-27
Mechanical stress	Avoid mechanical deformation of, or shocks to the device's fork tines as this can have a negative influence on the measuring accuracy.
Internal cleaning	**CIP cleaning** Suitable for CIP cleaning with a constant temperature of 110 °C (230 °F) maximum
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.

Process

Process temperature range	−10 to +110 °C (+14 to +230 °F)
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)

Mechanical construction

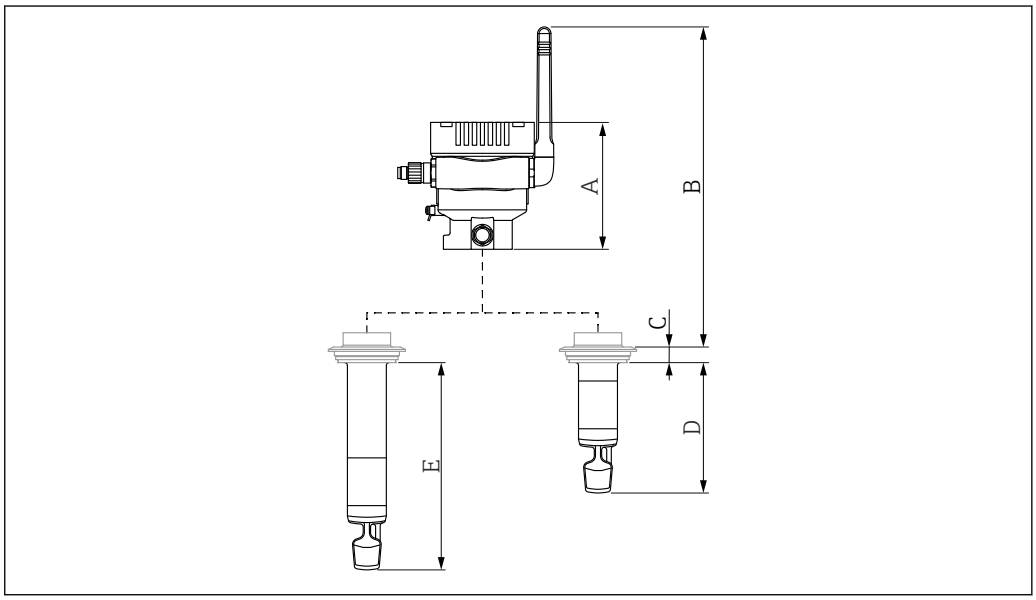
Design, dimensions

Device height

The device height is calculated from the following components:
- Housing including cover
- Antenna
- Process connection
- Probe design: compact version or pipe extension

You can rotate the antenna.

The individual heights of the components can be found in the following sections:
- Determine the height of the device and add the individual heights.
- Take the installation space into account (the space required to install the device)

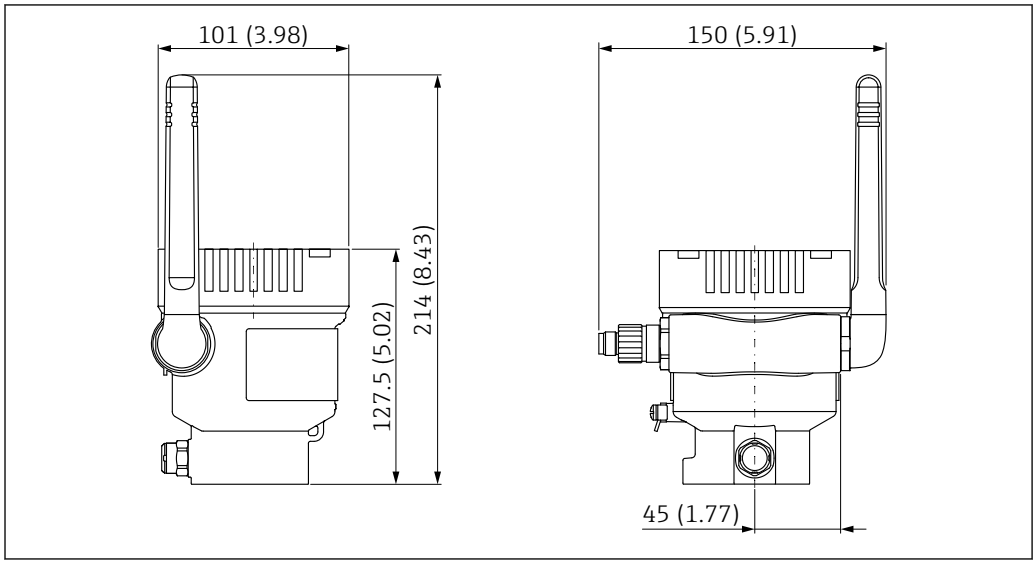


8 *Components for determining the height of the device*

A Housing including cover
B Maximum height of housing with antenna
C Height of process connection
D Probe design: compact version
E Probe design: pipe extension

Dimensions

Housing

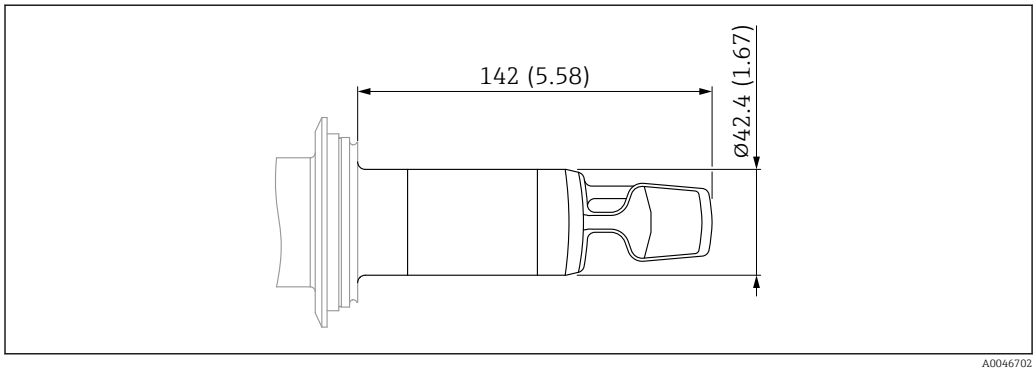


9 Single-compartment housing (dimensions in mm (in)). Unit of measurement mm (in)

Probe design

Compact version

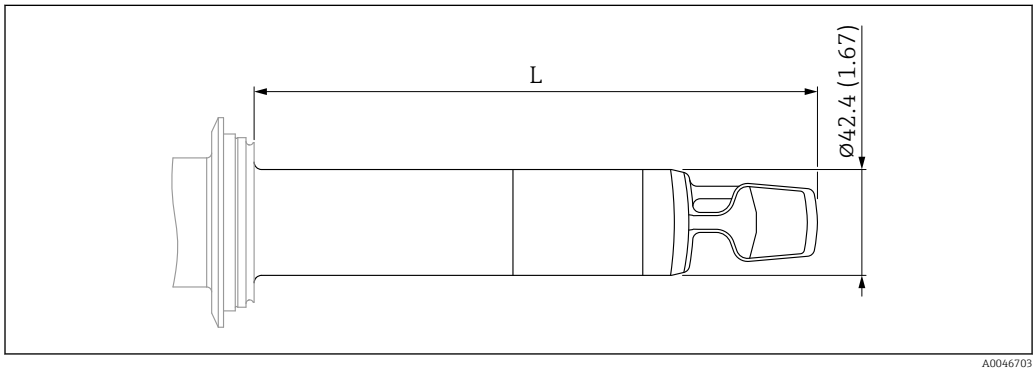
Material: 316L



10 Probe design: compact version (dimensions in mm (in))

Pipe extension

Material: 316L



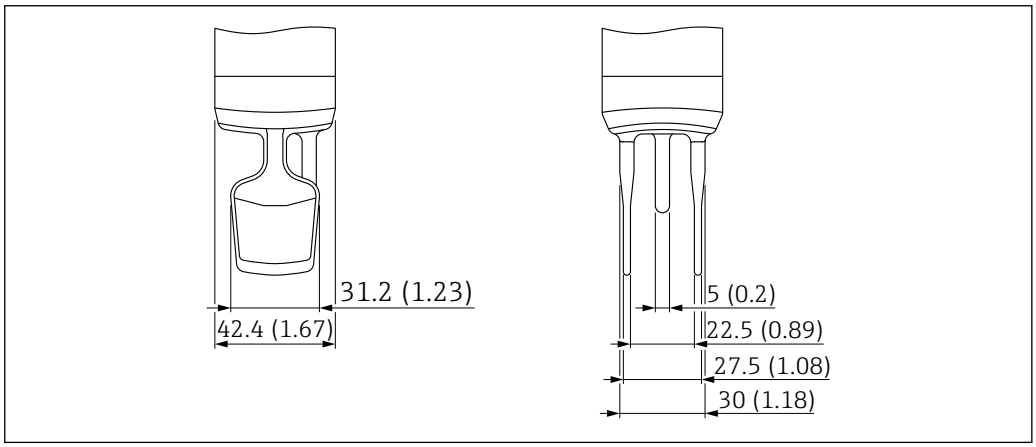
11 Probe design: pipe extension (dimensions in mm (in))

L Sensor length

Sensor length L
- 400 mm (15.8 in)
- 1 000 mm (39.4 in)
- 1 500 mm (59.1 in)
- 2 000 mm (78.7 in)

Measuring elements

Material: 316L

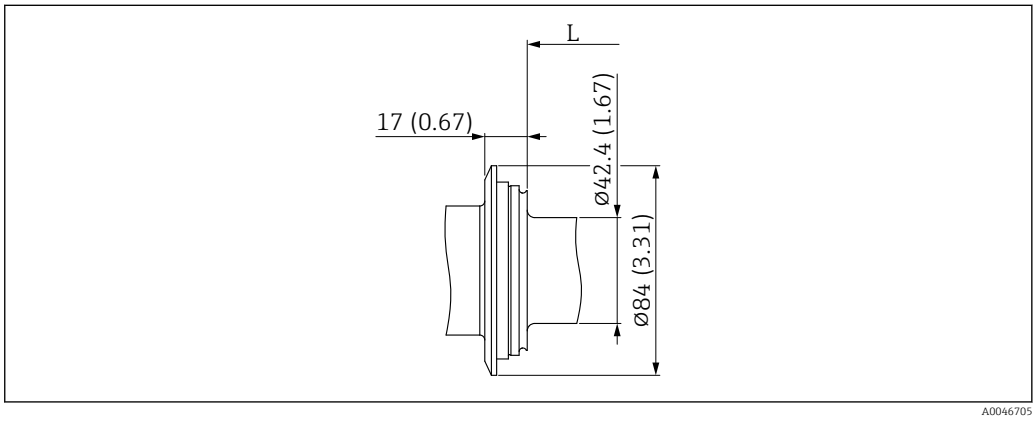


12 Measuring elements (dimensions in mm (in)). Unit of measurement mm (in)

Process connections

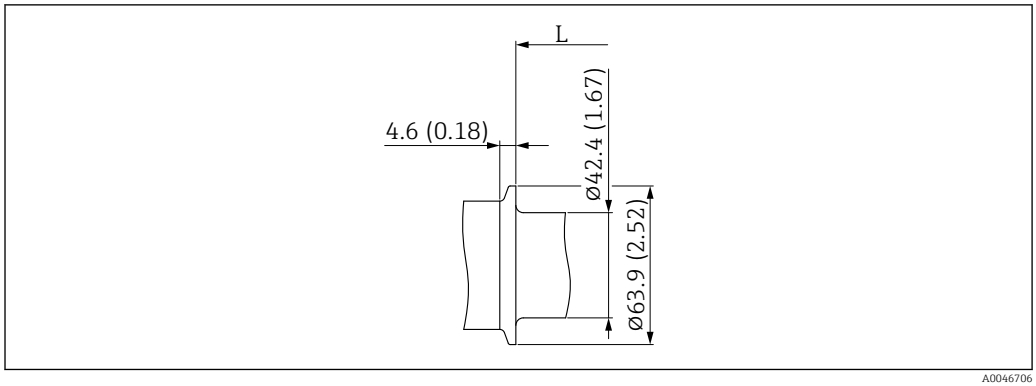
Material: 316L

Varivent N DN50 PN40



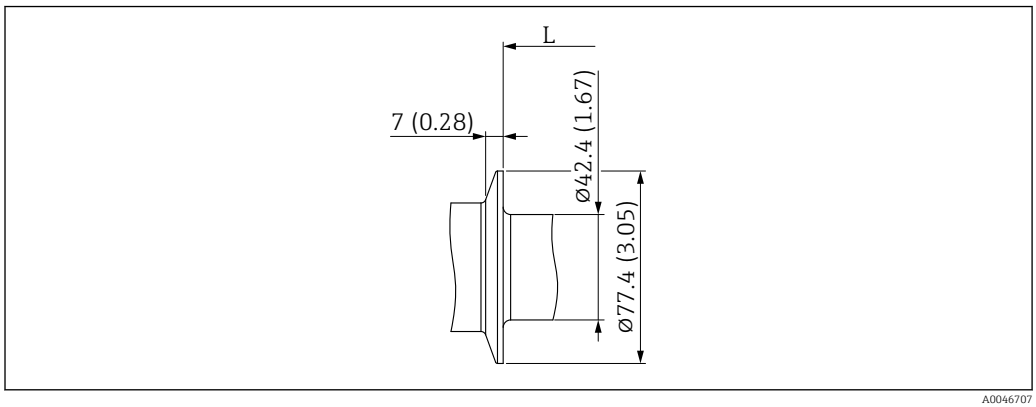
13 Varivent N DN50 PN40 (dimensions in mm (in))

2" Tri-Clamp



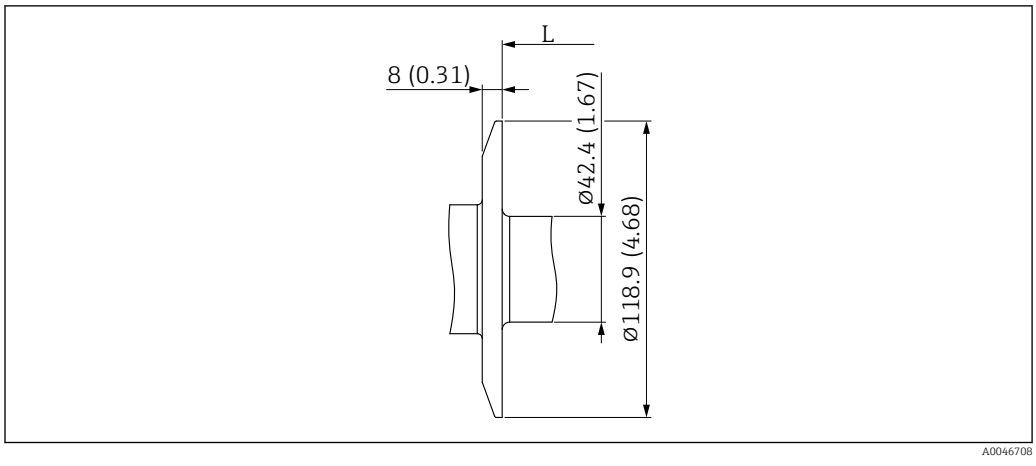
14 Tri-Clamp 2" (dimensions in mm (in))

2.5" Tri-Clamp



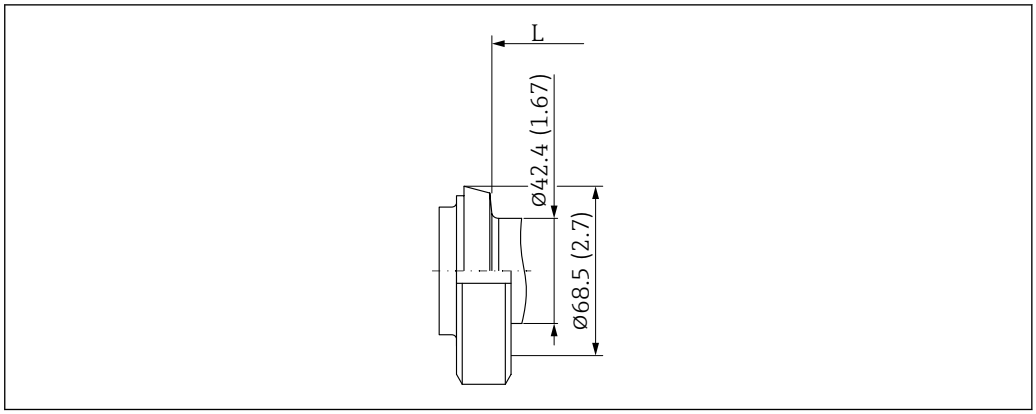
15 Tri-Clamp 2.5" (dimensions in mm (in))

4" Tri-Clamp



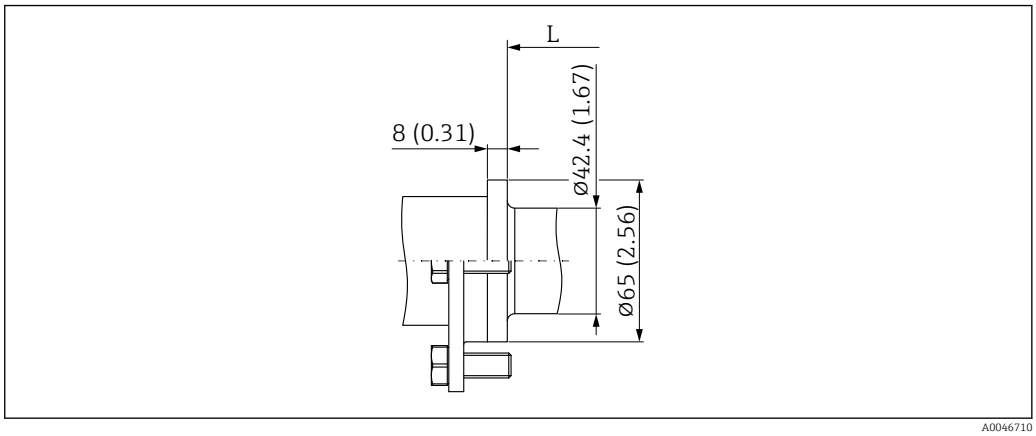
16 Tri-Clamp 4" (dimensions in mm (in))

DIN11851 DN50 PN25



17 DIN11851 DN50 PN25 (dimensions in mm (in))

DRD DN50 PN25

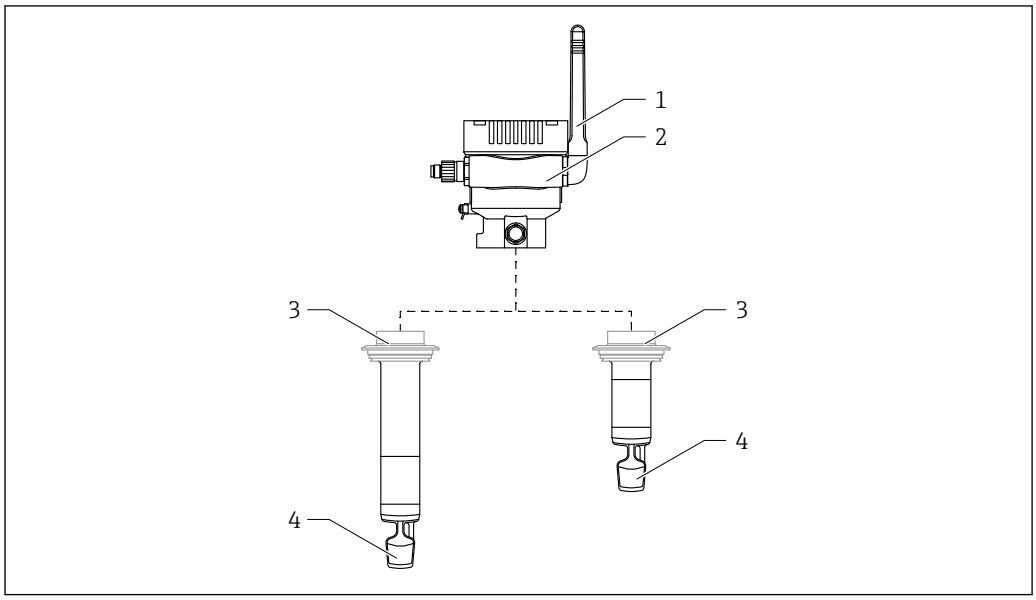


18 DRD DN50 PN25 (dimensions in mm (in))

Weight

- Compact version with Varivent N process connection: approx. 2.5 kg (5.5 lb)
- Pipe extension 1000 mm, additional weight: approx. 2 kg (4.4 lb)

Materials



19 Materials

1 Omnidirectional dipole antenna: polyester
2 Single-compartment housing with cover: polyester powder coating on aluminum as per EN 1706 AC-43400, adhesive label made of plastic
3 Process connection: 1.4404/316L
4 Measuring elements: 1.4404/316L

Also for versions with pipe extension: filler metal 1.4430

Surface roughness

Ra: < 0.76 µm of surfaces in contact with process

Operability

Netilion server platform

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

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 configure and operate the device using Netilion Value.

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

Direct integration

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

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

Protocol-specific data: → 9

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

Certificates and approvals

Current certificates and approvals for the product are available via the Product Configurator at www.endress.com.

1. Select the product using the filters and search field.
2. Open the product page.

The **Configuration** button opens the Product Configurator.

CE mark

The device meets the legal requirements of the relevant EU/EC directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

Sanitary compatibility

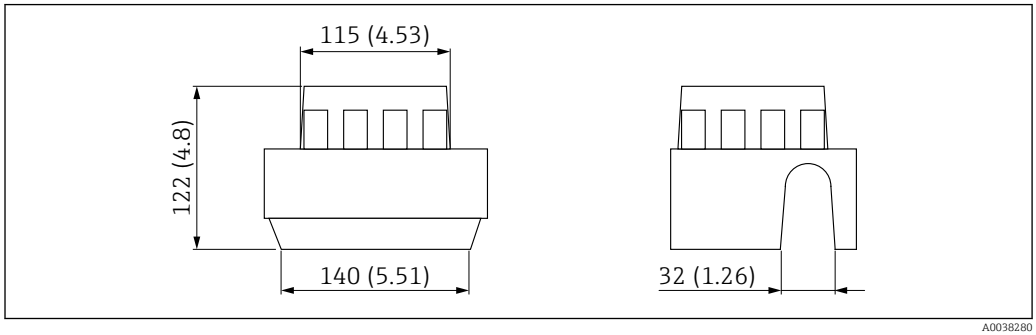
All materials in contact with foodstuffs comply with framework regulation (EC) 1935/2004. The device is available with hygienic process connections (overview: see order code).

The Fermentation Monitor QWX43 meets the hygiene requirements for food processing machinery as per EN 1672-2:2005+A1:2009. The product is designed in accordance with EHEDG hygienic design principles.

Accessories

Weather protection cover for single-compartment housing

- Material: plastic
- Order number: 71438291



20 *Weather protection cover for single-compartment housing (dimensions in mm (in)). Unit of measurement mm (in)*

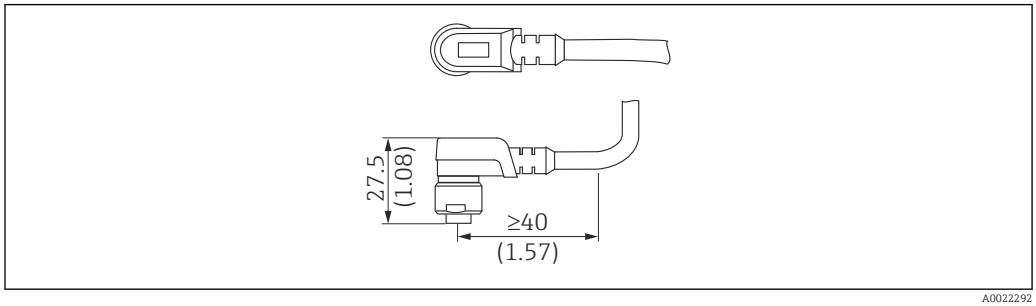
Plug-in jack with connecting cable

You can order the plug-in jack with the device.

Ordering information: → 25

Plug-in jack M12 IP67

- Elbowed 90 °
- 5 m (16 ft) PVC cable (gray)
- Slotted nut Cu Sn/Ni
- Body: PUR (black)
- Operating temperature range: –25 to +70 °C (–13 to +158 °F)
- Order number: 52010285



21 *Plug-in jack M12 IP67. Unit of measurement mm (in)*

Wireless access point for direct integration version

Accessories for the "direct integration" version. You can order a wireless access point as an "enclosed accessory".

Ordering information: → 25

Power supply
- Supply voltage: 100 to 240 VAC
- Input voltage: 9 to 30 VDC via power unit supplied
- Power consumption: < 5 W

Environment
- Operating temperature: −40 to +75 °C (−40 to +167 °F)
- Storage temperature: −45 to +80 °C (−49 to +176 °F)
- Relative humidity (operation): 10 % to 90 % non-condensating
- Relative humidity (storage): 5 % to 95 % non-condensating

Mechanical construction
- Dimensions (width x depth x height): 83 mm x 74 mm x 25 mm
- Weight: 125 g

Pay attention to the installation instructions: → 13

Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configuration at www.endress.com :

1. Click Corporate
2. Select the country
3. Click Products
4. Select the product using the filters and search field
5. Open the product page

The Configuration button to the right of the product image opens the Product Configurator.

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

Scope of delivery

Fermentation Monitor QWX43

Documentation

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

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

Standard documentation QWX43

Operating Instructions
BA02162F

Special Documentation
SD02875F: Commissioning

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www.addresses.endress.com

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