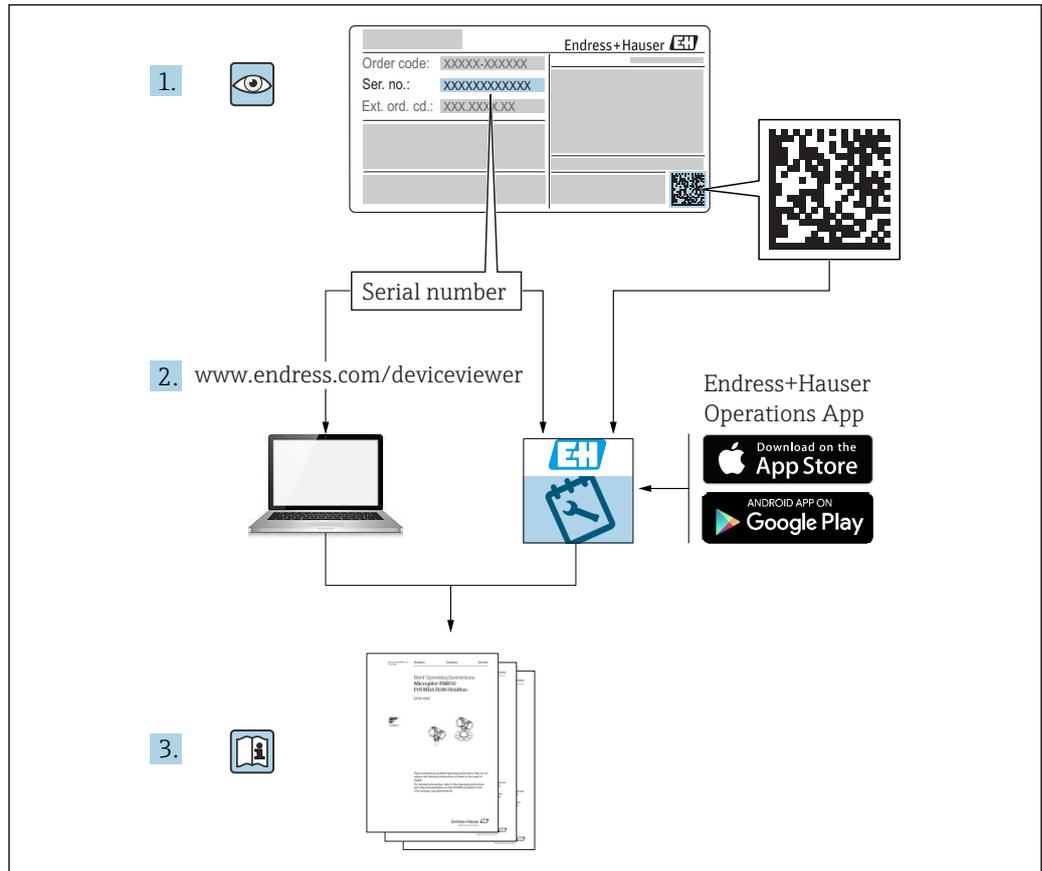


Operating Instructions

Liquiphant density FTL51B

Vibronic
Density measurement for liquids





A0023555

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1 About this document

1.1 Symbols

1.1.1 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.

1.1.2 Electrical symbols

 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.

1.1.3 Symbols for certain types of information

 Permitted

Procedures, processes or actions that are permitted.

 Forbidden

Procedures, processes or actions that are forbidden.

 Tip

Indicates additional information

 Reference to documentation

 Reference to another section

 1, 2, 3. Series of steps

1.1.4 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers

 Hazardous area

 Safe area (non-hazardous area)

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks, e. g., commissioning and maintenance:

- ▶ Trained, qualified specialists must have a relevant qualification for the specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Must have read and understood the instructions in the manual and supplementary documentation
- ▶ Follow instructions and comply with conditions

2.2 Designated use

- Use the measuring device only for measuring the density of liquids.
- Improper use can pose hazards
- Ensure that the measuring device is free of defects while it is in operation
- Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or drop below the limit values for the measuring device
☒ TIO1403F/00/EN

2.2.1 Incorrect use

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

Residual risks

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

Danger of burns from contact with surfaces!

- ▶ If necessary, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

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

2.4 Operational safety

Risk of injury!

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

2.5 Product safety

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

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

2.6 IT security

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

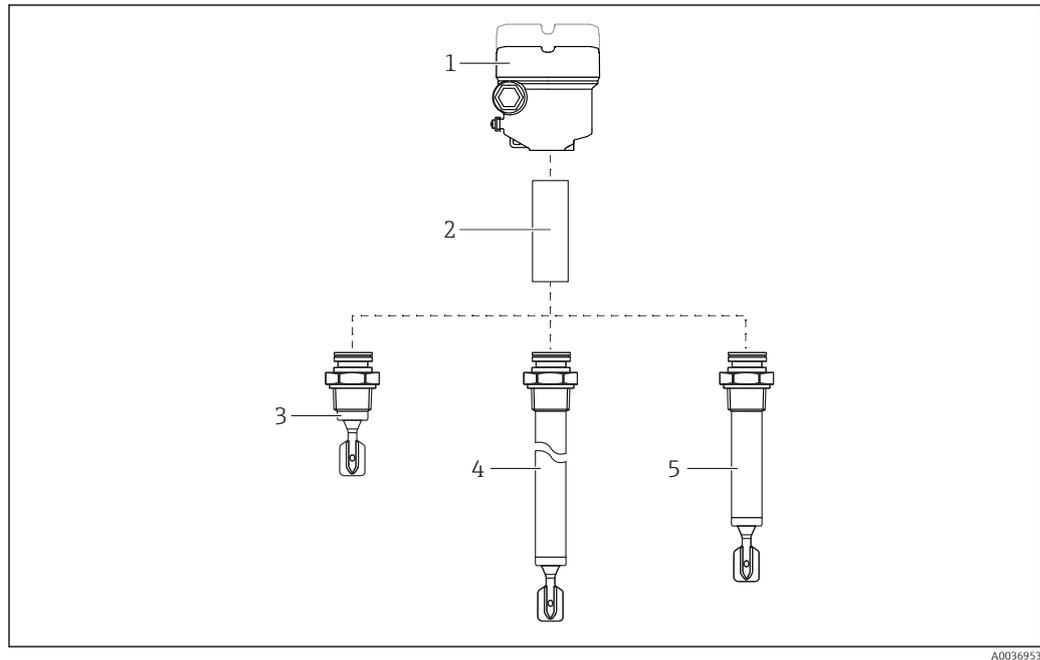
Provide additional protection for the device and data transfer to/from the device

- ▶ IT security measures defined in the plant owner/operator's own security policy must be implemented by plant owners/operators themselves.

3 Product description

Liquiphant sensor FTL51B with density electronics FEL60D for measuring the density of liquids in combination with density computer FML621.

3.1 Product design



1 Product design

- 1 Housing with electronic insert and cover
- 2 Optional spacer (temperature spacer or pressure-tight feedthrough (second line of defense))
- 3 Compact probe design
- 4 Probe design with pipe extension
- 5 Probe design with short pipe

i Identify the electronic insert via the order code on the nameplate.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during goods acceptance:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions, e. g. XA, provided?
- Is the device properly secured?

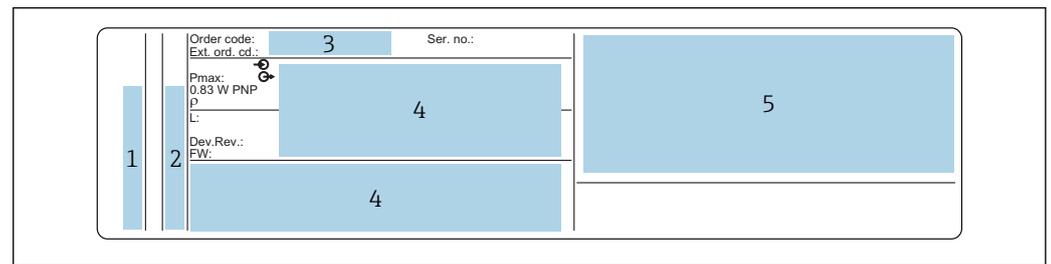
i If one of these conditions is not met, please contact the manufacturer's sales office.

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 serial number from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All of the information on the measuring device is displayed along with an overview of the scope of technical documentation provided
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or use the *Endress+Hauser Operations App* to scan the 2-D matrix code (QR Code) on the nameplate

4.2.1 Nameplate



 2 Nameplate specifications

- 1 Manufacturer name and device name
- 2 Manufacturer address
- 3 Order number, external order code, serial number
- 4 Technical data
- 5 Approval-specific information

4.2.2 Manufacturer address

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

4.3 Storage and transport

4.3.1 Storage conditions

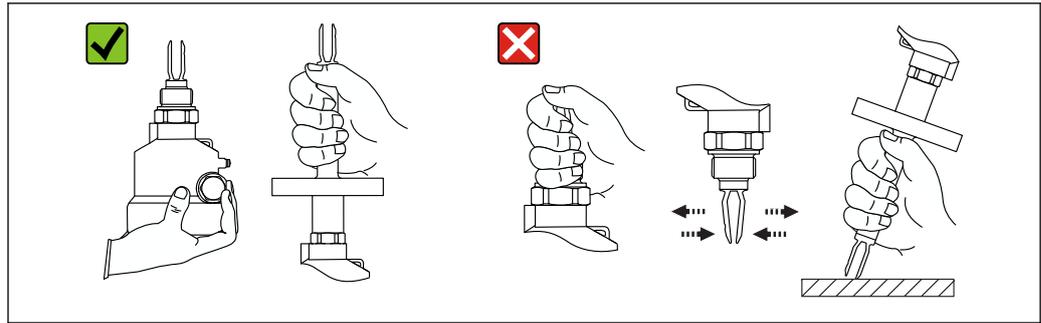
Use original packaging.

Storage temperature

-40 to +80 °C (-40 to +176 °F)

4.3.2 Transporting the device

- Transport the device to the measuring point in the original packaging
- Hold the device by the housing, temperature spacer, flange or extension pipe
- Do not bend, shorten or extend the tuning fork



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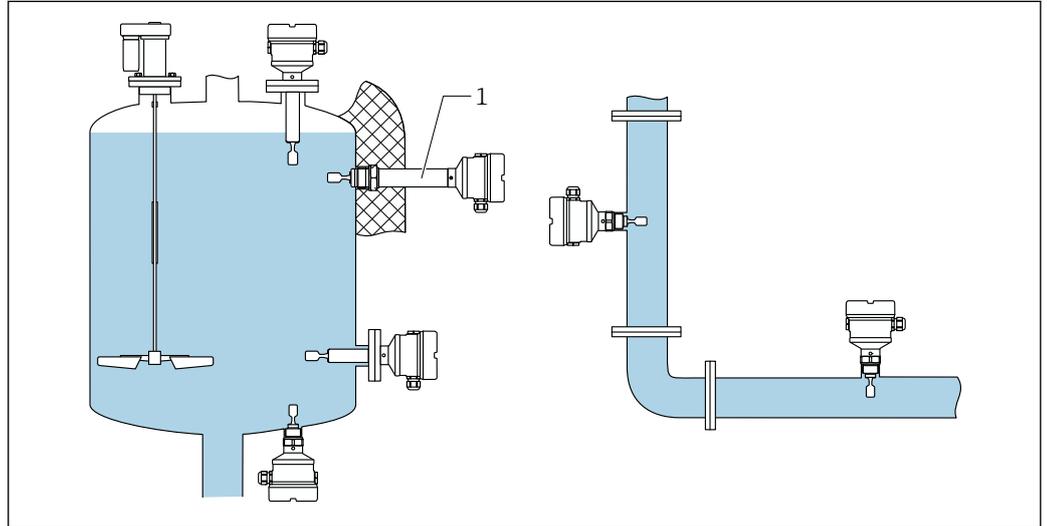
3 How the device should be handled during transportation

5 Installation

⚠ WARNING

Loss of protection rating if the device is opened in a wet environment.

- ▶ Only open the device in a dry environment!

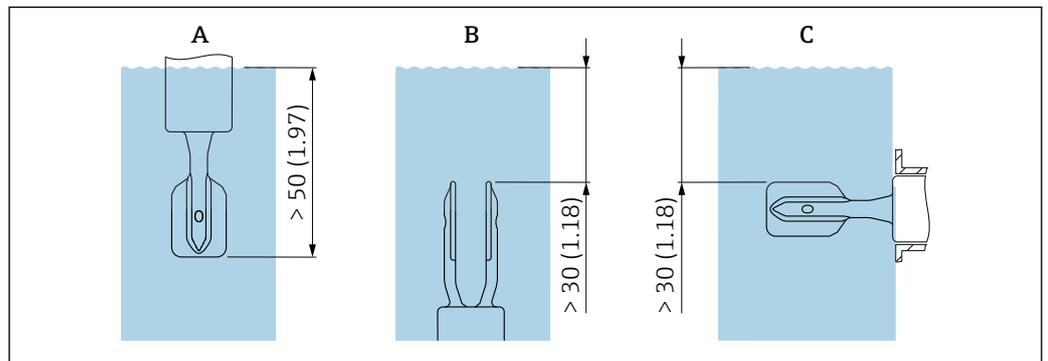


4 Installation in any position in container, pipe or tank

1 Temperature spacer for tank with insulation and/or high process temperatures

5.1 Installation conditions

For density measurement, the tuning fork must always be completely immersed.



Unit of measurement mm (in)

A Installation from above

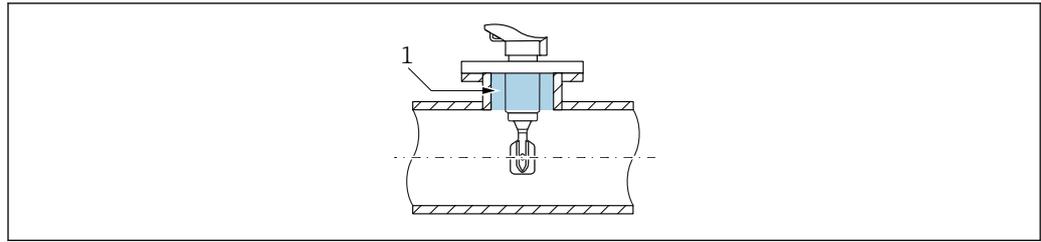
B Installation from below

C Installation from the side

5.1.1 Installation in pipes

Tuning fork positioned in the medium flow

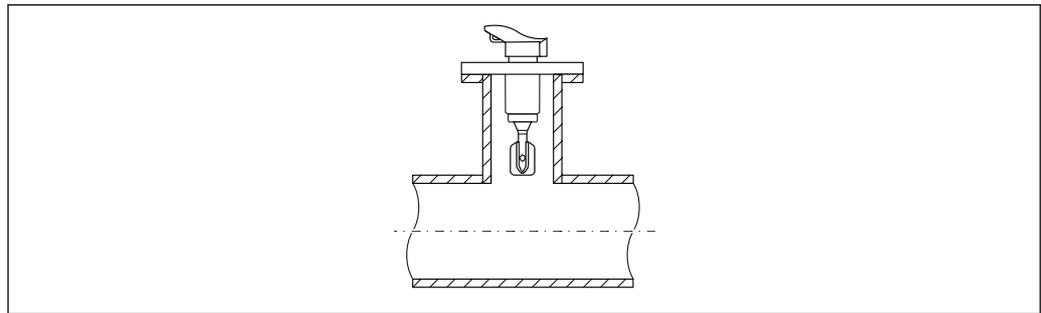
- Flow velocity: < 2 m (6.6 ft) per second
- Prevent the formation of air bubbles (1)



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Tuning fork positioned away from direct flow of medium

Flow velocity: 2 to 5 m (6.6 to 16 ft) per second



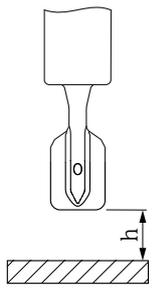
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5.1.2 Correction factor

If the vibration of the fork tines is affected by conditions at the mounting location, the measurement result can be adjusted using a correction factor (r).

Standard installation

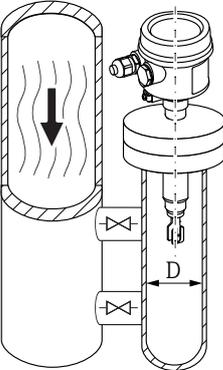
Correction factor "r" as a factor of height "h", for entering in the Density Computer FML621 or ReadWin2000:

	h	r
 <p>Unit of measurement mm (in)</p>	12 mm (0.47 in)	1.0026
	14 mm (0.55 in)	1.0016
	16 mm (0.63 in)	1.0011
	18 mm (0.71 in)	1.0008
	20 mm (0.79 in)	1.0006
	22 mm (0.87 in)	1.0005
	24 mm (0.94 in)	1.0004
	26 mm (1.02 in)	1.0004
	28 mm (1.10 in)	1.0004
	30 mm (1.18 in)	1.0003
	32 mm (1.26 in)	1.0003
	34 mm (1.34 in)	1.0002
	36 mm (1.42 in)	1.0001
	38 mm (1.50 in)	1.0001
	40 mm (1.57 in)	1.0000

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Installation in a bypass

Correction factor "r" as a factor of the internal diameter of bypass "D", for entering in the Density Computer FML621 or ReadWin2000:

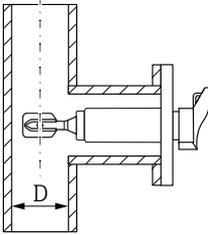
	D	r
	<44 mm (1.73 in)	-
	44 mm (1.73 in)	1.0191
	46 mm (1.81 in)	1.0162
	48 mm (1.89 in)	1.0137
	50 mm (1.97 in)	1.0116
	52 mm (2.05 in)	1.0098
	54 mm (2.13 in)	1.0083
	56 mm (2.20 in)	1.0070
	58 mm (2.28 in)	1.0059
	60 mm (2.36 in)	1.0050
	62 mm (2.44 in)	1.0042
	64 mm (2.52 in)	1.0035
	66 mm (2.60 in)	1.0030
	68 mm (2.68 in)	1.0025
	70 mm (2.76 in)	1.0021
	72 mm (2.83 in)	1.0017
	74 mm (2.91 in)	1.0014
	76 mm (2.99 in)	1.0012
	78 mm (3.07 in)	1.0010
	80 mm (3.15 in)	1.0008
82 mm (3.23 in)	1.0006	
84 mm (3.31 in)	1.0005	
86 mm (3.39 in)	1.0004	
88 mm (3.46 in)	1.0003	
90 mm (3.54 in)	1.0003	
92 mm (3.62 in)	1.0002	
94 mm (3.70 in)	1.0002	
96 mm (3.78 in)	1.0001	
98 mm (3.86 in)	1.0001	
100 mm (3.94 in)	1.0001	
>100 mm (3.94 in)	1.0000	

Unit of measurement mm (in)

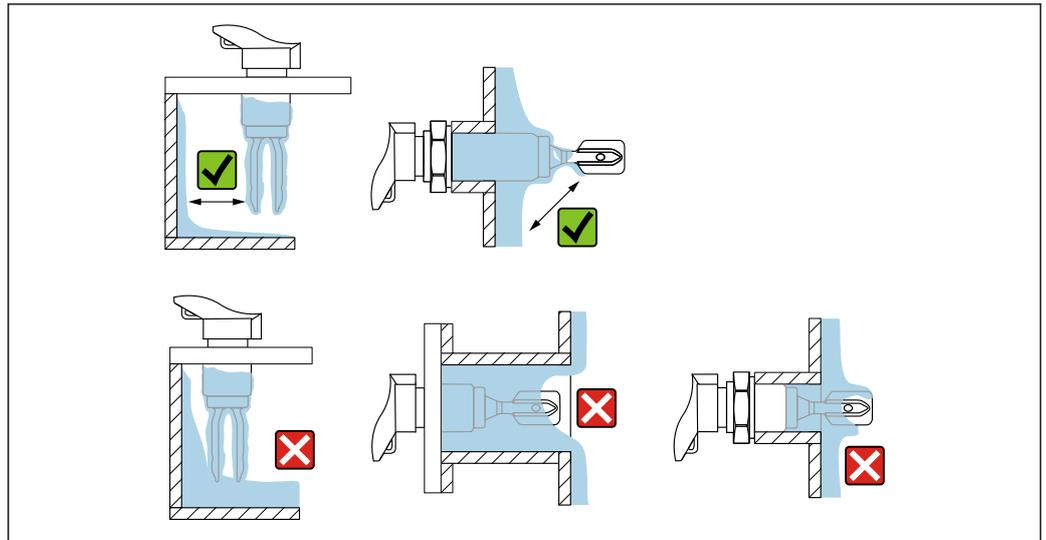
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Installation in pipe

Correction factor "r" as a factor of the internal diameter of pipe "D", for entering in the Density Computer FML621 or ReadWin2000:

	D	r
 <p>Unit of measurement mm (in)</p> <p>A0039707</p>	<44 mm (1.73 in)	-
	44 mm (1.73 in)	1.0225
	46 mm (1.81 in)	1.0167
	48 mm (1.89 in)	1.0125
	50 mm (1.97 in)	1.0096
	52 mm (2.05 in)	1.0075
	54 mm (2.13 in)	1.0061
	56 mm (2.20 in)	1.0051
	58 mm (2.28 in)	1.0044
	60 mm (2.36 in)	1.0039
	62 mm (2.44 in)	1.0035
	64 mm (2.52 in)	1.0032
	66 mm (2.60 in)	1.0028
	68 mm (2.68 in)	1.0025
	70 mm (2.76 in)	1.0022
	72 mm (2.83 in)	1.0020
	74 mm (2.91 in)	1.0017
	76 mm (2.99 in)	1.0015
	78 mm (3.07 in)	1.0012
	80 mm (3.15 in)	1.0009
	82 mm (3.23 in)	1.0007
	84 mm (3.31 in)	1.0005
	86 mm (3.39 in)	1.0004
	88 mm (3.46 in)	1.0003
	90 mm (3.54 in)	1.0002
	92 mm (3.62 in)	1.0002
	94 mm (3.70 in)	1.0001
	96 mm (3.78 in)	1.0001
98 mm (3.86 in)	1.0001	
100 mm (3.94 in)	1.0001	
>100 mm (3.94 in)	1.0000	

5.1.3 Avoiding buildup



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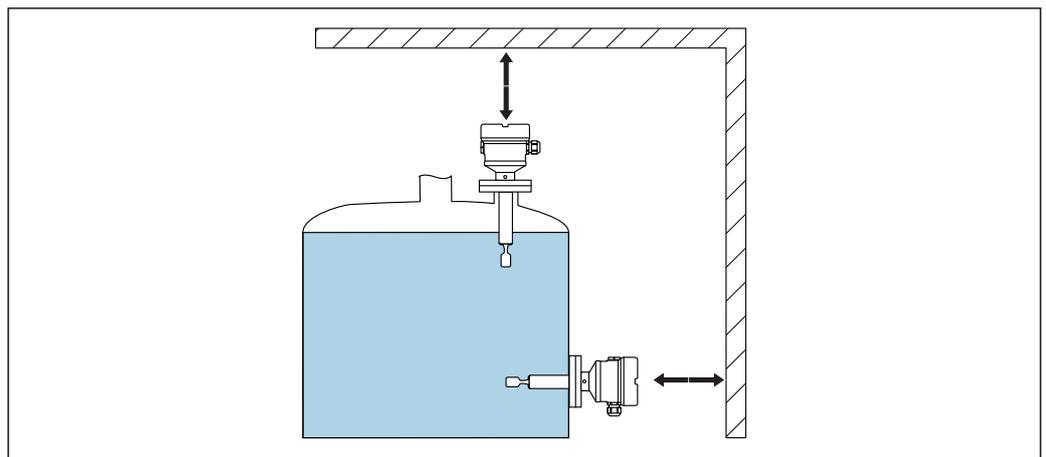
5 Installation examples for a highly viscous process medium

NOTICE

The presence of buildup or corrosion on the tuning fork affects the result of the measurement and must be avoided!

- ▶ Allow for maintenance intervals if required!
- Use short installation sockets to ensure that the tuning fork can project freely into the vessel.
- Install preferably flush-mounted on vessels or in pipes.
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork.

5.1.4 Take clearance into consideration

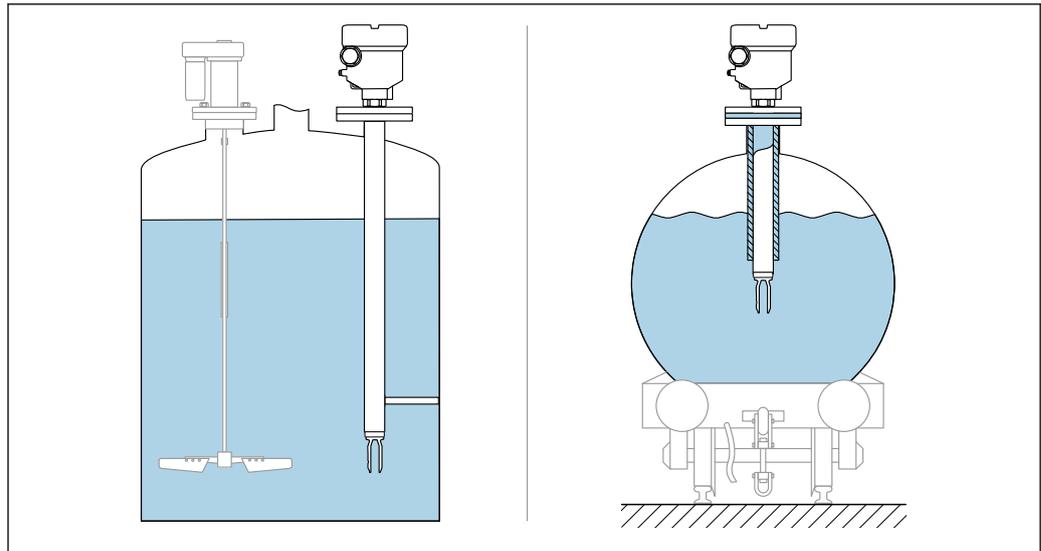


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6 Take clearance into consideration

Allow sufficient space outside the tank for mounting, connection and settings involving the electronic insert.

5.1.5 Support the device

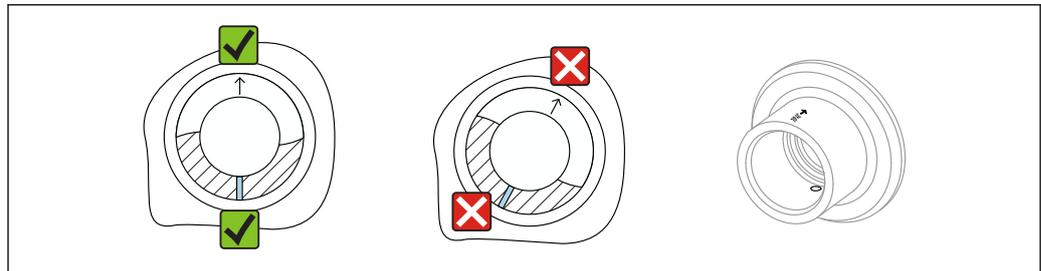


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7 Support in the event of dynamic load

Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).

5.1.6 Weld-in adapter with leakage hole



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8 Weld-in adapter with leakage hole

Weld in the welding neck in such a way that the leakage hole is pointing downwards. This enables any leaks to be detected quickly.

5.2 Mounting the measuring device

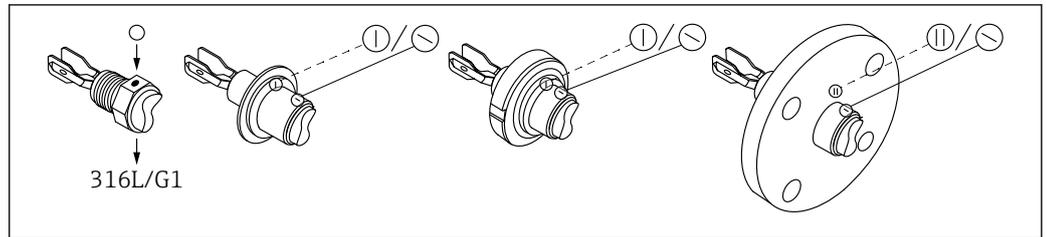
5.2.1 Required tools

- Open-ended wrench for sensor installation
- Screwdriver for electrical connection

5.2.2 Installation

Horizontal installation in vessels

Align the tuning fork with the marking



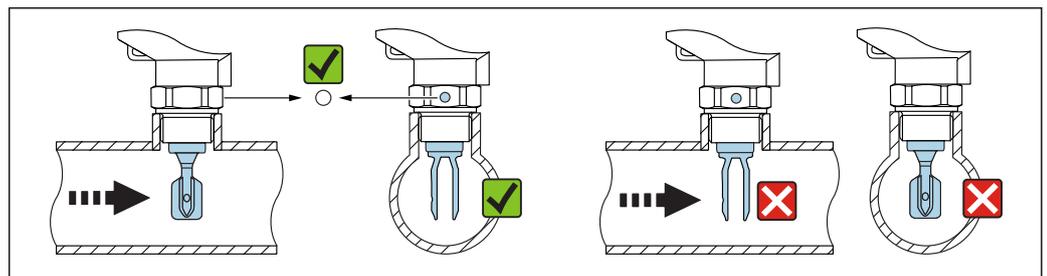
9 Marking to align the tuning fork

The tuning fork can be aligned with the help of the marking.

The following can be used as the marking:

- Material specification, thread description or circle on the hexagonal nut or on the weld-in adapter
- The II symbol on the back of the flange or Tri-Clamp

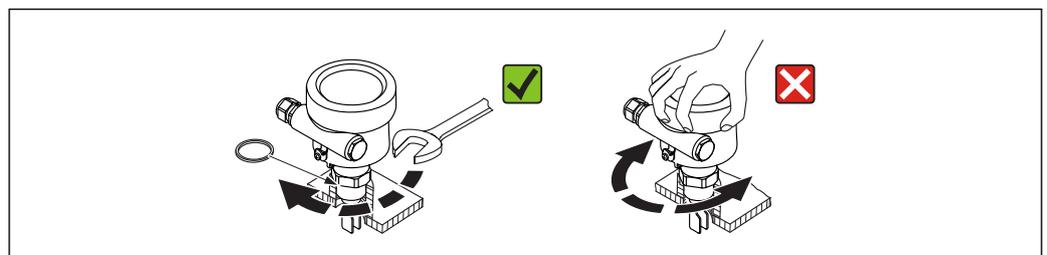
Installing in pipes



10 Marking and fork position

- Flow velocity up to 2 m/s with viscosity 1 mm²/s (cSt) and density 1 g/cm³ (SGU)
Check for correct functioning in the event of other process medium conditions.
- The marking on the adapter points in the flow direction; the flow is thus not severely obstructed
- The marking can be identified while the device is installed

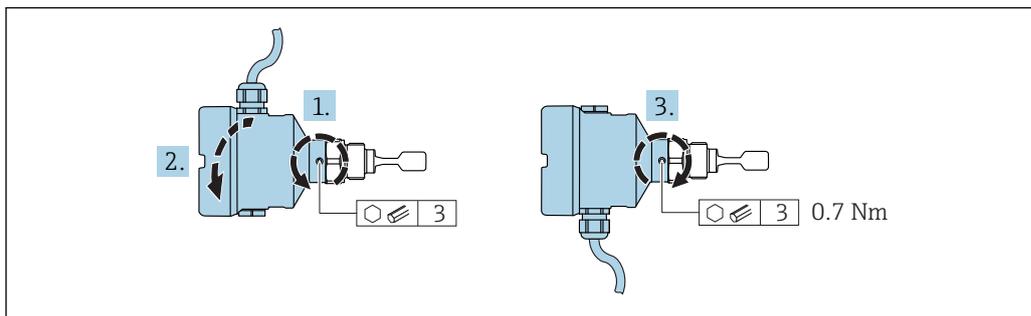
Screwing in the device



11 Screwing in the device

- Turn by the hex bolt only, 15 to 30 Nm (11 to 22 lbf ft)
- Do not turn at the housing!

Aligning the cable entry



12 Housing with external locking screw

The locking screw is not tightened when the device is delivered.

1. Release the external locking screw.
2. Turn the housing, align the cable entry.
3. Tighten the external locking screw.

5.3 Post-installation check

- Is the measuring device undamaged (visual inspection)?
- Does the measuring device conform to the measuring point specifications?

For example:

- Process temperature
- Process pressure
- Ambient temperature range
- Measuring range

- Are the measuring point number and labeling correct (visual inspection)?
- Is the measuring device adequately protected against precipitation and direct sunlight?
- Is the device properly secured?

6 Electrical connection

6.1 Connection conditions

6.1.1 Connecting protective earth (PE)

When the device is used in hazardous areas, it must always be included in the potential equalization of the system, irrespective of the operating voltage.

 The plastic housing is available with or without an external protective earth connection (PE).

6.2 Connecting the measuring device

6.2.1 2-wire density (electronic insert FEL60D) for density measurement

- This electronic insert cannot be installed in devices that were originally used as a point level switch.
- Only for connection to the Density Computer FML621

Supply voltage

$U = 24 V_{DC} \pm 15 \%$, only suitable for connecting to the Density Computer FML621

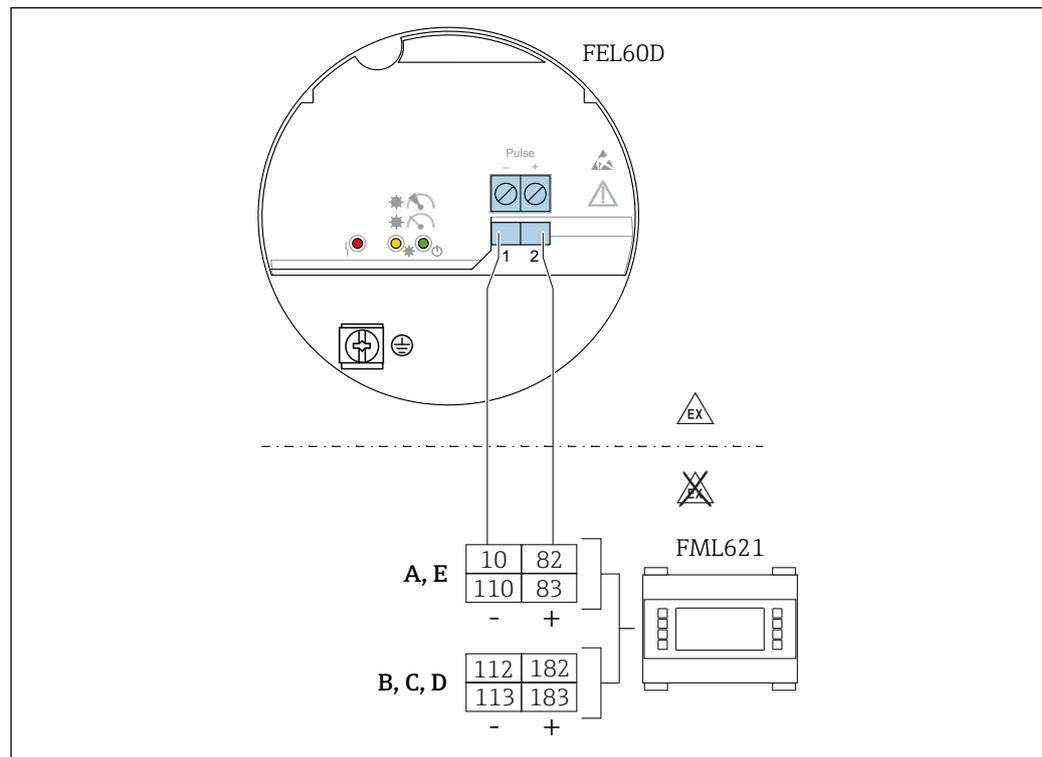
Power consumption

< 160 mW

Current consumption

< 10 mA

Terminal assignment



13 A, E, B, C, D: input cards

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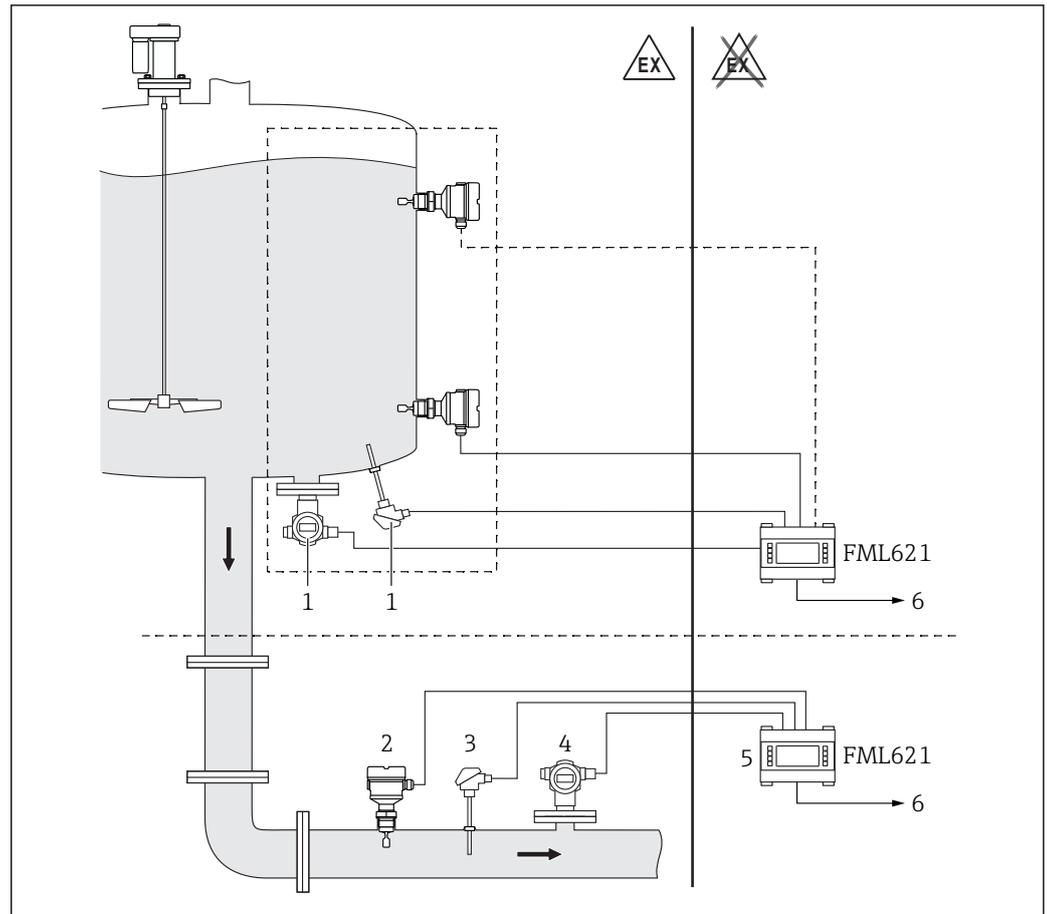
Adjustment

- Standard adjustment (included in standard delivery)
 - Two fork parameters are determined to describe the sensor characteristics. These are indicated in the adjustment report and provided with the product.
 - These parameters must be transferred to the Density Computer FML621.
- Special adjustment (optionally available to order)
 - Three fork parameters are determined to describe the sensor characteristics. These are indicated in the adjustment report and provided with the product.
 - These parameters must be transferred to the Density Computer FML621.
 - This adjustment results in greater accuracy.
- Field adjustment (adjustment by the user in the field)
 - An actual user-determined density value is entered. The system is automatically adjusted to this value (wet adjustment).

i More information on the Liquiphant density can be found in the relevant Technical Information: www.endress.com → Downloads.

Operating principle

Measurement of the density of a liquid medium in pipes and vessels. Also suitable for use in hazardous areas, and preferably for applications in the chemical and food industry.



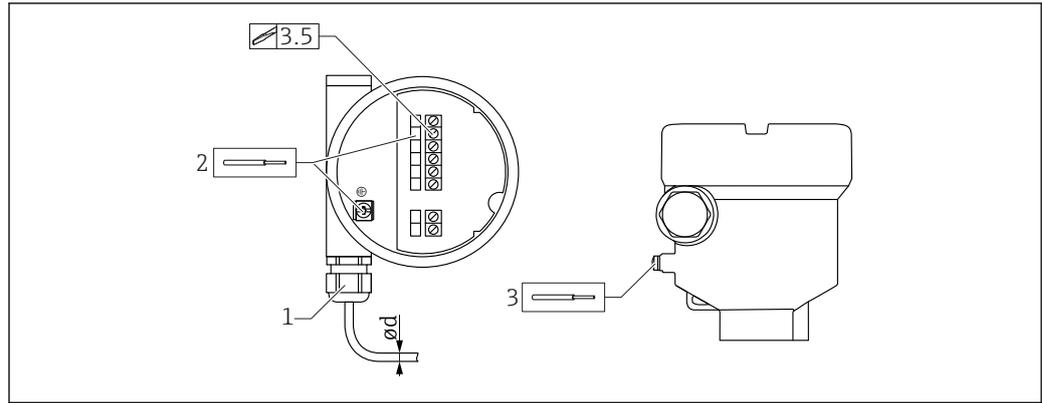
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- 1 Pressure and temperature information required depending on the application
- 2 Liquiphant sensor with electronic insert FEL60D (pulse output)
- 3 Temperature sensor (e. g. 4-20 mA output)
- 4 Pressure transmitter (4-20 mA output)
- 5 Liquiphant Density and Concentration Computer FML621 with display and operating unit
- 6 PLC

6.2.2 Cable entry

Required tools

- Flat-blade screwdriver (0.6 x 3.5 mm) for terminals
- Torque spanner (8 Nm) for M20 cable gland



14 Cable entry, electronic insert

- 1 M20 cable gland
- 2 Conductor cross-section, 2.5 mm² maximum (AWG14)
- 3 Conductor cross-section, 4.0 mm² maximum (AWG12)
- ød Nickel-plated brass 7 to 10.5 mm (0.28 to 0.41 in)
- ød Plastic 5 to 10 mm (0.2 to 0.38 in)
- ød Stainless steel 7 to 12 mm (0.28 to 0.47 in)

Secure the cable gland and tighten the union nut of the cable gland, 8 Nm (5.9 lbf ft) torque. Screw the enclosed cable glands into the housing with a torque of 3.75 Nm (2.76 lbf ft).

6.3 Post-connection check

- Is the device or cable undamaged (visual inspection)?
- Do the cables used comply with the requirements?
- Do the mounted cables have adequate strain relief?
- Are the cable glands mounted and firmly tightened?
- Does the supply voltage match the specifications on the nameplate?
- No reverse polarity, is terminal assignment correct?
- If supply voltage is present, is the green LED lit?
- Are all the housing covers installed and tightened?
- Optional: Is the cover with securing screw tightened?

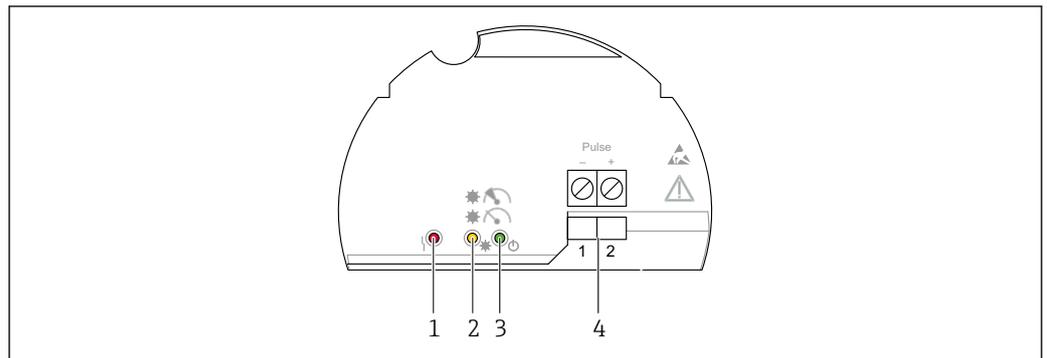
7 Operation options

7.1 Overview of operation options

7.1.1 Operation concept

Operation with the Density Computer FML621. For details, see documentation for the Density Computer FML621.

7.1.2 Elements on the electronic insert



A0039683

- 1 LED red, for warning or alarm
- 2 LED yellow, switch status
- 3 LED, green, operational status (device is on)
- 4 Power supply terminals

8 Commissioning

8.1 Function check

Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed:

- "Post-installation check" checklist → 18
- "Post-connection check" checklist → 22

8.2 Powering up the measuring device

During the power-up time, the device output is in the safety-oriented state, or in the alarm state if available.

9 Operation

9.1 Light signals

Yellow LED

Symbols, information

 /  Measurement valid

 /  Unstable process situation

 Maintenance required

Green LED

Symbols, information

 /  Power on

 /  Power off

Red LED

Symbols, information

 /  No fault

 Maintenance required

 Device failure

 For more information, see the Technical Information for density measuring technology.

10 Diagnostics and troubleshooting

The device indicates warnings and faults via the LEDs on the electronic insert. The errors diagnosed by the device are displayed in accordance with NE107. Depending on the diagnostic message, the device behaves as per a warning or fault condition.

The device behaves in accordance with NAMUR Recommendation NE131 "NAMUR standard device requirements for field devices for standard applications".

10.1 Diagnostic information via light emitting diodes

10.1.1 LED at electronic insert

  **indicator: power supply /off**

- No supply voltage present: check supply voltage
- Reverse polarity: check terminal assignment
- Signal line is defective: check signal line
- Incorrect terminal assignment at FML: check terminal configuration at FML621

  **indicator: unstable process situation**

- Extreme vibrations from an external source: isolate measuring point from vibrations
- Extremely turbulent flow: provide a calming section
- Flow rate > 2 m/s: remove tuning fork from direct flow of medium
- Buildup: remove buildup, allow for cleaning intervals

  **indicator: maintenance required**

- Extreme vibrations from an external source: isolate measuring point from vibrations
- Flow rate > 2 m/s: remove tuning fork from direct flow of medium
- Buildup: remove buildup, allow for cleaning intervals
- Tuning fork is blocked: change installation position

  **indicator: device failure**

- Electronic insert is defective: replace electronic insert
- No connection to sensor: replace sensor

11 Maintenance

No special maintenance work is required.

11.1 Maintenance tasks

11.1.1 Cleaning

It is not permitted to use the device with abrasive media. Material abrasion on the tuning fork can result in the device malfunctioning.

- Clean the tuning fork as necessary
- Cleaning is also possible in the installed state, e. g. CIP Cleaning in Place and SIP Sterilization in Place

12 Repair

12.1 General information

12.1.1 Repair concept

Endress+Hauser repair concept

- Measuring devices have a modular design
- Customers can carry out repairs

 For more information on service and spare parts, please contact your Endress+Hauser sales representative.

12.1.2 Repair of Ex-certified devices

WARNING

Limitation of electrical safety due to incorrect connection!

Risk of explosion!

- ▶ Only specialist personnel or the Endress+Hauser service team may carry out repairs on Ex-certified devices.
- ▶ Relevant standards and national regulations on hazardous areas, safety instructions and certificates must be observed.
- ▶ Use only original Endress+Hauser spare parts.
- ▶ Please note the device designation on the nameplate. Only identical parts may be used as replacements.
- ▶ Carry out repairs according to the instructions. On completion of repair work, carry out the routine test specified for the device.
- ▶ Only the Endress+Hauser service team is permitted to modify a certified device and convert it to another certified version.
- ▶ All repairs and modifications must be documented.

12.2 Spare parts

- Some replaceable measuring device components are identified by means of a spare part nameplate. This contains information about the spare part.
- All the spare parts for the measuring device along with the order code are listed in the *W@M Device Viewer* (www.endress.com/deviceviewer) and can be ordered. If available, users can also download the associated Installation Instructions.

 Measuring device serial number or QR code:
Located on the device and spare part nameplate.

12.3 Return

The measuring device must be returned if the wrong device has been ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at <http://www.endress.com/support/return-material>

12.4 Disposal



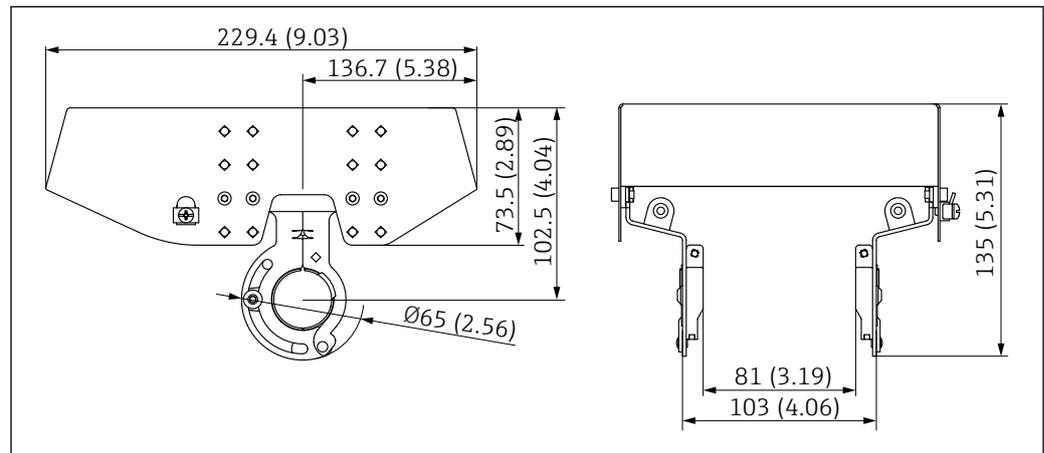
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to Endress+Hauser for disposal at conditions stipulated in our General Terms and Conditions or as individually agreed.

13 Accessories

13.1 Device-specific accessories

13.1.1 Weather protection cover for dual-compartment housing, aluminum

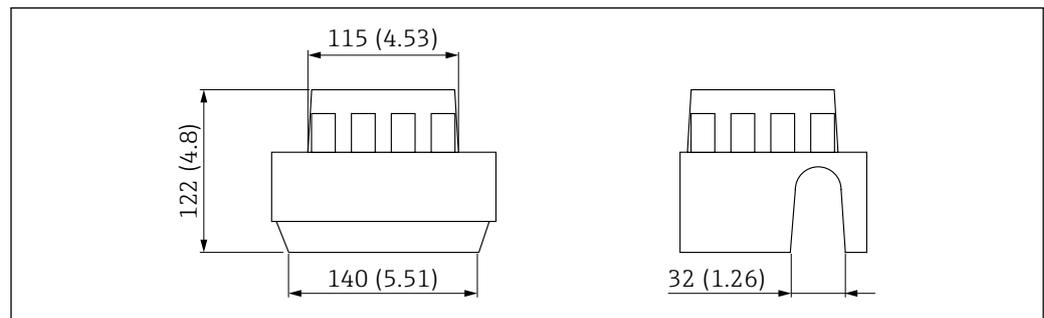
- Material: stainless steel 316L
- Order number: 71438303



15 Weather protection cover for dual-compartment housing, aluminum. Unit of measurement mm (in)

13.1.2 Weather protection cover for single-compartment housing, metal

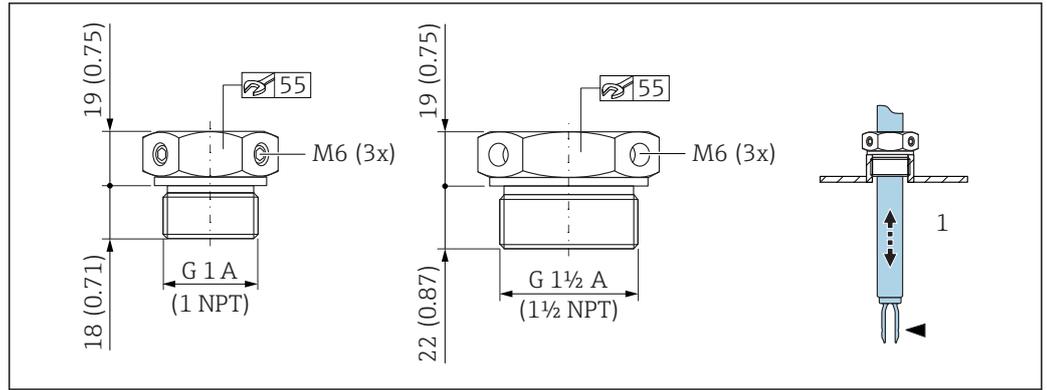
- Material: plastic
- Order number: 71438291



16 Weather protection cover for single-compartment housing, metal. Unit of measurement mm (in)

13.1.3 Sliding sleeves for unpressurized operation

For installation from above and immersion in the liquid for density measurement.



17 Sliding sleeves for unpressurized operation. Unit of measurement mm (in)

1 $p_e = 0 \text{ bar (0 psi)}$

G 1, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003978
- Order number: 52011888, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003979
- Order number: 52011889, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1

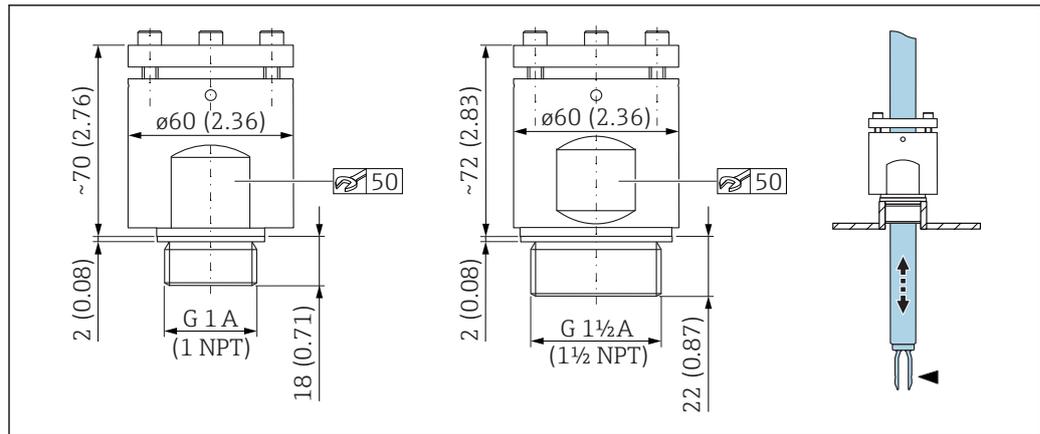
- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003980
- Order number: 52011890, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003981
- Order number: 52011891, approval: with inspection certificate EN 10204 - 3.1 material

13.1.4 High pressure sliding sleeves

- For installation from above and immersion in the liquid for density measurement
- For use in hazardous areas,
- Seal package made of graphite
- For G 1, G 1½: seal included in delivery



18 High pressure sliding sleeves. Unit of measurement mm (in)

G 1, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003663
- Order number: 52011880, approval: with inspection certificate EN 10204 - 3.1 material

G 1, DIN ISO 228/1

- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118691

NPT 1, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003667
- Order number: 52011881, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1

- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118694

G 1½, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003665
- Order number: 52011882, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1

- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003669
- Order number: 52011883, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118695

14 Technical data

14.1 Input

14.1.1 Measured variable

Density of liquids

14.1.2 Measuring range

Density range: 0.3 to 2 g/cm³

14.2 Output

14.2.1 Output and input variants

2-wire density (FEL60D) for density measurement

Connection to Density Computer FML621



For more information, see the Technical Information for density measuring technology.

14.2.2 Ex connection data

See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads Area of the Endress+Hauser-website. The Ex documentation is supplied as standard with all Ex devices.

14.3 Environment

14.3.1 Ambient temperature range

-40 to +70 °C (-40 to +158 °F)

In the hazardous area, the permitted ambient temperature can be limited depending on the zones and gas groups. Pay attention to the information in the Ex documentation (XA).

The minimum permitted ambient temperature of the plastic housing is limited to -20 °C (-4 °F); for North America, "indoor use" applies.

Outdoor operation in strong sunlight:

- Mount the device in the shade
- Avoid direct sunlight, particularly in warmer climatic regions
- Use a protective cover, which can be ordered as an accessory

14.3.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)

14.3.3 Humidity

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

14.3.4 Operating altitude

As per IEC 61010-1 Ed.3:

- Up to 2 000 m (6 600 ft) above sea level
- Can be extended to 3 000 m (9 800 ft) above sea level if overvoltage protection is used

14.3.5 Climate class

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

14.3.6 Degree of protection

For housing with electrical connection

M20 coupling, plastic

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

M20 coupling, nickel-plated brass

Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P

M20 coupling, 316L

- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread M20

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread G ½

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread NPT ½

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread NPT ¾

- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

M12 plug

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber, aluminum: IP66/67 NEMA type 4X
- Single-chamber 316L, cast: IP66/67 NEMA type 4X

14.3.7 Vibration resistance

As per IEC60068-2-64-2009

$a(\text{RMS}) = 50 \text{ m/s}^2$, $f = 5 \text{ to } 2\,000 \text{ Hz}$, $t = 3 \text{ planes} \times 2 \text{ h}$

For increased oscillations or vibrations, the additional option of order code "Application" option "B" 100 bar (1 450 psi) process pressure is recommended.

14.3.8 Shock resistance

As per IEC60068-2-27-2008: 300 m/s^2 [=30 gn] + 18ms

14.3.9 Mechanical load

Lateral loading capacity

 Special mounting instructions

14.3.10 Electromagnetic compatibility

- Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21).
- The requirements of EN 61326-3-1 are fulfilled.

Details are available in the supplementary Functional Safety Manual.

14.4 Process

14.4.1 Process temperature range

0 to 80 °C (32 to 176 °F)

14.4.2 Thermal shock

≤ 120 K/s

14.4.3 Process pressure range

0 to 25 bar (0 to 362.5 psi)

For exceptions, see the "Process connections" section. Canadian CRN approval: more details on the maximum pressure values are available in the download area of the product page under "www.endress.com".

WARNING

The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components. This means that it is necessary to pay attention to the process connection as well as the sensor.

- ▶ For pressure specifications, see the "Mechanical construction" section.
- ▶ The measuring device must be operated only within the specified limits!
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.

Approved pressure values of the flanges at higher temperatures, taken from the following standards:

- pR EN 1092-1: 2005 With regard to its stability-temperature property, the material 1.4435 is identical to 1.4404, which is classed as 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5
- JIS B 2220

In each case, the lowest value from the derating curves of the device and the selected flange applies.

14.4.4 Pressure tightness

Up to vacuum

14.5 Additional technical data

See technical documentation:

- Liquiphant FTL51B: TI01403F
- Liquiphant density: TI01466F

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