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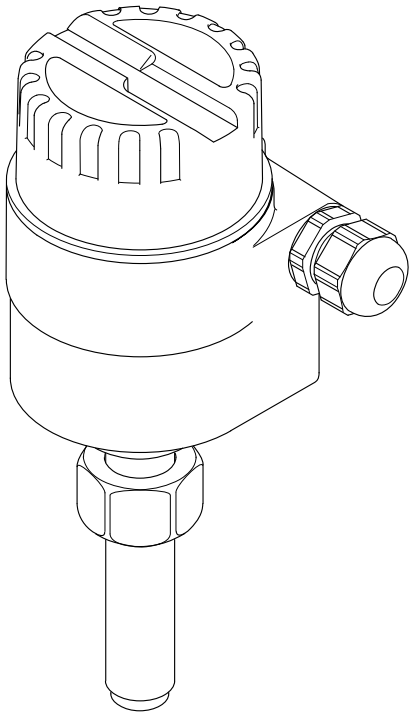
Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Magphant

Electromagnetic flowmeter



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 danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser Sales Center will supply you with current information and updates to these instructions.

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

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⊕	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protectiv earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

1.2.3 Tool symbols

Symbol	Meaning
	Open-ended wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**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.
	Notice or individual step to be observed.
1., 2., 3...	Series of steps.
	Result of a step.
	Help in the event of a problem.
	Visual inspection.

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1., 2., 3., ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Detailed list of the individual documents along with the documentation code

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.3.2 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.

2 Safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Designated use

Application and media
The measuring device described in this manual is intended only for flow measurement of liquids with a minimum conductivity of 20 µS/cm.

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, or where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
- Keep within the specified pressure and temperature range.
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- If the ambient temperature of the measuring device is outside the atmospheric temperature, it is absolutely essential to comply with the relevant basic conditions as specified in the device documentation.
- Protect the measuring device permanently against corrosion from environmental influences.

Incorrect use
Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

⚠ WARNING
Danger of breakage due to corrosive or abrasive fluids and ambient conditions!
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Keep within the specified pressure and temperature range.

NOTICE

Verification for borderline cases:

- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

⚠ WARNING

Risk of injury if the process connection and sensor gland are opened under pressure.

- The process connection and sensor gland should be opened only when in an unpressurized state.

Residual risks

⚠ WARNING

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

- For elevated fluid temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

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

For welding work on the piping:

- Do not ground the welding unit via the measuring device.

2.4 Operational safety

Risk of injury.

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

Conversions 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,

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to 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.

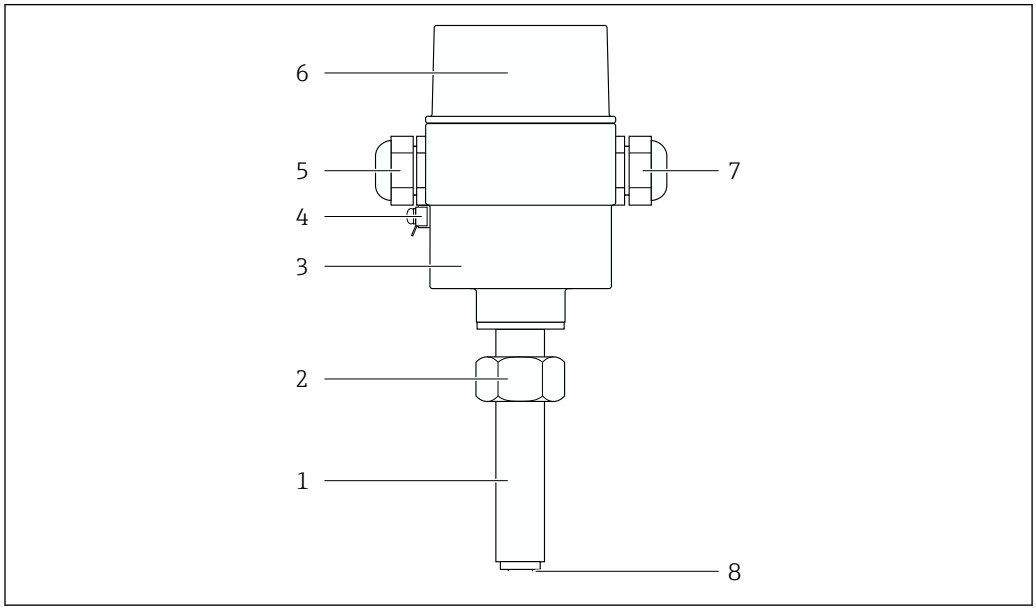
It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity.

3 Product description

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

3.1 Product design

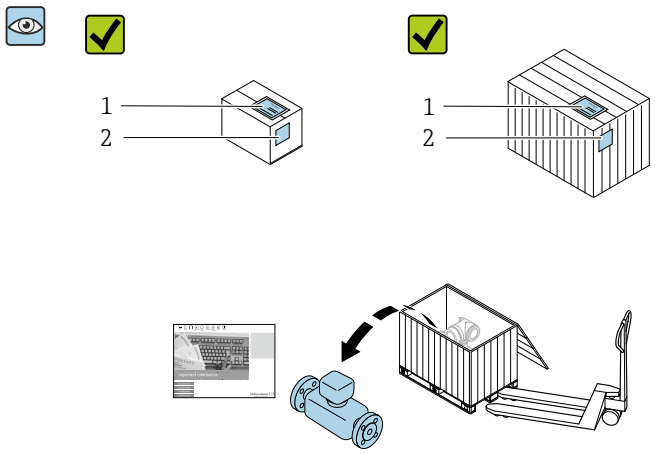


1 Important components of a measuring device

1 Sensor
2 Union nut M30x2 with clamping ring
3 Transmitter housing
4 Ground terminal
5 Signal cable
6 Connection compartment cover
7 Power supply
8 Electrode

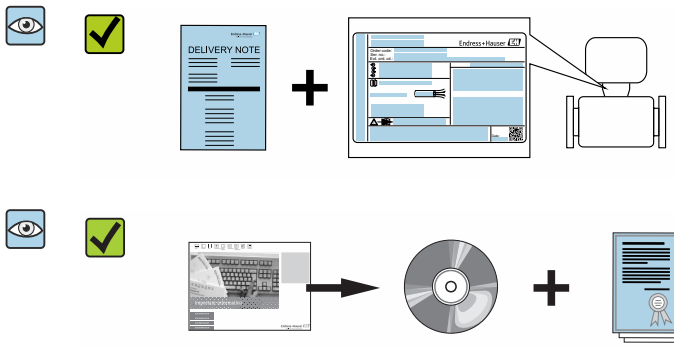
4 Incoming acceptance and product identification

4.1 Incoming acceptance



Are the order codes on the delivery note (1) and the product sticker (2) identical?

Are the goods undamaged?



Do the nameplate data match the ordering information on the delivery note?

Is the document folder present with accompanying documents?
Is the optional CD-ROM with the Technical Documentation present?

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 12.

4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in the *W@M Device Viewer* (www.endress.com/deviceviewer): All information about the device is displayed.
- Enter the serial number from nameplates in the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate using the *Endress+Hauser Operations App*: All information about the device is displayed.

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The "Additional standard documentation on the device" and "Supplementary device-dependent documentation"→ 🖹 7 sections
- The *W@M Device Viewer*: enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Symbols on measuring device

Symbol	Meaning
	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	**Reference to documentation** Refers to the corresponding device documentation.

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:
- ▶ Store in the original packaging to ensure protection from shock.
- ▶ Do not remove the protection cap mounted on the sensing element. It prevents mechanical damage and contamination in the measuring tube.
- ▶ Protect from direct sunlight to avoid unacceptably high surface temperatures.
- ▶ Store in a dry and dust-free place.
- ▶ Do not store outdoors.

5.2 Transporting the product

Transport the measuring device to the measuring point in the original packaging.

5.3 Packaging disposal

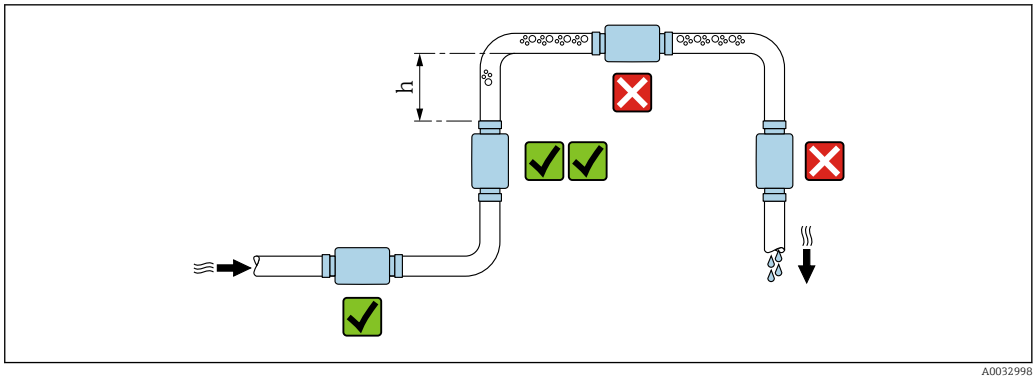
All packaging materials are environmentally friendly and 100 % recyclable:
- Outer packaging of device
  Polymer stretch wrap that complies with EU Directive 2002/95/EC (RoHS)
- Packaging
  - Wooden crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
  - Cardboard box in accordance with European packaging guideline 94/62EC, recyclability confirmed by Resy symbol
- Carrying and securing materials
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Filler material
  Paper pads

6 Installation

6.1 Installation conditions

6.1.1 Mounting position

Mounting location



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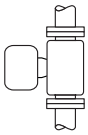
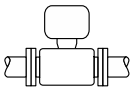
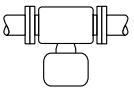
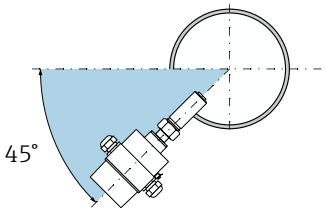
Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 5 × DN

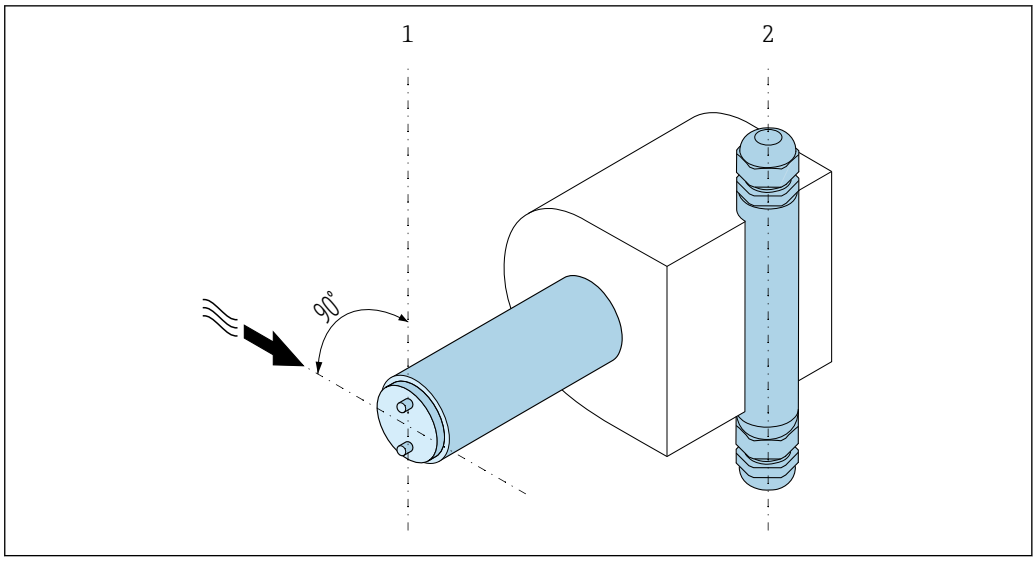
Installation position

Installation position		Recommendation
Vertical orientation	 A0017337	✓✓
Horizontal orientation, transmitter head up	 A0015589	✗ 1)
Horizontal orientation, transmitter head down	 A0015590	✗ 2)
Horizontal orientation, transmitter head at side	 A0040154	✓ 3)

1) Risk of air pockets.
2) Risk of build-up of solids.
3) This installation method in horizontal pipes ensures that the electrodes are always immersed in the flowing medium.

Alignment with flow direction

The sensor must be installed in such a way that the electrode axis is always at a 90° angle to the flow direction. The cable glands, which are located on the same axis, serve as a visual aid.



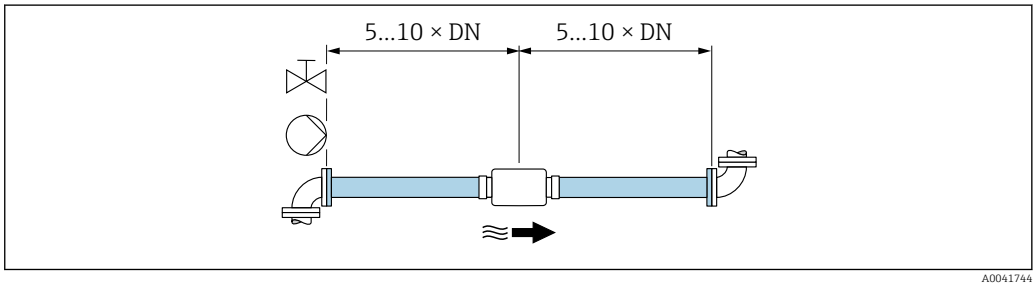
2 *Position of electrode axis*

1 Axis of electrodes
2 Axis of cable glands

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



For information on the dimensions and installed lengths of the device → 38

Mounting conditions for welding socket

Installation in steel pipes

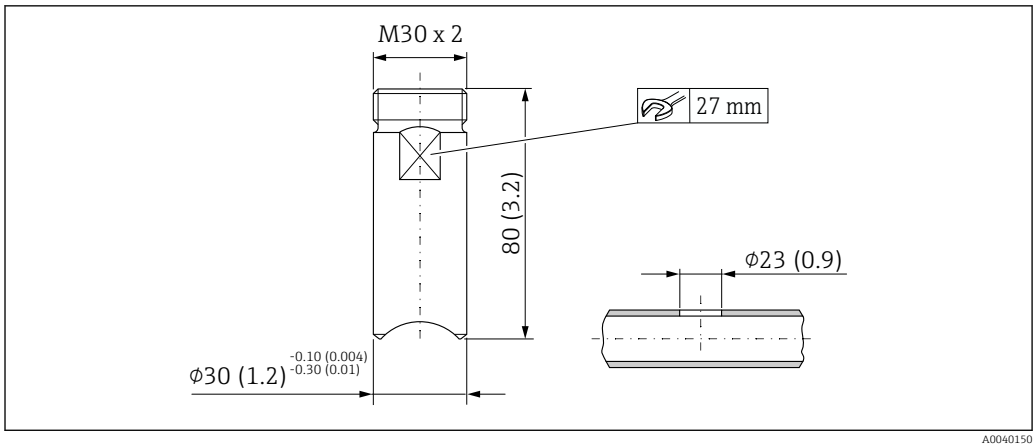
The measuring device is mounted in steel pipes using the welding socket supplied. Two different types of welding socket are available, depending on the nominal diameter:

- Welding socket for pipes DN 25
- Welding socket for pipes ≥DN 40

NOTICE

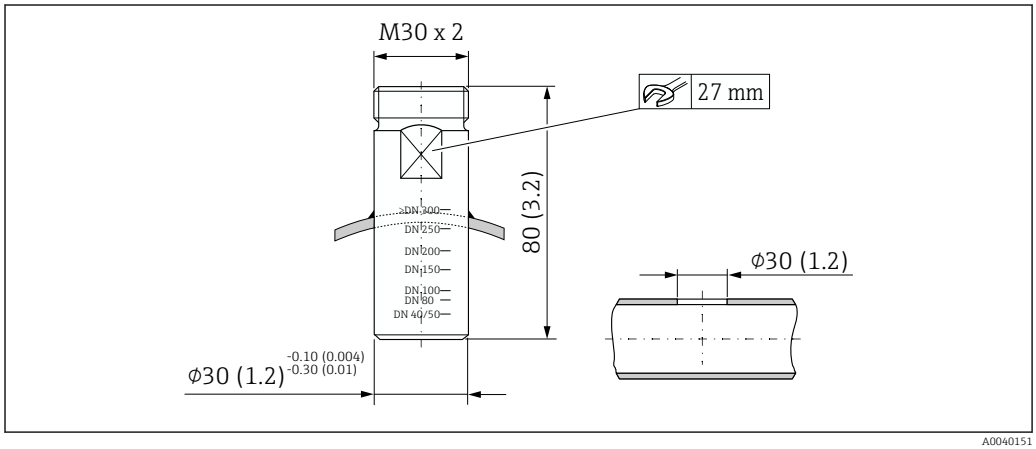
Damage to the measuring device

- ▶ Only weld the welding socket when the measuring device is not installed.
- ▶ Pipe DN 25: Weld the welding socket at right angles to the axis of the piping.



3 Welding socket for pipes DN 25. Engineering unit mm (in)

- Pipe ≥DN 40: With the marking (according to the nominal diameter) flush against the outer wall of the pipe, weld the welding socket at right angles to the axis of the piping. The DN 300 marking must be used for nominal diameters >DN 300.



4 Welding socket for piping ≥DN 40. Engineering unit mm (in)

Installation in plastic pipe

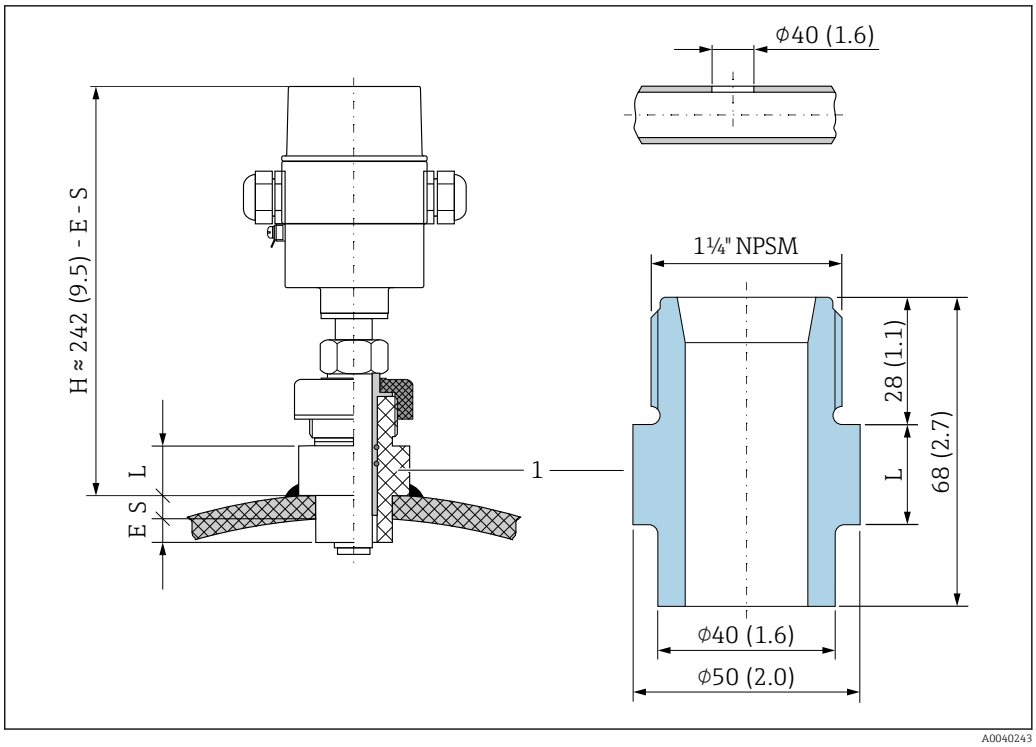
For pipe sizes ≥DN 65, the measuring device is mounted in plastic pipes using a plastic welding socket. The plastic welding socket can be purchased from the Georg Fischer company. PVC, PP and PE sockets are available. Depending on the outer diameter of the pipe, the dimension L must be adjusted accordingly by the client onsite. Perform the following steps when installing a plastic welding socket:

NOTICE

Damage to the measuring device

- Only weld the welding socket when the measuring device is not installed.

1. Determine dimension L: L = 40 - S - E.
2. Determine the welding socket taking dimension L into account.
3. Taking immersion depth E into account, weld the welding socket at right angles to the axis of the piping.



5 Installation conditions for plastic welding socket. Engineering unit mm (in)

1 Plastic welding socket
L To be determined
S Pipe wall thickness
E Immersion depth of plastic welding socket (please refer to the table below for dimension E)

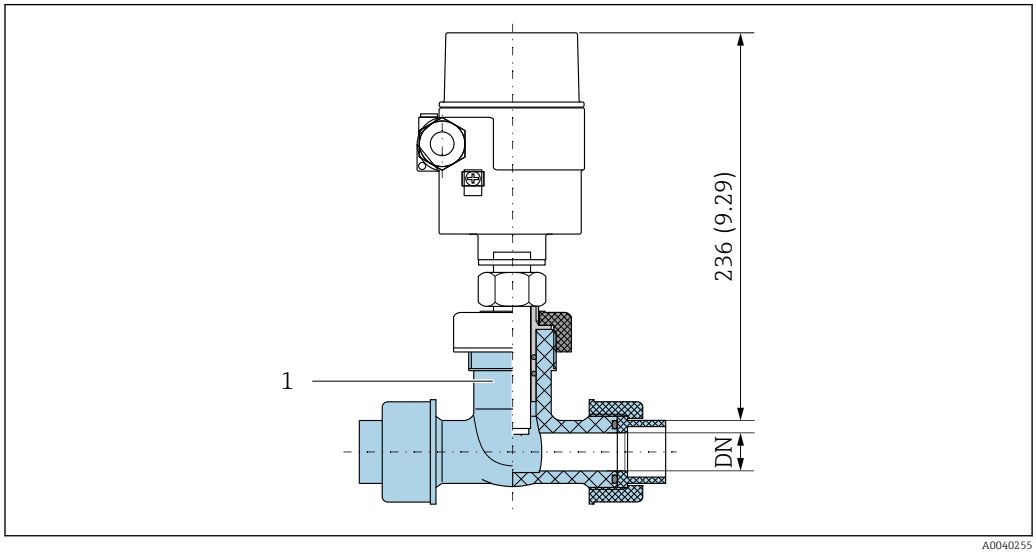
Immersion depth depending on the pipe outer diameter

Pipe outer diameter mm (in)	Immersion depth E mm (in)
65 (2.6)	6.9 (0.27)
75 (3.0)	8.3 (0.33)
110 (4.33)	11.4 (0.45)
125 (4.92)	14.4 (0.57)
140 (5.51)	17.7 (0.70)
160 (6.30)	17.7 (0.70)
200 (7.87)	12.0 (0.47)
225 (8.86)	10.0 (0.39)
250 (9.84)	10.0 (0.39)
280 (11,.0)	10.0 (0.39)
315 (12.4)	10.0 (0.39)
355 (14.0)	10.0 (0.39)
400 (17.8)	10.0 (0.39)
450 (17.7)	5.0 (0.20)
500 (19.7)	5.0 (0.20)
630 (24.8)	5.0 (0.20)

Installation conditions for T-fitting

For pipe sizes DN 15 to 50, the measuring device is mounted in plastic pipes using a standard T-fitting. The T-fitting can be purchased from the Georg Fischer company. PVC, PP and PE T-fittings are available.

Only use the Magphant version for device installation in plastic pipes (order code for "Process connection", option 5 "Adapter, plastic pipe, 316L, NBR").



6 *Installation conditions for T-fitting. Engineering unit mm (in)*

1 *Standard T-fitting*

6.1.2 Environment and process requirements

Ambient temperature range

−20 to +60 °C (−4 to +140 °F)

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

6.2 Mounting the measuring device

6.2.1 Required tool

For sensing element

For the gland of the sensing element: use the appropriate installation tool.

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.
3. Remove stick-on label on the electronics compartment cover.

6.2.3 Mounting the sensor

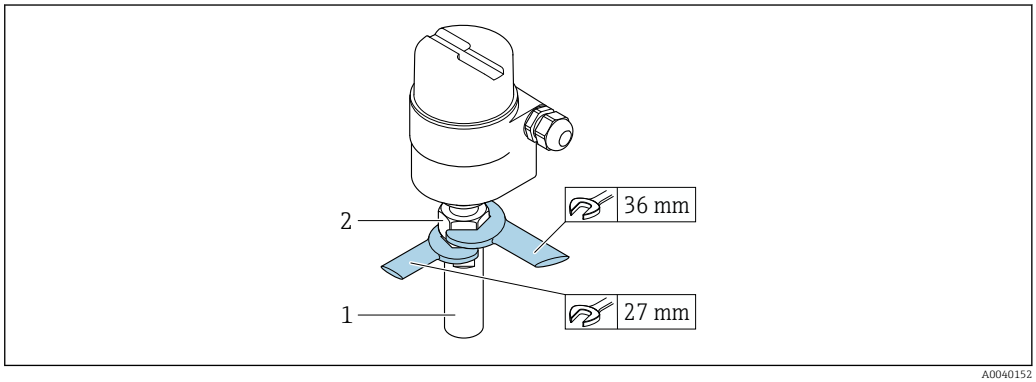
Mounting the sensor in a steel pipe

NOTICE

Damage to the sensor tip.

- When inserting the sensor into the welding socket, care must be taken to ensure the sensor tip is not damaged.

1. Taking the flow direction → 14 into consideration, insert the sensor into the welding socket and tighten the metal union nut by hand.
2. Hold the welding socket steady with an open-ended wrench, size 27 mm AF.
3. Tighten the union nut a further ½ turn approximately with an open-ended wrench, size 36 mm AF.



7 *Mounting the sensor in a steel pipe*

1 Welding socket
2 Metal union nut

Mounting the sensor in a plastic pipe

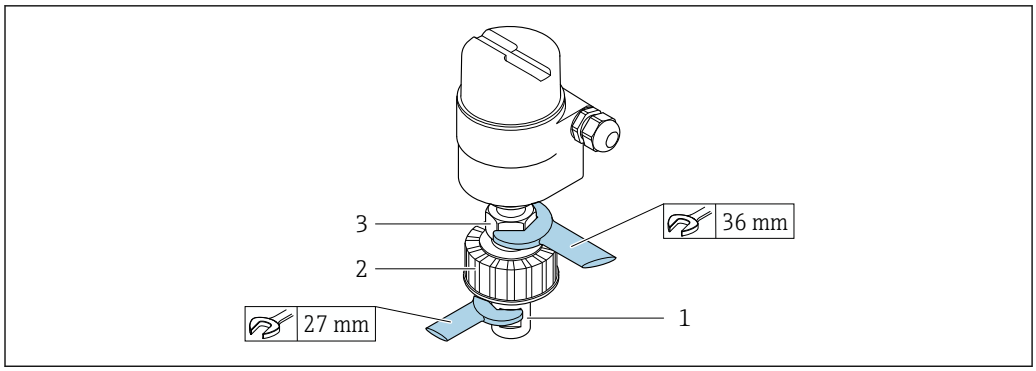
The measuring device for installation in plastic piping is delivered as part of a set. The set consists of the measuring device, an adapter piece and a plastic union nut.

NOTICE

Damage to the sensor tip.

- When inserting the sensor into the adapter piece, care must be taken to ensure the sensor tip is not damaged.

1. Place the plastic union nut over the adapter piece.
2. Carefully insert the sensor into the adapter piece and tighten the metal union nut by hand.
3. Hold the adapter piece steady with an open-ended wrench, size 25 mm AF.
4. Tighten the union nut a further ½ turn approximately with an open-ended wrench, size 36 mm AF.
5. **For pipes DN 15-50:** Taking the flow direction → 14 into consideration, insert the adapter piece mounted on the sensor into the standard T-fitting and tighten the plastic union nut firmly by hand.
6. **For pipes ≥DN 65:** Taking the flow direction → 14 into consideration, insert the adapter piece mounted on the sensor into the plastic welding socket and tighten the plastic union nut firmly by hand.



8 Mounting the adapter piece on the sensor

1 Adapter piece made of stainless steel, 1.4435 (F316L)
2 Plastic union nut
3 Metal union nut

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range	❑
Is there sufficient distance between the sensor and the next pipe bend?	❑
Is the electrode axis at a 90° angle to the flow direction?	❑
Is the sensor area fully immersed in the liquid?	❑
Has the correct orientation for the sensor been selected? ▪ According to medium temperature ▪ According to medium properties (risk of air pockets and build-up of solids)	❑
Is the measuring device adequately protected against precipitation and direct sunlight?	❑

7 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

- ▶ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.

7.1 Connection conditions

7.1.1 Required tool

- For cable entries: use appropriate tool
- Wire stripper
- When using stranded cables: crimper for wire end ferrule

7.1.2 Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

Electrical safety

In accordance with applicable federal/national regulations.

Protective ground cable

Cable ≤2.08 mm^2 (14 AWG)

The grounding impedance must be less than 1 Ω.

Permitted temperature range

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output

Standard installation cable is sufficient.

Relay output

Standard installation cable is sufficient.

Cable diameter

With M20 × 1.5 cable glands:
- Conductor cross-section: max. 0.2 to 1.5 mm^2 (24 to 16 AWG).
- Cable diameter: 7 to 12 mm (0.28 to 0.47 in)

7.1.3 Terminal assignment

Supply voltage		Relay output			Current output 4 to 20 mA	
1 (+)	2 (–)	23	24	25	26 (+)	27 (–)

7.1.4 Preparing the measuring device

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

- ▶ Use suitable cable glands corresponding to the degree of protection.

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 21.

7.2 Connecting the measuring device

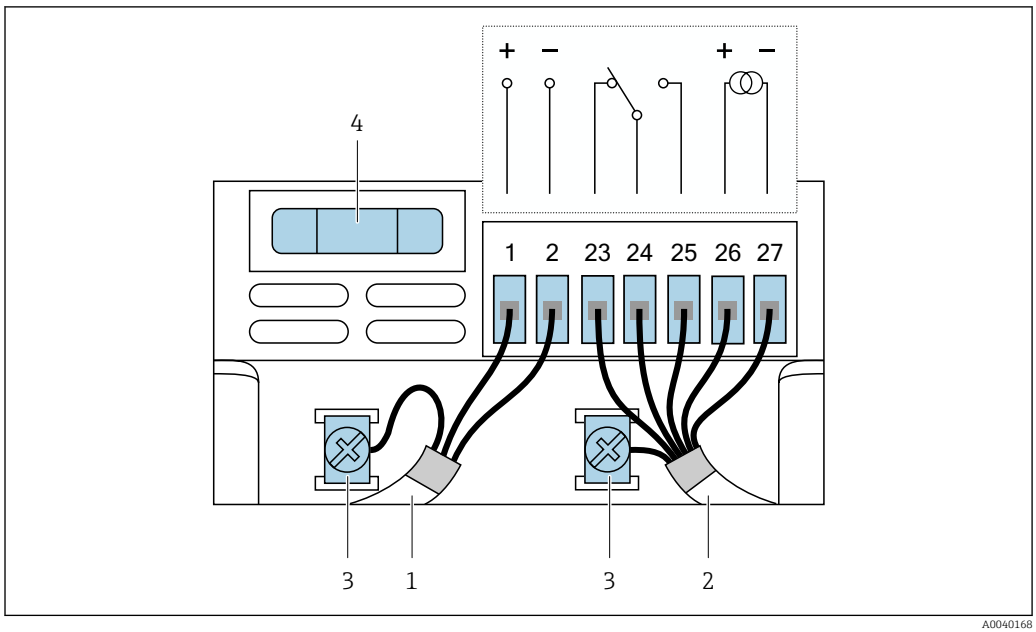
NOTICE

Limitation of electrical safety due to incorrect connection!

- ▶ Have electrical connection work carried out by appropriately trained specialists only.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.

7.2.1 Connecting the transmitter

- ▶ Tighten the screw terminals. Recommended tightening torque: 0.5 Nm (0.37 lbf ft)



9 *Connecting the transmitter*

1 *Power supply cable*
2 *Signal cable*
3 *Ground terminals for cable shield*
4 *160 mA fuse, slow-blow*

7.3 Ensuring potential equalization

7.3.1 Requirements

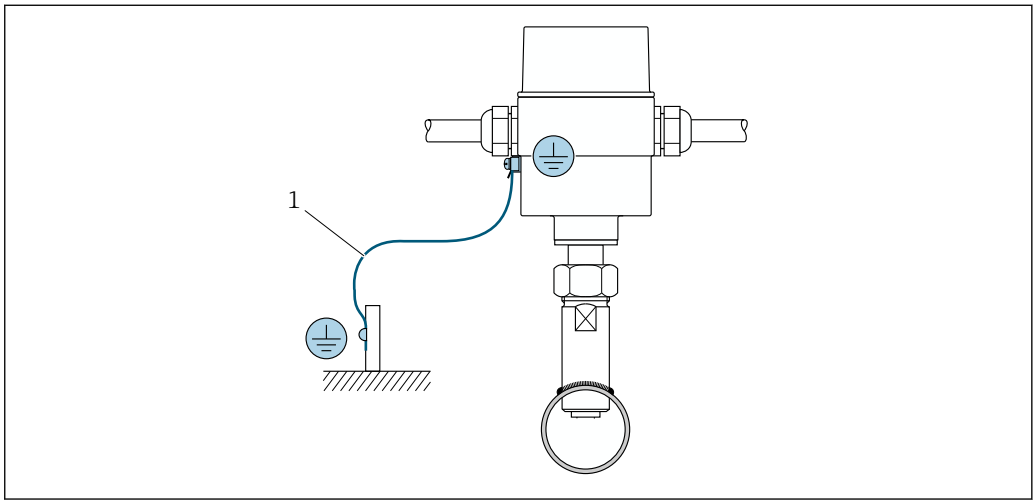
⚠ CAUTION

Electrode damage can result in the complete failure of the device!

- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding
- Keep the grounding cable as short as possible

7.3.2 Connection example, standard scenario

In order to ensure electromagnetic compatibility (EMC), we recommend connecting the measuring device to ground via the ground terminal on the housing.



10 Connection example, potential equalization

1 Copper wire, ≤2.08 mm² (14 AWG)

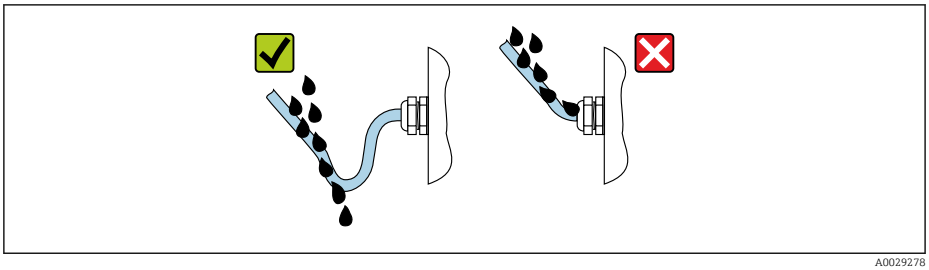
7.4 Ensuring the degree of protection

The measuring device fulfills all the requirements for degree of protection IP66.

To guarantee degree of protection IP66 , carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.

5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").



A0029278

6. Insert dummy plugs into unused cable entries.

7.5 Post-connection check

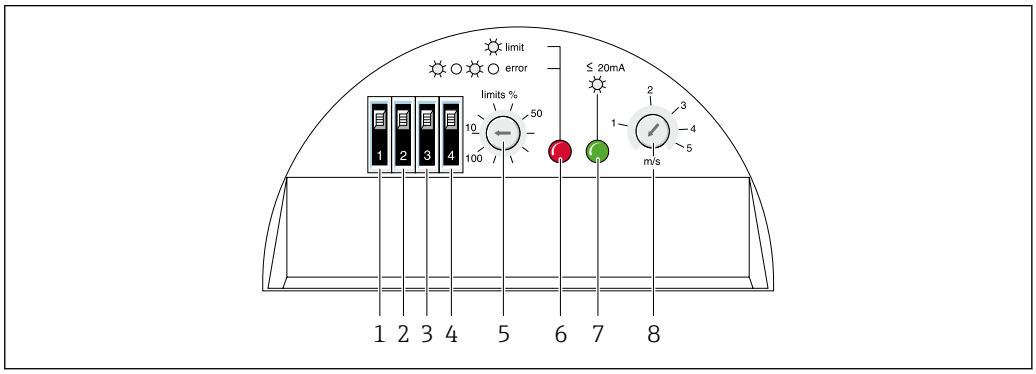
Are cables or the device undamaged (visual inspection)?	❑
Are the power supply and signal cables correctly connected?	❑
Do the cables used meet the requirements → 🖹 21?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 23?	❑
Is the potential equalization established correctly → 🖹 23?	❑

8 Operation options

8.1 Access via local display

Customized settings can be recorded on the operating and display interface.

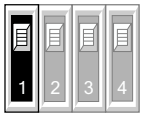
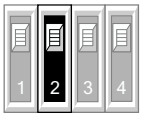
8.1.1 Operating and display elements

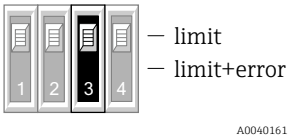
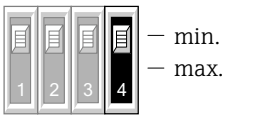
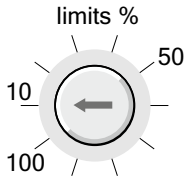
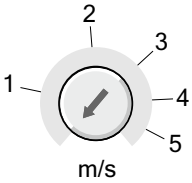


A0040158

11 *Operating and display elements*

1 *Test mode*
2 *Current output time constant and relay hold time*
3 *Relay functions*
4 *Min./max. safety setting*
5 *Limit value setting*
6 *Limit value or error indicator*
7 *Indicator for full scale setting*
8 *Full scale value scaling*

Operating and display element	Meaning
 A0040159	**Test mode** *"Test off" switch position* Test mode is switched off. *"Test" switch position* Test mode is switched on. *Factory setting* "Test off" switch position. Check the electronics with the test mode: → 29
 A0040160	**Current output time constant and relay hold time** The switch positions t = 3 s and t = 10 s correspond to the time constant of the current output: *Switch position "t = 3s"* The relay switches immediately and remains in this state for 3 seconds. Changes to the flow are not considered during this time. *Switch position "t = 10s"* The relay only switches if the limit value is exceeded or undershot continuously for a period of at least 10 seconds and then maintains this state for 10 seconds. *Factory setting* Switch position "t = 3s".

Operating and display element	Meaning
 A0040161	**Relay functions** If all functions are operating correctly, the relay is energized. The relay is de-energized as soon as an error or alarm occurs: *"Limit" switch position* The relay is de-energized and the red LED is lit if the limit value is exceeded or undershot (this depends on the min./max. safety setting). *"Limit+error" switch position* The same function as the "limit" function but in addition: The relay is de-energized if the flow velocity is greater than the measurable value of the measuring device of if a device error occurs. The red LED flashes. "Error" has a higher priority than "limit". *Factory setting* "Limit" switch position.
 A0040162	**Min./max. safety setting** *"Min." switch position* The relay is de-energized if the signal drops below the limit value. The red LED lights up. *"Max." switch position* The relay is de-energized if the signal exceeds the limit value. The red LED lights up. *Factory setting* "Limit" switch position.
 A0040165	**Limit value setting** The limit value is defined as a % of the full scale value using this switch. It can be set in increments of 10%, from 10% to 100%.
 A0040167	**Limit value or error indicator** *LED is lit red* Limit value is reached. *LED flashes red* Fault condition → 29
 A0040166	**Indicator for full scale setting** *LED is lit green* The current flow is lower than the configured full scale value, i.e. I = ≥20 mA
 A0040164	**Full scale value scaling** Full scale value scaling can be adjusted continuously between 1 and 5 m/s via this potentiometer. *Full scale setting:* The change from an unlit green LED to a lit green LED indicates that the full scale value matches the current flow velocity, with the current output set to 20 mA.

9 Commissioning

9.1 Function check

Before commissioning the measuring device:

▶ Make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist → 20
- "Post-connection check" checklist → 24

9.2 Switching on the measuring device

Once the supply voltage has been switched on, the measuring device adopts the normal mode.

9.3 Configuring the measuring device

Settings can be made at the measuring device with the operating and display interface. Description of the operating and display elements → 25.

10 Operation

Settings can be made at the measuring device with the operating and display interface.
Description of the operating and display elements → 25.

11 Diagnostics and troubleshooting

11.1 Diagnostic behavior

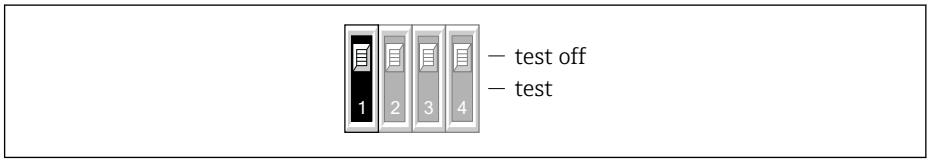
Error messages are reported via the current output and relay output (depending on the relay function that is configured). In addition, the red LED flashes to indicate the limit value or error condition.

Type of error	Relay output	Current output	Red LED
Amplifier error, EEPROM error (system error)	De-energized	2 mA	Flashing
Overflow (process error)	De-energized	2 mA	Lit

11.2 Test mode

The miniature switch for the test mode (→ 25, No. 1) allows the user to test the electronics.

Testing the electronics

1. Set the test mode switch to the "test" position.
   ↳
   

   A0040159
2. Turn the potentiometer for full scale value scaling counterclockwise to the end stop.
   ↳ The current output must now be exactly 20 mA.
3. If this is not the case, then replace the electronics module.

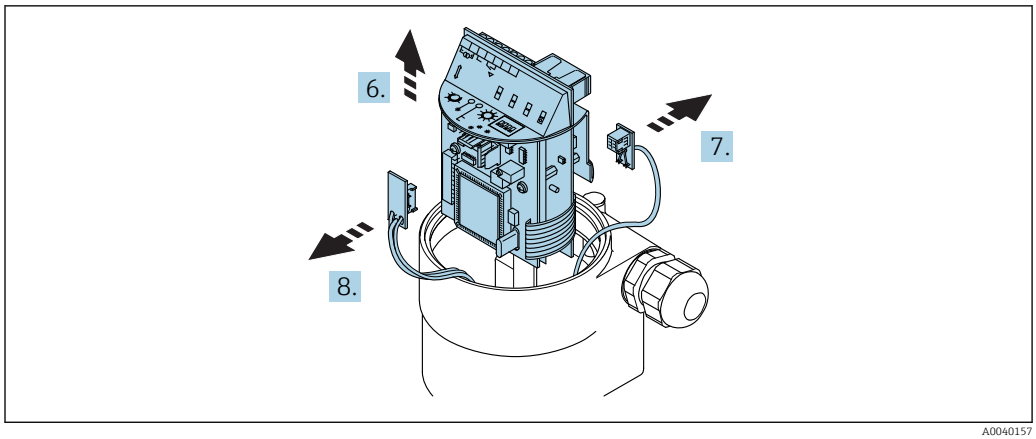
11.3 Replacing the electronics module

⚠ WARNING

Death or serious injury from electric shock when replacing the electronics module!

▶ Switch off the power supply before opening the electronics compartment cover.

1. Switch off the power supply.
2. Unscrew the cover from the housing.
3. Release the connecting cable from the terminal block.
4. Release the Phillips screw of the board support plate.
5. Release the securing screw of the ground wire (cable lug).
6. Carefully remove the board support plate from the housing.
7. Disconnect the plug of the coil current cable from the power supply board.
8. Disconnect the plug of the electrode signal cable from the amplifier board.



A0040157

9. Release the ground cable.
10. Replace the electronics module.
11. Install the new electronics module in the reverse order.

12 Maintenance

12.1 Maintenance tasks

No special maintenance work is required.

12.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

12.1.2 Interior cleaning

Cleaning the sensing element

In applications with unclean fluids, it is advisable to inspect and clean the device regularly to minimize measured errors caused by fouling or buildup.

The inspection and cleaning intervals depend on the field of application.

NOTICE

The use of unsuitable equipment or cleaning liquids can damage the sensing element.

- ▶ Do not use pigs to clean the pipe.
- ▶ Use an oil-free cleaning agent that does not form a film to clean the sensor. Gently clean the surface using a soft brush.
- ▶ When cleaning make sure that the cap is not damaged.
- ▶ Never use cleaning agents that can corrode the material and the seal.

Sensor-specific information:

- Follow the safety instructions when removing the sensor .
- Follow the instructions in the "Installation" section when removing the sensor→ 8.

12.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

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

13 Repair

13.1 Spare parts

W@M Device Viewer (www.endress.com/deviceviewer):
All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

Measuring device serial number:
Is located on the nameplate of the device.

13.2 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

13.3 Return

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

1. Refer to the website for more information:
   http://www.endress.com/support/return-material
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

13.4 Disposal

13.4.1 Removing the measuring device

1. Switch off the device.

WARNING

Danger to persons from process conditions.

- Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

13.4.2 Disposing of the measuring device

WARNING

Danger to personnel and environment from fluids that are hazardous to health.

- Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

14 Accessories

Various accessories are available for the device, and can be ordered with the device or at a later stage from Endress+Hauser. An up-to-date overview of accessories is available from your local Endress+Hauser sales organization or on the product page of the Endress +Hauser website: www.endress.com.

Cover set

Order number	Description
50093653	Cover set, MAGPHANT

Connection set (process)

Order number	Description
50093656	Welding socket set, DN 40 to 2000; 1.4435/316L
50093657	Welding socket set, DN 40 to 2000; St37/A570
50093658	Welding socket set, DN 25; 1.4435/316L
50093659	Welding socket set, DN 25; St37/A570
50093662	Socket set for connection, PVC

Connection set (electrical)

Order number	Description
50093671	Set, 2 extensions PG16 /NPT1/2"
50093672	Set, 2 extensions PG16 /G 1/2"
50093673	Set, 2 extensions PG16 /M20x1.5

Seal set

Order number	Description
50093631	Set, NBR seal, connection St37/A570

Set, electronics

Order number	Description
50093564	Set, electronics module, MAGPHANT
50093522	Set, 10 fuses T 0A16/250

15 Technical data

15.1 Application

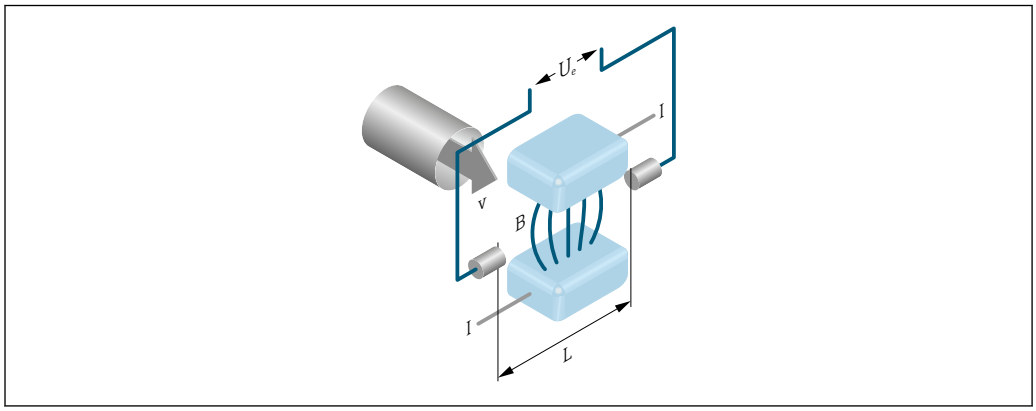
The measuring device is intended only for the flow measurement of liquids with a minimum conductivity of 20 µS/cm.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are sufficiently resistant.

15.2 Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.



A0028962

Ue Induced voltage
B Magnetic induction (magnetic field)
L Electrode spacing
I Current
v Flow velocity

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced (U_e) is proportional to the flow velocity (v) and is supplied to the amplifier by means of two measuring electrodes. The flow volume (Q) is calculated via the pipe cross-section (A). The DC magnetic field is created through a switched direct current of alternating polarity.

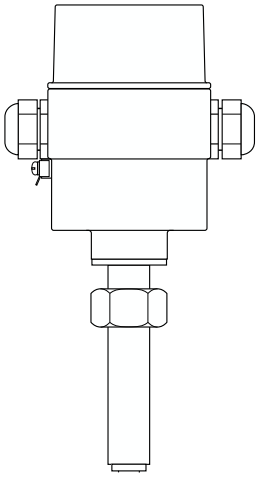
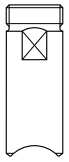
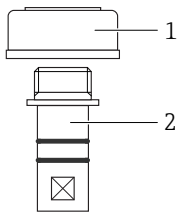
Formulae for calculation

- Induced voltage $U_e = B \cdot L \cdot v$
- Volume flow $Q = A \cdot v$

Measuring system

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

Magphant  A0041392	**Transmitter** ▪ Materials: Transmitter housing: powder-coated die-cast aluminum ▪ Configuration: Via operating and display elements on the transmitter ▪ Cable entry: M20 × 1.5 cable gland or M20 × 1.5 thread or ½" NPT thread or G ½" thread **Sensor** Materials: ▪ Sensor tip: PVDF; Viton O-ring ▪ Electrodes: stainless steel, 1.4435 (316L) ▪ Sensor sleeve: Stainless steel, 1.4435 (316L) with clamping ring 1.4571 (316Ti) for welding socket 1.4435 (316L); Stainless steel, 1.4435 (316L) with clamping ring and NBR seal for welding socket 1.4435 (316L)
Welding socket for steel pipes DN 25  A0040147	Materials: stainless steel, 1.4435 (316L) or steel St.37/A570
Welding socket for steel pipes ≥DN 40  A0040148	Materials: stainless steel, 1.4435 (316L) or steel St.37/A570
Plastic union nut (1) and adapter piece (2) for plastic pipes  A0040149	Materials: ▪ Plastic union nut: PVC ▪ Adapter piece: stainless steel, 1.4435 (316L), Viton O-rings

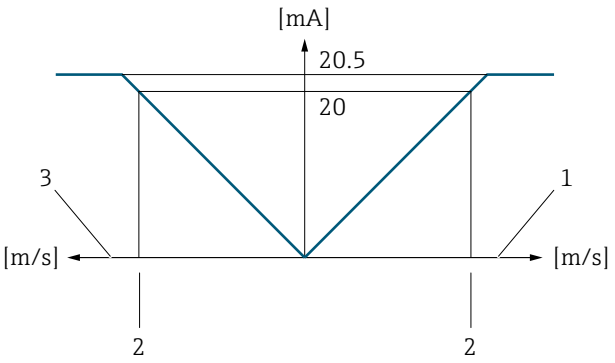
15.3 Input

Measured variable	Volume flow
Measuring range	0.1 to 5 m/s (0.33 to 16.41 ft/s)

15.4 Output

Output signal

Current output 4 to 20 mA

Signal mode	Active
Load	0 to 750 Ω
Bidirectional flow measurement	The measuring device is able to measure in both flow directions, i.e. it supports bidirectional measurement. The current output is always positive. The relay is activated in both flow directions.  *1 Forward flow* *2 Scalable full scale values* *3 Reverse flow*

Relay output

Floating changeover contact
- 60 V AC/0.4 A
- 75 V DC/0.5 A

15.5 Power supply

Terminal assignment → 21

Supply voltage

24 V_{DC} (20 to 30 V_{DC})

The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

Power consumption

<2.5 W

Electrical connection → 22

Potential equalization → 23

Cable specification → 21

15.6 Performance characteristics

Maximum measured error	o.r. = of reading ±2 % o.r. at the measuring electrode with local adjustment at flow velocities >1 m/s
Reproducibility	o.r. = of reading ±2 % o.r.

15.7 Installation

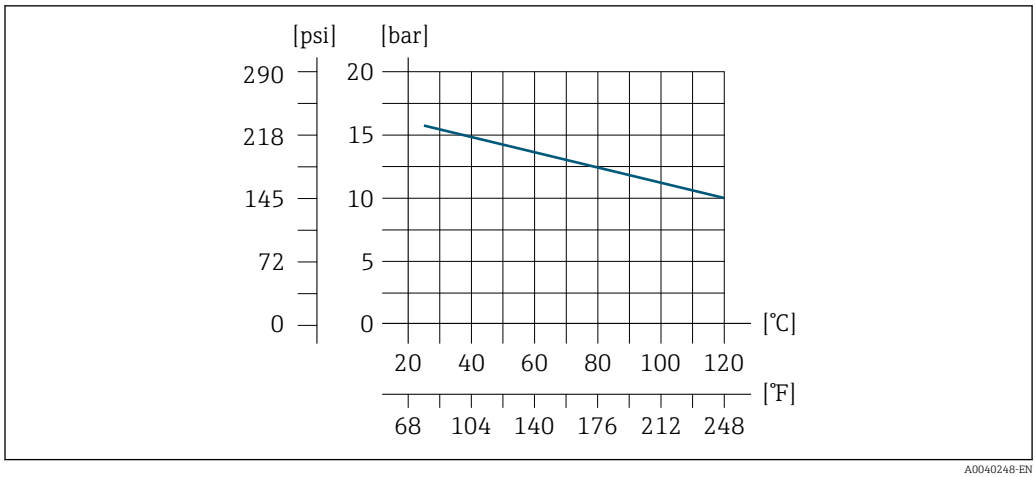
Installation conditions	→ 13

15.8 Environment

Ambient temperature range	→ 18
Degree of protection	IP66, Type 4X
Electromagnetic compatibility (EMC)	Details are provided in the Declaration of Conformity. As per EN 61326-1 and EN 61326-2-3

15.9 Process

Medium temperature range	▪ −20 to +120 °C (+4 to +248 °F) for welding socket made of 1.4435 (316L) with clamping ring ▪ −20 to +100 °C (+4 to +212 °F) for welding socket made of St.37/A570 with clamping ring and NBR seal
Conductivity	≥20 µS/cm for liquids in general.
Pressure-temperature ratings	▪ 16 bar (230 psi) at 25 °C (77 °F) ▪ 10 bar (145 psi) at 120 °C (250 °F)



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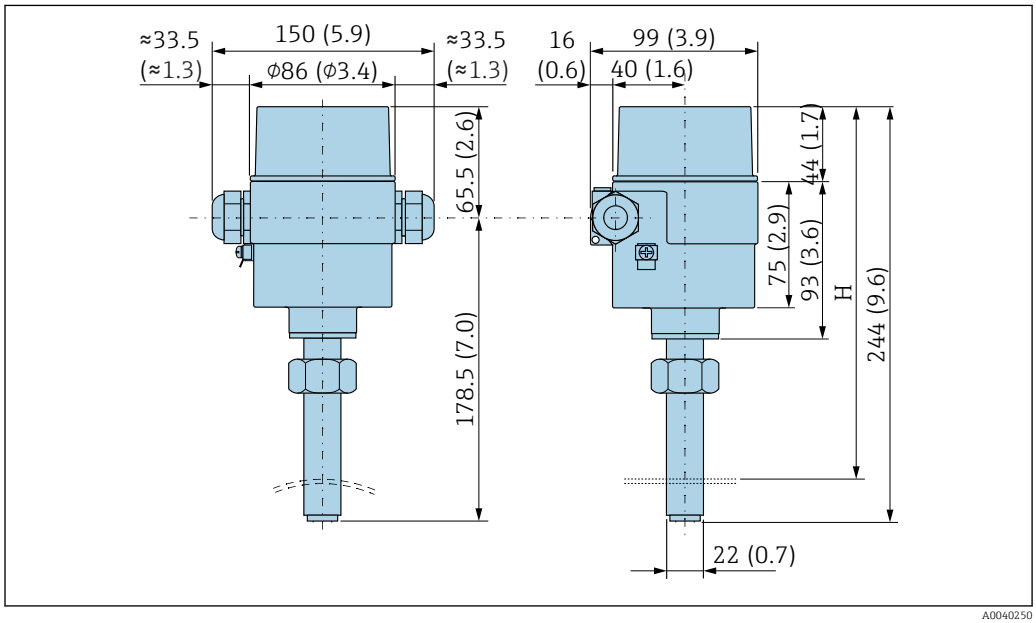
15.10 Mechanical construction

Dimensions



A0040250

Dimension H

Pipe nominal diameter mm (in)	H for installation in steel pipes mm (in)	H for installation in plastic pipes
25 (0.98)	237.0 (9.331)	→ 16
40 (1.57)	234.0 (9.212)	
50 (1.97)	234.0 (9.212)	
80 (3.15)	230.0 (9.055)	
100 (3.94)	227.0 (8.937)	
150 (5.91)	220.5 (8.681)	
200 (7.87)	214.5 (8.445)	

Pipe nominal diameter mm (in)	H for installation in steel pipes mm (in)	H for installation in plastic pipes
250 (9.84)	207.5 (8.169)	
≥300 (11.81)	201.5 (7.933)	

Dimensions of welding sockets → 15

Weight

1.2 kg (2.6 lb)

Materials

Sensor

- Sensor tip:
  - PVDF
  - Viton O-ring
- Electrodes:
  Stainless steel, 1.4435 (316L)
- Sensor sleeve:
  - Stainless steel, 1.4435 (316L) with clamping ring 1.4571 (316Ti) for welding socket 1.4435 (316L)
  - Stainless steel, 1.4435 (316L) with clamping ring and NBR seal for welding socket ST. 37/A570

Welding socket (for steel pipes)

- Stainless steel, 1.4435 (316L)
- Steel St.37/A570

Adapter piece (for plastic pipes)

- Stainless steel, 1.4435 (316L)
- Viton O-rings

Plastic union nut (for plastic pipes)

PVC

Transmitter housing

Powder coated die-cast aluminum

15.11 Human interface

Local operation

The device is operated and configured via operating and display elements on the transmitter → 25.

Communication

The measured values are communicated to a higher-level system via the current output.

15.12 Certificates and approvals

Currently available certificates and approvals can be called up via the product configurator.

Ex approval

The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.

The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

ATEX, IECEx

Zone 2

FM

- NI Class I Division 2 Groups A-D
- DIP/II, III/1/EFG
- Type 4X

CSA

- Class I, Division 2 Groups A-D
- Class II Groups E-G
- Class III
- Type 4X

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).

15.13 Accessories

Overview of accessories available for order → 33.

15.14 Supplementary documentation

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

- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Standard documentation

Document type	Documentation code
Brief Operating Instructions	KA01451D
Technical Information	TI00036D

Device-dependent additional documentation

Document type	Documentation code
Safety Instructions	XA00025D

Index

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