

# Technical Information

## Magphant

Electromagnetic flowmeter



### Cost-effective limit switch for reliable and repeatable flow monitoring

#### Application

- The bidirectional measuring principle is virtually independent of pressure, density, temperature and viscosity
- Universal usability for all water applications in utilities

#### Device properties

- Compact, space-saving design
- Nominal diameter: DN 15 to 2000 (½ to 80")
- Can be used with steel or plastic pipes
- Switch point setting via rotary switch
- Current output and relay output
- ATEX, FM, CSA

#### Your benefits

- High plant availability – reliable flow information
- Energy-saving flow measurement – no pressure loss due to cross-section constriction
- Maintenance-free – no moving parts
- Process safety – device self-monitoring and reliable display even with empty pipes
- Product safety – integrated testing to check correct functioning of the electronics
- Easy operation – full-scale value adjustment via potentiometer






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## About this document

### Symbols




#### Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.  The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> <li>▪ Inner ground terminal: Connects the protective earth to the mains supply.</li> <li>▪ Outer ground terminal: Connects the device to the plant grounding system.</li> </ul>

#### Symbols for certain types of information

Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.
	<b>Preferred</b> Procedures, processes or actions that are preferred.
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.
	<b>Tip</b> Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
	Visual inspection.

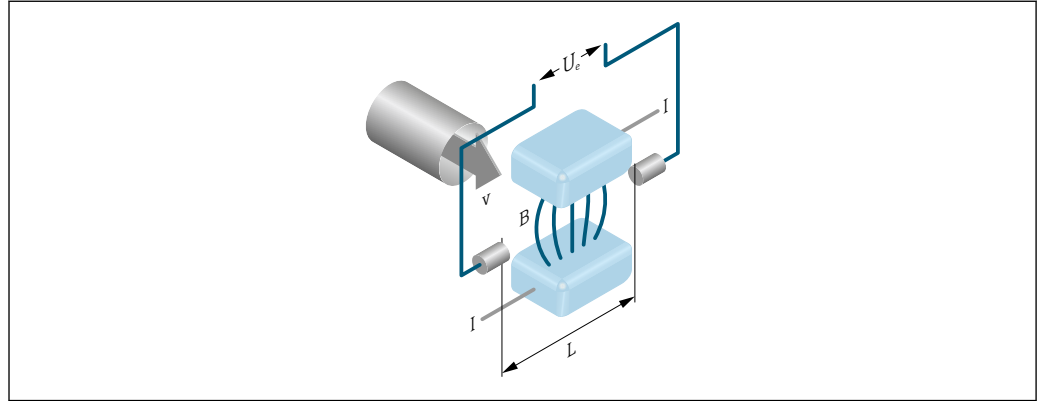
#### Symbols in graphics

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

## 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

$U_e$  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

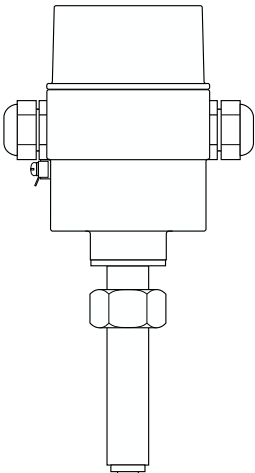
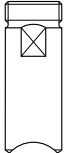
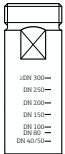
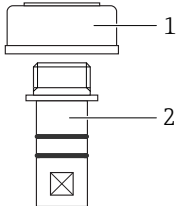
- Induced voltage  $U_e = B \cdot L \cdot v$
- Volume flow  $Q = A \cdot v$

### 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.

<p><b>Magphant</b></p>  <p style="text-align: right;">A0041392</p>	<p><b>Transmitter</b></p> <ul style="list-style-type: none"> <li>■ <b>Materials:</b> Transmitter housing: powder-coated die-cast aluminum</li> <li>■ <b>Configuration:</b> Via operating and display elements on the transmitter</li> <li>■ <b>Cable entry:</b> M20 × 1.5 cable gland or M20 × 1.5 thread or ½" NPT thread or G ½" thread</li> </ul> <p><b>Sensor</b></p> <p>Materials:</p> <ul style="list-style-type: none"> <li>■ Sensor tip: PVDF; Viton O-ring</li> <li>■ Electrodes: stainless steel, 1.4435 (316L)</li> <li>■ 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)</li> </ul>
<p><b>Welding socket for steel pipes DN 25</b></p>  <p style="text-align: right;">A0040147</p>	<p>Materials: stainless steel, 1.4435 (316L) or steel St.37/A570</p>
<p><b>Welding socket for steel pipes ≥DN 40</b></p>  <p style="text-align: right;">A0040148</p>	<p>Materials: stainless steel, 1.4435 (316L) or steel St.37/A570</p>
<p><b>Plastic union nut (1) and adapter piece (2) for plastic pipes</b></p>  <p style="text-align: right;">A0040149</p>	<p>Materials:</p> <ul style="list-style-type: none"> <li>■ Plastic union nut: PVC</li> <li>■ Adapter piece: stainless steel, 1.4435 (316L), Viton O-rings</li> </ul>

## Input

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

## Output

### Output signal

### Current output 4 to 20 mA

<b>Signal mode</b>	Active
<b>Load</b>	0 to 750 $\Omega$
<b>Bidirectional flow measurement</b>	<p>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.</p> <p style="text-align: right;">A0040249</p>
	<p>1 Forward flow 2 Scalable full scale values 3 Reverse flow</p>

### Relay output

Floating changeover contact

- 60 V AC/0.4 A
- 75 V DC/0.5 A

## Power supply

<b>Terminal assignment</b>	Supply voltage		Relay output			Current output 4 to 20 mA	
	1 (+)	2 (-)	23	24	25	26 (+)	27 (-)

### Supply voltage

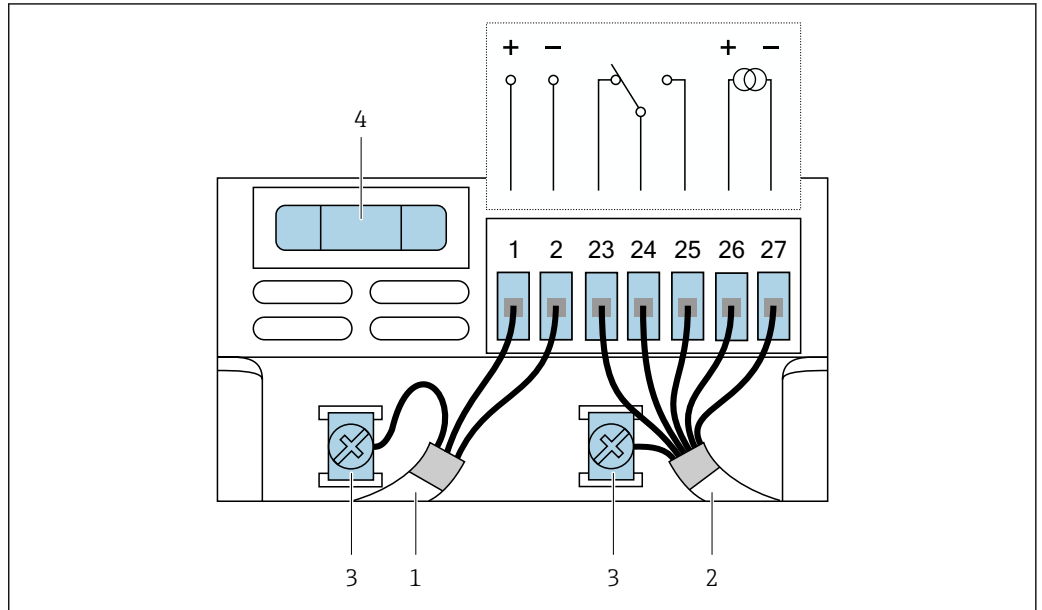
24 V<sub>DC</sub> (20 to 30 V<sub>DC</sub>)

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

### Power consumption

<2.5 W

**Electrical connection**



A0040168

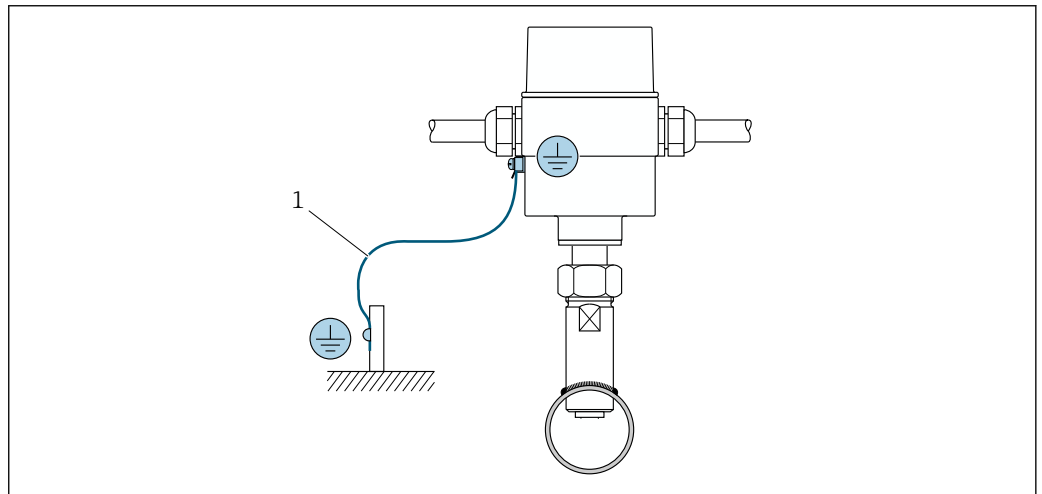
1 Electrical connection

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

**Potential equalization**

**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.



A0040156

2 Connection example, potential equalization

- 1 Copper wire,  $\leq 2.08 \text{ mm}^2$  (14 AWG)

**Terminals**

<b>Terminal type</b>	Screw terminals
<b>Conductor cross-section</b>	0.2 to 1.5 mm <sup>2</sup> (24 to 16 AWG)

**Cable specification**

**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.

**Protective ground cable**

Cable  $\leq 2.08 \text{ mm}^2$  (14 AWG)

The grounding impedance must be less than  $1 \Omega$ .

**Signal cable**

*Current output*

Standard installation cable is sufficient.

*Relay output*

Standard installation cable is sufficient.

**Performance characteristics**

**Maximum measured error**

o.r. = of reading

$\pm 2 \%$  o.r. at the measuring electrode with local adjustment at flow velocities  $> 1 \text{ m/s}$

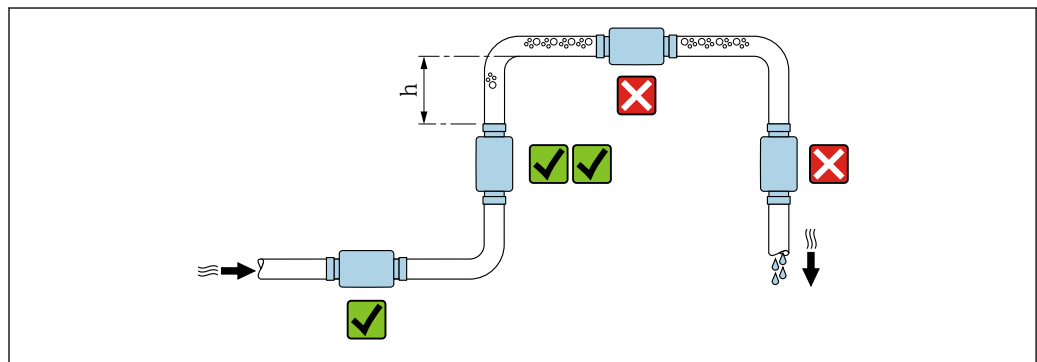
**Reproducibility**

o.r. = of reading

$\pm 2 \%$  o.r.

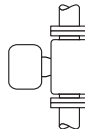
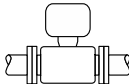
**Installation**

**Mounting location**

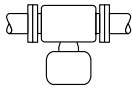
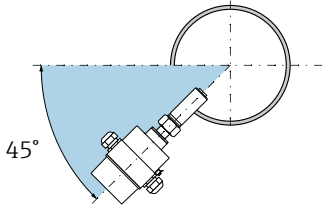


Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow:  $h \geq 5 \times \text{DN}$

**Installation position**

Installation position		Recommendation
Vertical orientation	 A0017337	✓✓
Horizontal orientation, transmitter head up	 A0015589	✗ <sup>1)</sup>

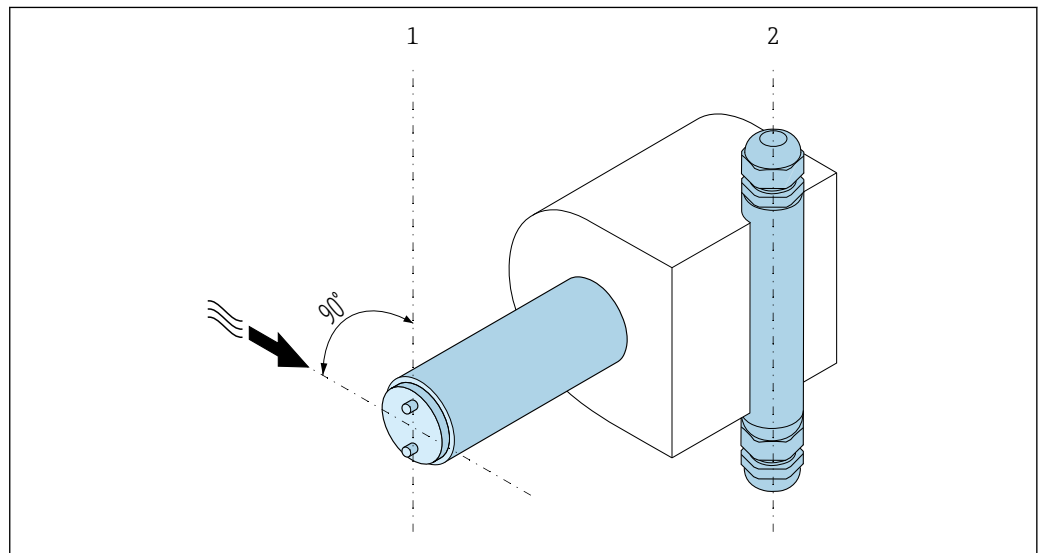


Installation position		Recommendation
Horizontal orientation, transmitter head down	 <p style="text-align: right;">A0015590</p>	<input checked="" type="checkbox"/> 2)
Horizontal orientation, transmitter head at side	 <p style="text-align: right;">A0040154</p>	<input checked="" type="checkbox"/> 3)

- 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.

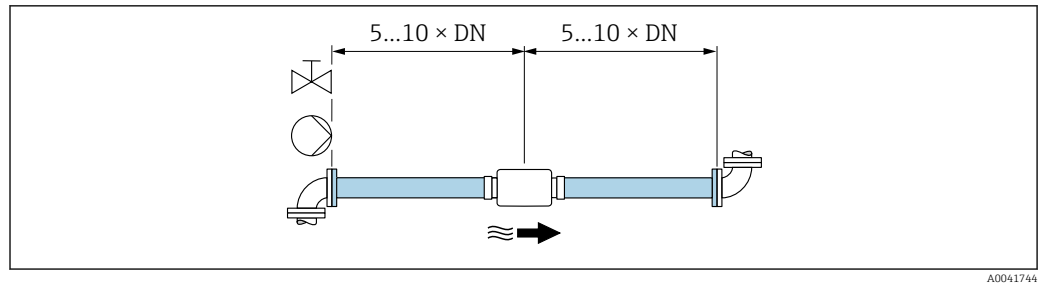


3 Position of electrode axis

- 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:



A0041744

**i** For information on the dimensions and installed lengths of the device → 13

### Mounting conditions for welding socket

#### Installation in steel pipes

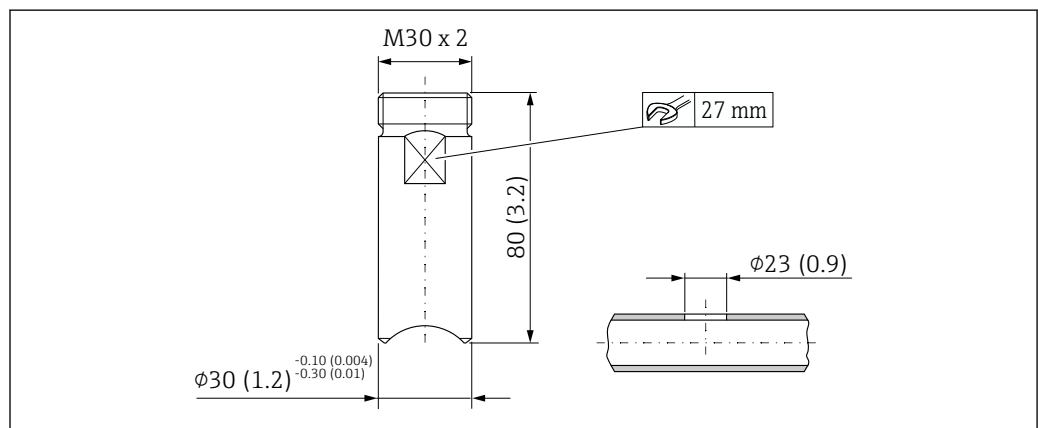
The measuring device is mounted in steel pipes using the welding socket supplied. Two different types of welding socket are available, depending on the nominal diameter:

- Welding socket for pipes DN 25
- Welding socket for pipes  $\geq$ DN 40

#### NOTICE

##### Damage to the measuring device

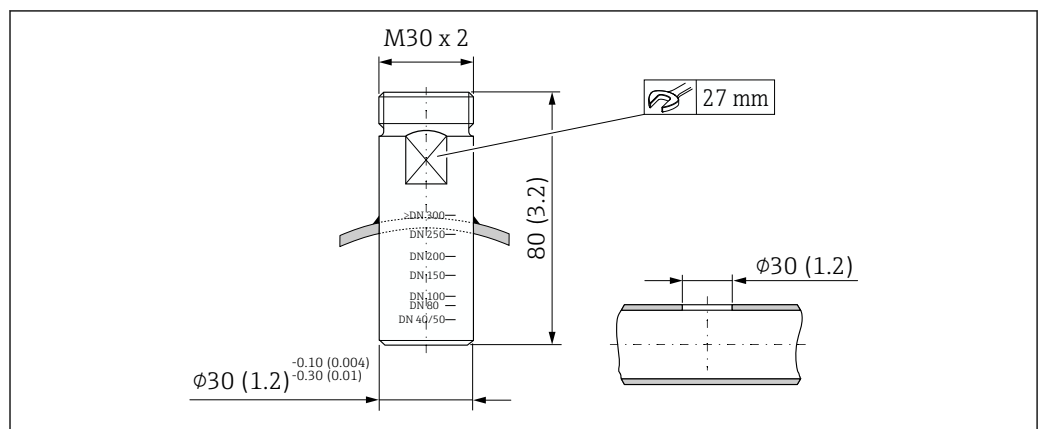
- ▶ Only weld the welding socket when the measuring device is not installed.
- ▶ Pipe DN 25: Weld the welding socket at right angles to the axis of the piping.



A0040150

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

- ▶ Pipe  $\geq$ 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.



A0040151

5 Welding socket for piping  $\geq$ DN 40. Engineering unit mm (in)

**Installation in plastic pipe**

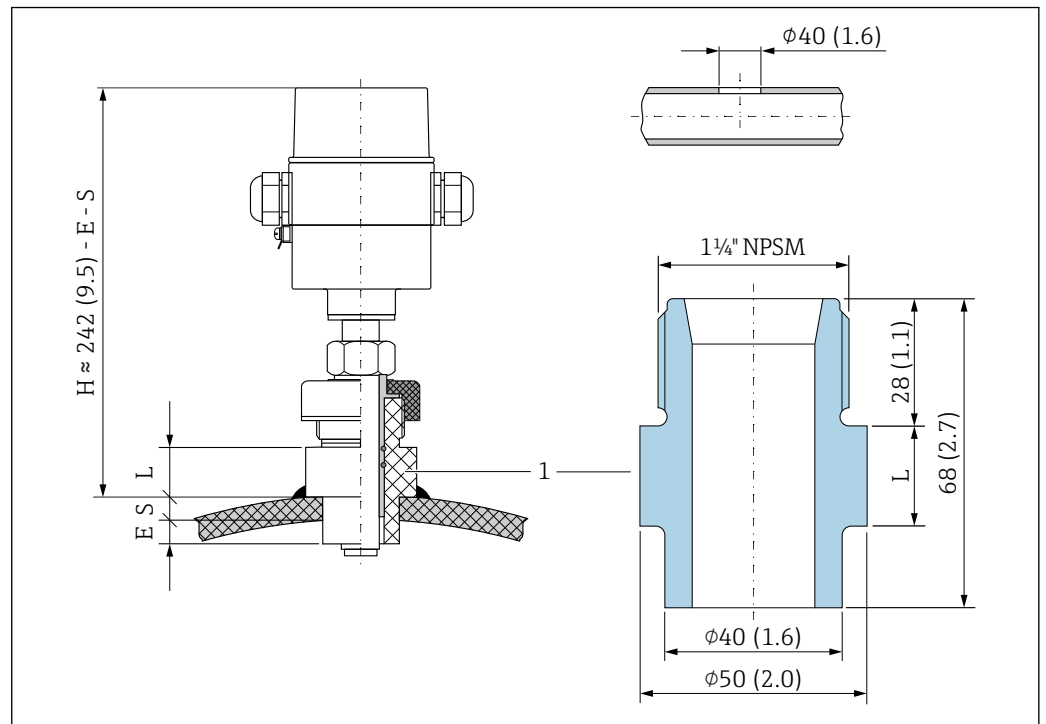
For pipe sizes  $\geq$ DN 65, the measuring device is mounted in plastic pipes using a plastic welding socket. The plastic welding socket can be purchased from the Georg Fischer company. PVC, PP and PE sockets are available. Depending on the outer diameter of the pipe, the dimension L must be adjusted 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.



6 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*

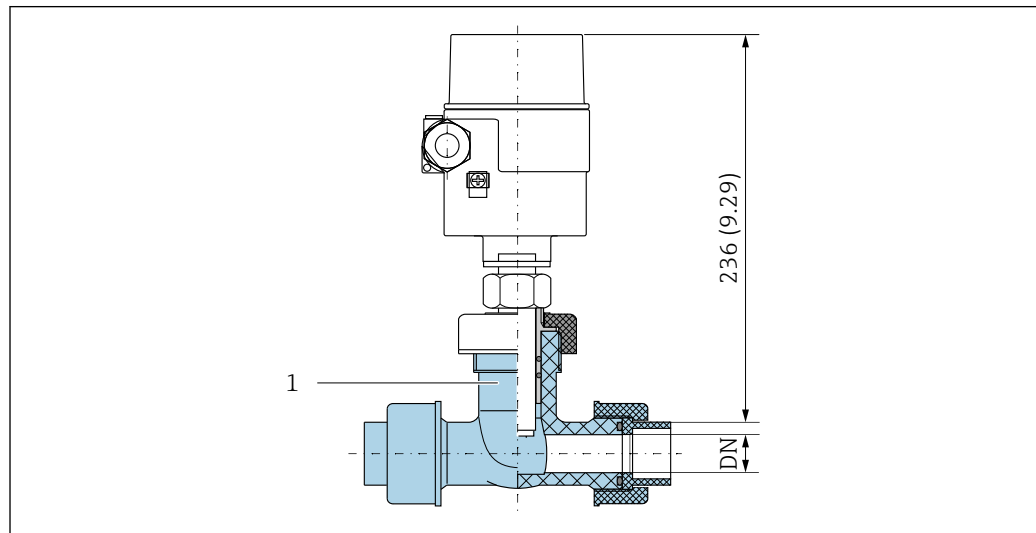
Pipe outer diameter mm (in)	Immersion depth E mm (in)
65 (2.6)	6.9 (0.27)
75 (3.0)	8.3 (0.33)
110 (4.33)	11.4 (0.45)
125 (4.92)	14.4 (0.57)
140 (5.51)	17.7 (0.70)
160 (6.30)	17.7 (0.70)
200 (7.87)	12.0 (0.47)
225 (8.86)	10.0 (0.39)

Pipe outer diameter mm (in)	Immersion depth E mm (in)
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.

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



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

1 Standard T-fitting

## Environment

**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.

**Degree of protection** IP66, Type 4X

**Electromagnetic compatibility (EMC)**

**i** Details are provided in the Declaration of Conformity.

As per EN 61326-1 and EN 61326-2-3

## Process

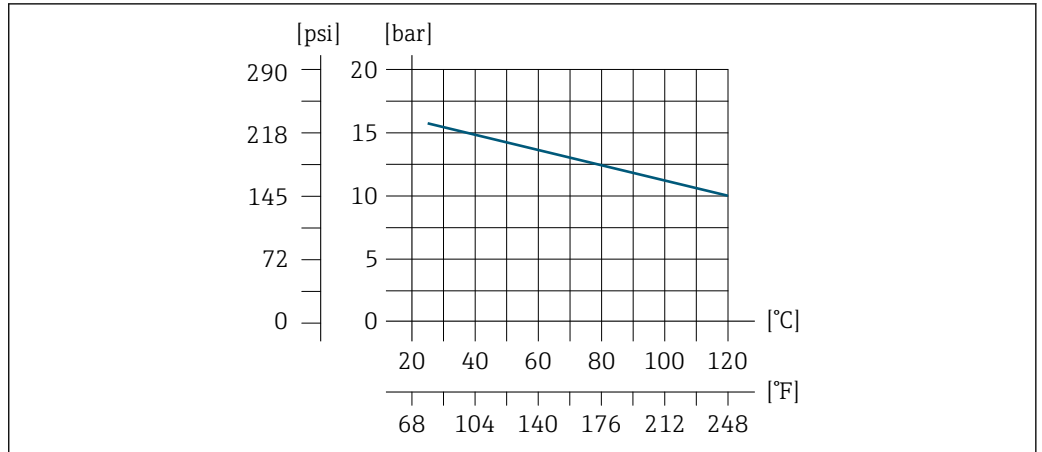
**Medium temperature range**

- -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**

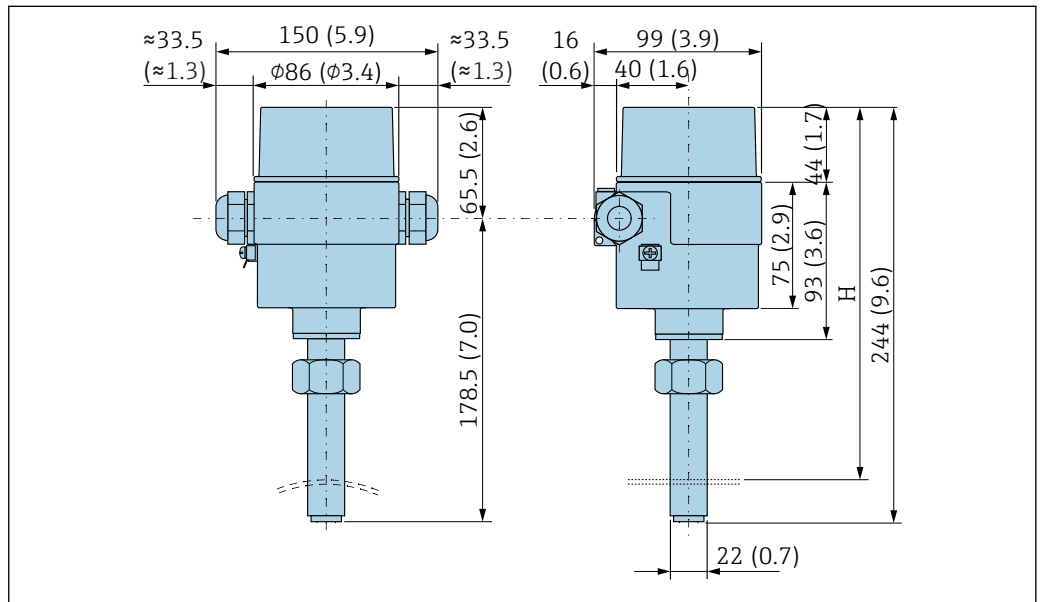
- 16 bar (230 psi) at 25 °C (77 °F)
- 10 bar (145 psi) at 120 °C (250 °F)



A0040248-EN

## 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)	→ 11
40 (1.57)	234.0 (9.212)	

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

 Dimensions of welding sockets →  10

**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

## Human interface

### Local operation

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

### Communication

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

## Certificates and approvals

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

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**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

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**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).

## Ordering information

Detailed ordering information is available for your nearest sales organization [www.addresses.endress.com](http://www.addresses.endress.com) or in the Product Configurator under [www.endress.com](http://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

## 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](http://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

## 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](http://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
Operating Instructions	BA00025D

### Device-dependent additional documentation

Document type	Documentation code
Safety Instructions	XA00025D



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[www.addresses.endress.com](http://www.addresses.endress.com)

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