

Operating Manual

Magphant

Electromagnetic Flow Monitor

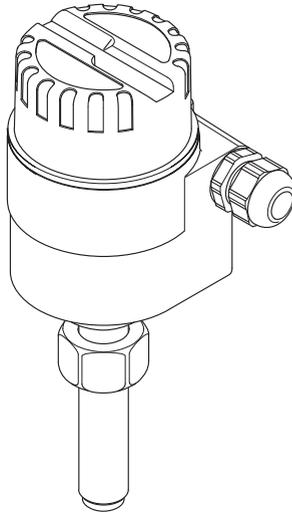


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1 Safety Instructions

⚠ Warning!

The following safety instructions must always be carefully observed!

1.1 Correct Usage

- The Magphant flow monitor may only be used for flow measurement of conductive liquids.
- The Magphant flow monitor is designed and checked according to the regulations in force according to EN 61010 (VDE 0411, "Protection Measures for Electronic Measurement, Control, Regulation and Laboratory Equipment"). A hazardous situation may occur if the instrument is not used for the purpose it was designed or is used incorrectly.
Please carefully note the information provided in this Operating Manual indicated by the pictograms: ⚠ Warning!, ⚡ Caution!, 📌 Note!
- The manufacturer assumes no liability for damage caused by incorrect use of the instrument.

1.2 Personnel for Installation, Start-up and Operation

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorised by the operator of the facility.
Personnel must read and understand this Operating Manual before carrying out its instructions.
- The instrument may only be operated by personnel who are authorised and trained by the operator of the facility. All instructions in this manual are to be observed.
- With special fluids, including those used for cleaning, E+H will be pleased to supply information concerning the chemical resistance properties of wetted parts.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams.
The flowmeter is to be grounded.

1.3 Repairs, Dangerous Chemicals

The following procedures must be carried out before a Magphant is sent to Endress+Hauser for repair:

- A note must always be enclosed with the instrument, containing a description of the fault, the application and the chemical and physical properties of the product being measured.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, carcinogenic, radioactive, etc.
- No instrument should be returned to us without all dangerous material being removed first (e.g. in scratches or diffused through plastic).

1.4 Technical Improvements

The manufacturer reserves the right to modify technical data, to reflect development progress, without prior notice. Your local E+H Sales Office will supply you with all current information and any updates to this Operating Manual.

2 System Description

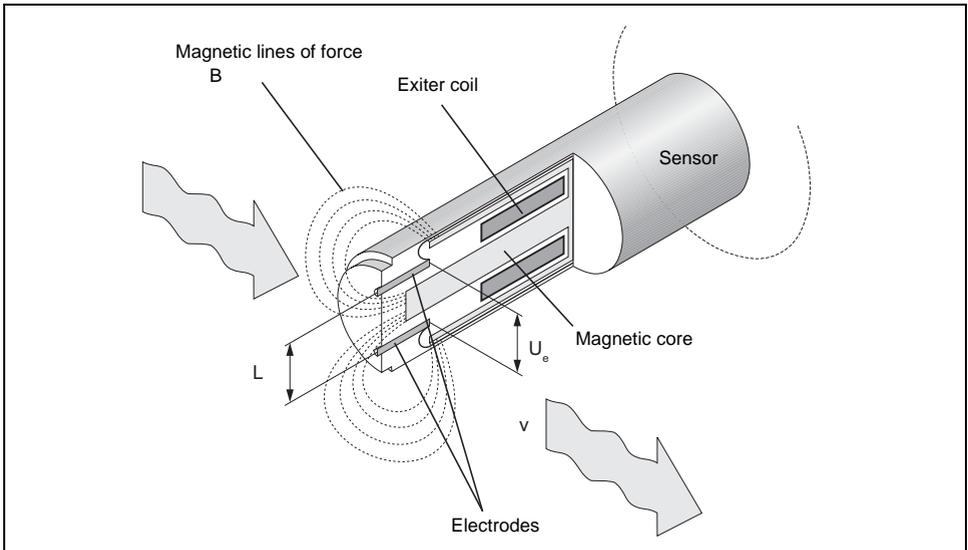
2.1 Areas of Application

The Magphant flow monitor provides the plant system with the information needed on flowrate in the piping. The magnetic-inductive measuring principle determines the flow velocity of the conductive liquid at the tip of the sensor. Exceeding the preset switchpoint (limit value) is indicated by a relay contact. An analogue 4...20 mA signal proportional to the flow is also available for monitoring the flowrate at the same time. The Magphant is ideal for process protection and monitoring.

2.2 Measuring Principle

In accordance with Faraday's law of magnetic induction, a voltage is induced in a conductor that is moved through a magnetic field. In the electromagnetic principle of measurement the flowing fluid represents the moving conductor. The induced voltage is proportional to the flow velocity and is fed to the measuring amplifier by a pair of electrodes.

Microprocessor-controlled electronics, with a stable zero-point, convert the voltage into an analogue 4...20 mA output signal.



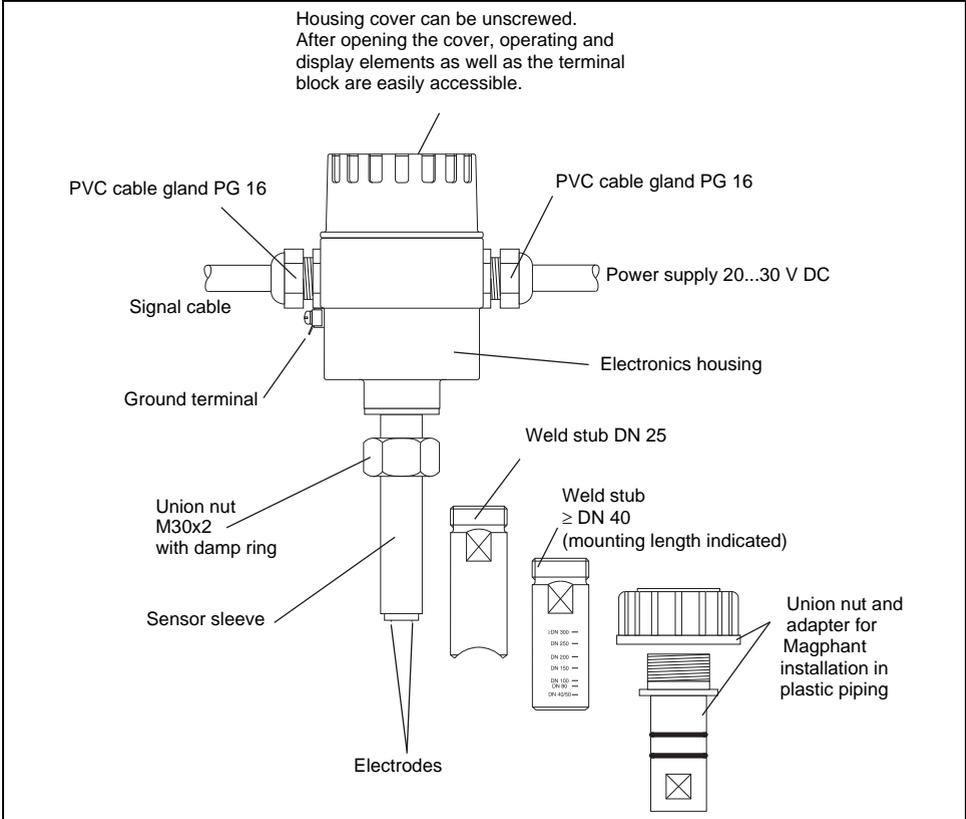
1 Measuring principle of electromagnetic flow measurement

- U_e $B \times L \times v =$ induced voltage
- B magnetic induction (magnetic field)
- L distance between electrodes
- v flow velocity at the tip of the sensor

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2.3 Measuring System Design

A construction overview of the Magphant measuring system is shown in the diagram below.



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 2 Construction of the measuring system

Operational safety

- Comprehensive self-monitoring of the measuring system assures high safety. Any error messages that do occur (process errors, instrument system errors) are immediately signalled via the current and relay outputs.
- The Magphant measuring unit fulfills the general safety requirements according to EN 61010, as well as the general electromagnetic interference (EMI) immunity requirements EN 50081 Parts 1 and 2 / EN 50082 Parts 1 and 2.
- Protection type IP 66 is standard (DIN 40050).

3 Mounting and Installation

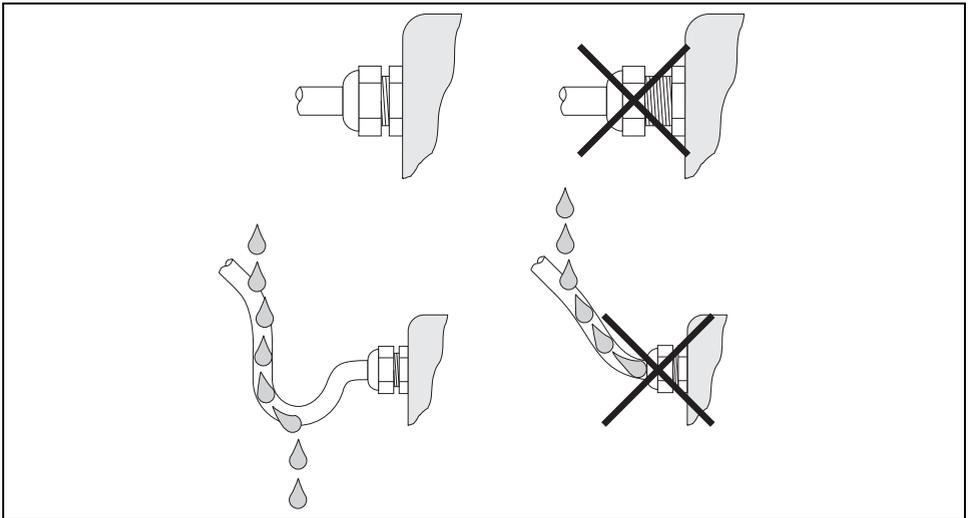
3.1 Protection Type IP 66 (DIN 40050)

The Magphant fulfils all the requirements for IP 66.

⚠ Caution!

After successful installation in the field or after replacing an instrument, the following points must always be observed in order to ensure protection to IP 66:

- Housing gaskets must be clean and undamaged and lie at the end of the cover threads. The gaskets may need to be dried, cleaned or replaced.
- The screw cover must be firmly tightened.
- The cables used for connecting must have an outer diameter of 7...12 mm.
- The cable glands must be firmly tightened.
- The cable must loop down before entering the cable gland to ensure that no moisture can enter it.
- An unused cable gland is to be replaced with a blind plug.
- The protective bush should not be removed from the cable gland.



 3 *Mounting regulations for cable glands*

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3.2 Temperature Ranges

⚠ Caution!

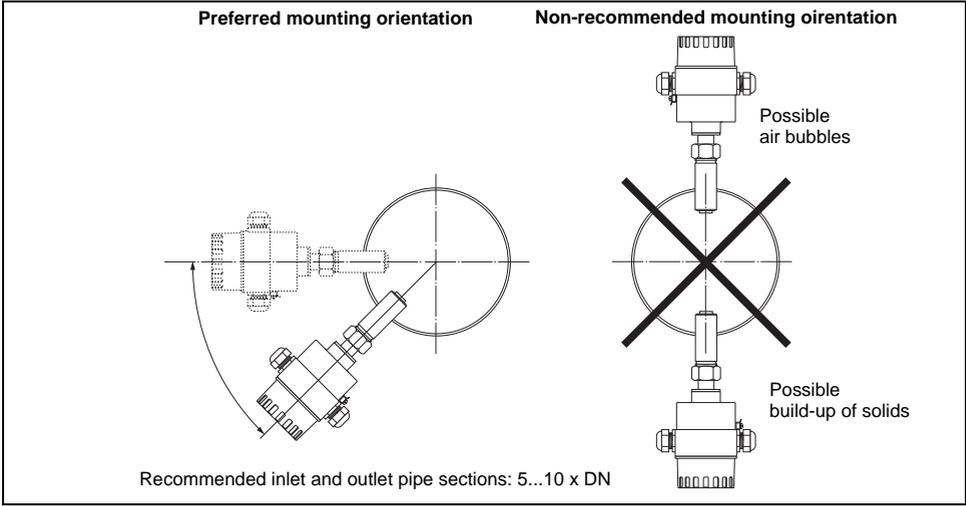
- The maximum approved ambient and fluid temperatures must be observed (see page 20).
- For outside installation of the instrument, take care that it is protected from direct sunlight. This applies especially in countries with high ambient temperatures.

3.3 Mounting Instructions

Orientation in the piping

The Magphant is best mounted in vertical piping. If the piping runs horizontally, then the Magphant is to be mounted to the side. This mounting procedure ensures that the electrodes are always immersed in flowing fluid.

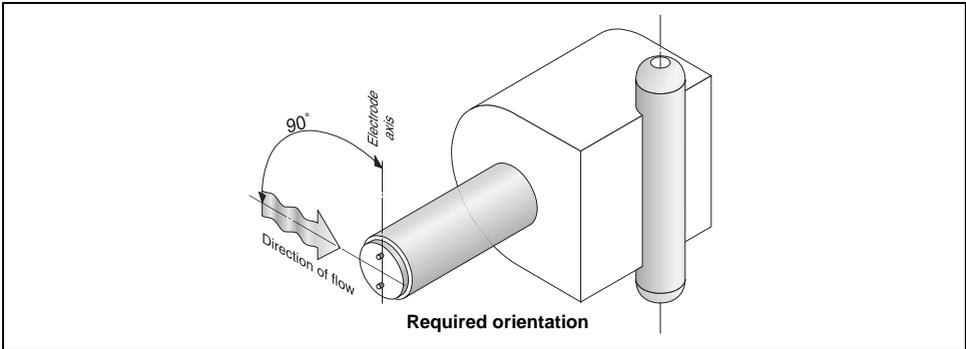
Caution!
Never weld the weld stub to the pipe with the Magphant in place.



4 Mounting orientation in horizontal piping

Position of the electrode axis

The sensor is to be mounted so that the electrode axis is always 90° to the direction of flow. The two PG 16 cable glands can be used as a visual check as these also lie on the same axis.



5 Orientation of the electrode axis and PG 16 cable gland

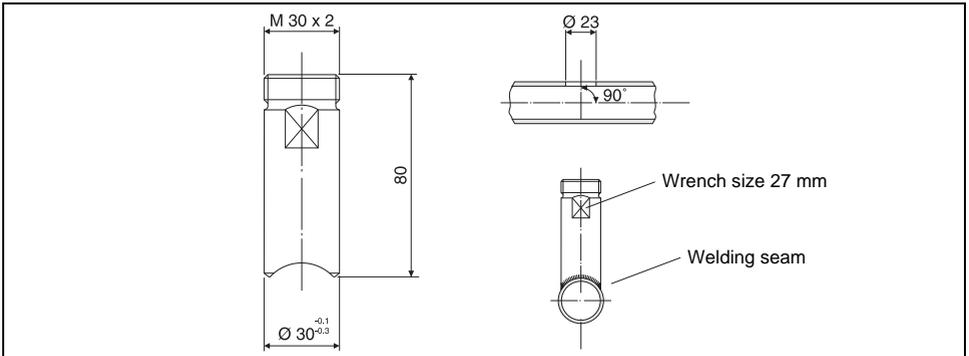
3.4 Mounting in Steel Piping

The Magphant is mounted in steel piping using the weld stub supplied. Two different versions are available, depending on nominal diameter:

Weld stub for DN 25

For DN 25 piping, the weld stub has the appropriate radius to match the diameter.

- Opening in the piping: $\varnothing = 23$ mm.
- Place the weld stub on the opening and weld it at right angles to the axis of the piping.



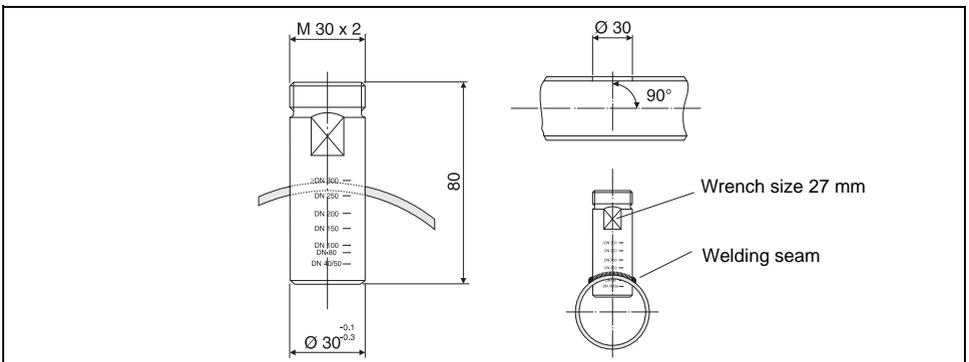
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6 DN 25 weld stub

Weld stub for \geq DN 40

For \geq DN 40 piping, the weld stub has a graduated scale to ensure that the stub can be correctly positioned for mounting.

- Opening in the piping: $\varnothing = 30$ mm.
- Insert the weld stub into the opening, with the marking (according to the nominal diameter) flush against the outer wall of the piping and weld it at right angles to the axis of the piping. For diameters $>$ DN 300, the DN 300 marking is to be used.



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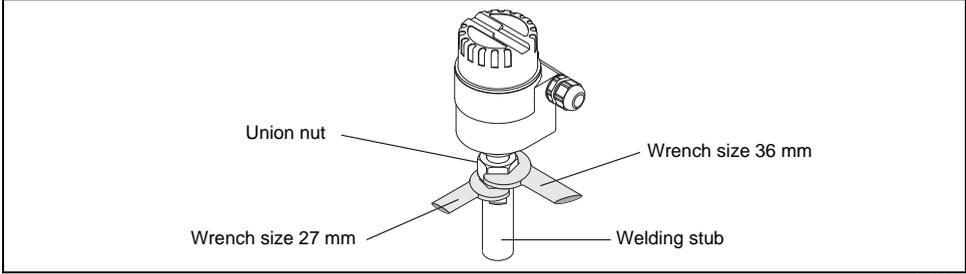
7 \geq DN 40 weld stub

Mounting of the adapter piece for steel piping

1. Insert the Magphant into the weld stub and tighten the union nut by hand.
2. Hold the weld stub with an open-ended wrench size 27 mm.
3. Tighten the union nut a further approx. ½ turn with an open-ended wrench size 36 mm.

⚠ Caution!

When inserting the Magphant into a weld stub, care must be taken so that the sensor tip is not damaged



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8 Mounting of the adapter piece for steel piping

3.5 Mounting in plastic piping

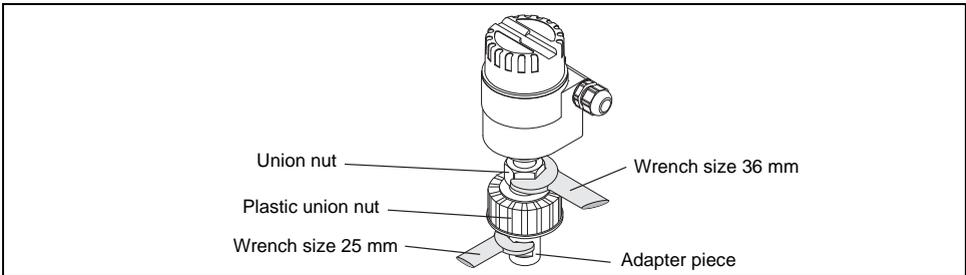
The Magphant for mounting in plastic piping is delivered as part of a set, consisting of the Magphant, an adapter piece made of 1.4435 (316L), and a plastic union nut.

Mounting of the adapter piece for plastic piping

1. Place the plastic union nut over the adapter piece.
2. Carefully insert the Magphant into the adapter piece and hand tighten the metal union nut.
3. Hold the weld stub with an open-ended wrench size 25 mm. Tighten the union nut a further approx. ½ turn with an open-ended wrench size 36 mm.

⚠ Caution!

When inserting the Magphant into a adapter piece, care must be taken so that the sensor tip is not damaged.



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9 Mounting of the adapter piece for plastic piping

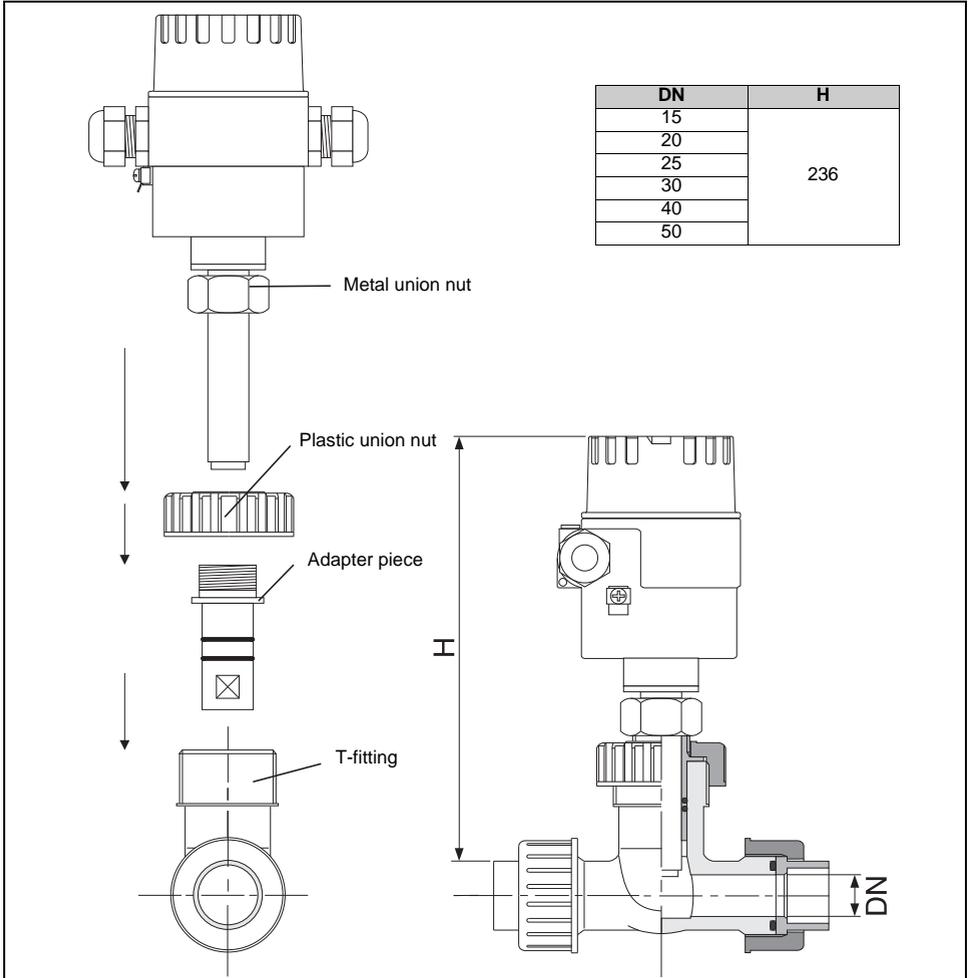
Mounting in the standard T-fitting for diameters DN 15...50

The T-fitting, which can be obtained from the Georg Fischer company in PVC, PP and PVDF, serves as Magphant holder for diameters DN 15...50.

After the unit has been assembled as described on page 10, insert it into the plastic T-section and screw on the plastic union nut tightly by hand.

⚠ Caution!

- Observe the electrode axis orientation (see page 8).
- Use only the Magphant version for mounting in plastic piping (different insertion depths)!



10 Mounting procedure for diameters DN 15...50 in plastic

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Mounting in plastic piping for diameters \geq DN 65

A plastic weld stub is used for mounting in plastic piping for diameters \geq DN 65. These plastic weld stubs can be obtained from the Georg Fischer company in PVC, PP and PE materials. The L dimension must be adjusted by the customer accordingly, depending on the pipe outer diameter.

The L dimension can be calculated based on the following formula:

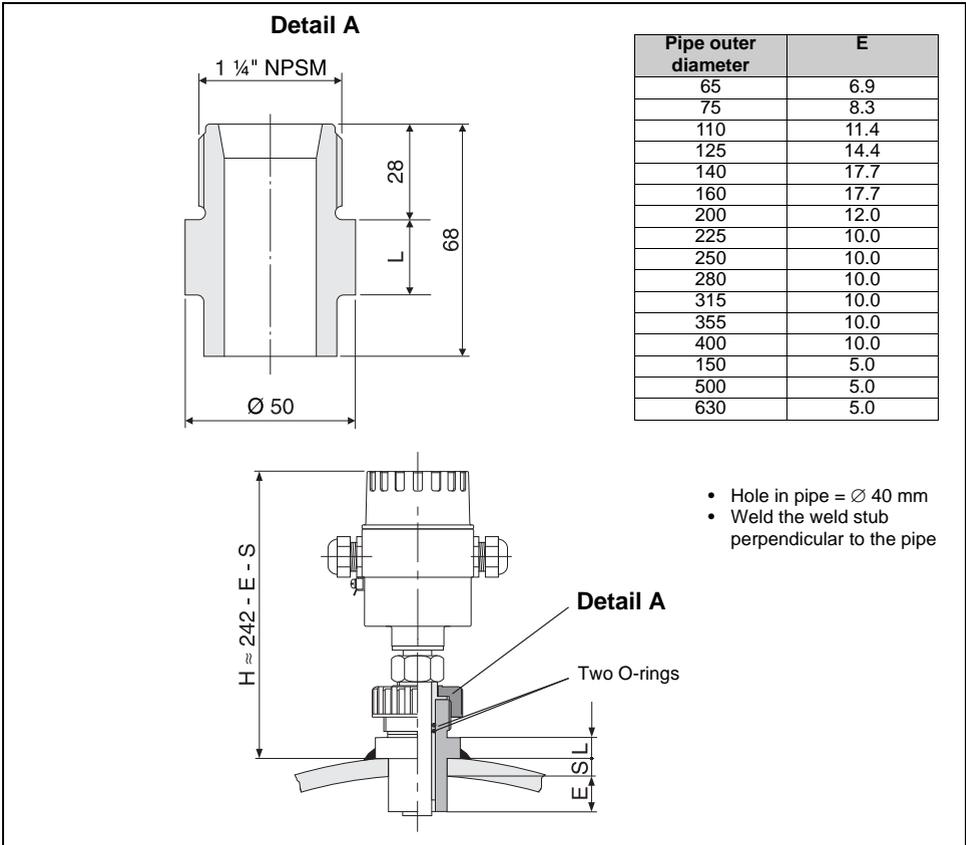
$$L = 40 - S - E$$

S = pipe wall thickness

E = insertion depth of the plastic weld nipple (E can be obtained from the table below)

⚠ Caution!

- Observe the electrode axis orientation (see page 8).
- Use only the Magphrant version for mounting in plastic piping (different insertion depths)!



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11 Mounting in plastic piping for diameters \geq DN 65

4 Electrical Connection

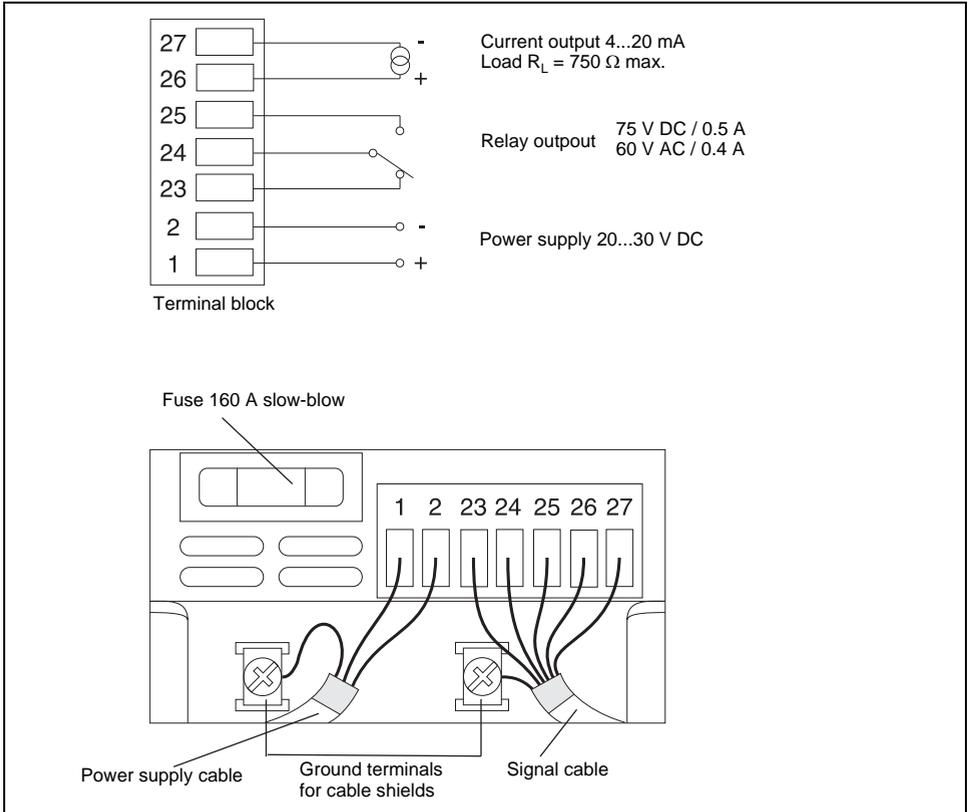
4.1 General Information

Note both the polarity and operating voltage.

⚠ Warning!

Do not install, wire up or dismantle the instrument when the power supply is switched on.

4.2 Connecting the Magphant



12 Electrical connection

Wiring and cable specifications

Wire cross-section: max. 1.5 mm²

Cable diameter: 7...12 mm

Cable gland: PG 16

Shielded cable should always be used.

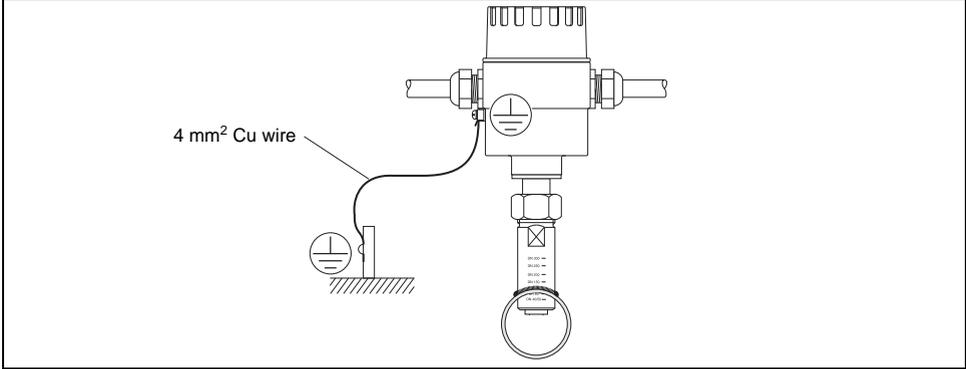
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Potential equalization

The Magphant should be connected to ground via the ground terminal at the housing to ensure complete electromagnetic compatibility.

 Note!

Take care that the ground cable is kept as short as possible.



 13 *Magphant potential equalization*

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4.3 Commissioning

Before switching on the measuring system, the following checks should be carried out:

- Does the directional arrow on the Magphant agree with the actual flow direction, i.e. do the two PG 16 cable glands lie at 90° to the direction of flow?
- Check the electrical connections and terminal assignments as shown on page 13.
- Check that the local power supply agrees with the information stated on the nameplate.

The following procedure should now be carried out:

1. Set miniature switch 1 (test mode) to the "normal" position (see page 17).
2. Set the miniature switches 2 to 4 for
 - time constant / relay latch time
 - relay function
 - min. / max. fail-safe
 as appropriate.
3. After switching on the power supply, the outputs are deactivated for 5s (relay de-energised and current output remains at 0 mA). Both LEDs flash during this procedure.
4. Set the full-scale value. This can be done in two ways: Full-scale value with actual flow (local calibration)
 - Take into account general flowrates anticipated.
 - Turn the full-scale potentiometer until the green LED lights up (see page 16).
 Setting the full-scale value without actual flow
 - Set the full-scale potentiometer at the mean flow rate anticipated.
5. Use the limit switch to set the relay switchpoint in % of the preset full-scale as described in Point 4.

 Note!

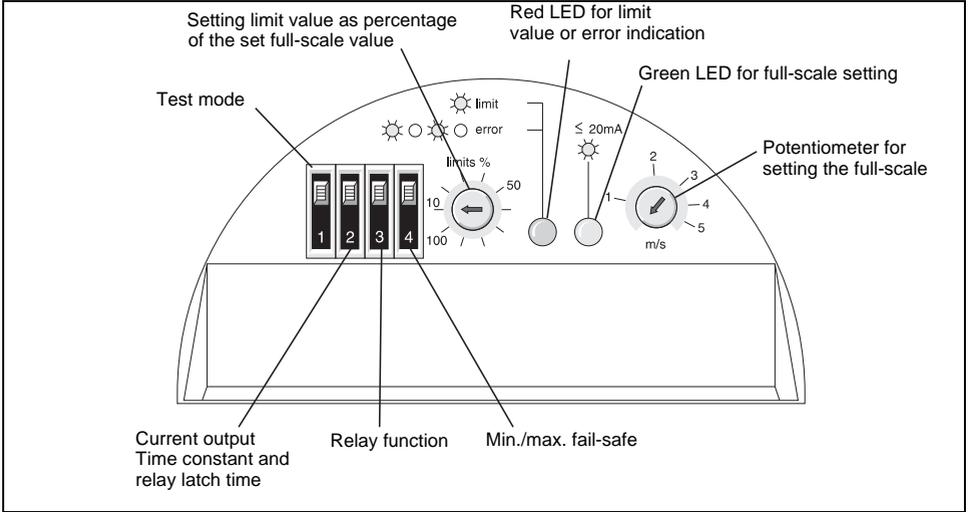
A detailed description of the display and operating elements is given on pages 15/16.

5 Operation

5.1 Operating and Display Surfaces

Note!

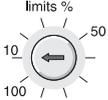
Customer settings can be noted on the operating and display surface.



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14 Operating and display elements with factory settings

Functions of the operating and display elements	
Operating and display element (factory setting)	Description of function
<p>t = 3 s t = 10 s</p>	<p>Time constant / Relay latch time The times t = 3 s and t = 10 s correspond to the current output time constant and also to the relay latch time.</p> <p>t = 3 s: The relay switches immediately and then remains in this state for 3 seconds.</p> <p>t = 10 s: The relay first switches when the measured value is below or above the limit value for a continuous 10 seconds.</p>
<p>limit limit + error</p>	<p>Relay functions The relay is energised if all functions are operating correctly. The relay is de-energised immediately when an error or alarm occurs.</p> <p>limit The relay de-energises or the red LED lights up if the signal moves outside the upper or lower limit value (depending on the min./max. fail-safe setting).</p> <p>(limit) + error The same function as for "limit", but in addition: The relay de-energises if the flow rate is larger than the measurable value of the Magphant or if an instrument error occurs. The red LED flashes. "Error" has higher priority than "limit".</p>

Functions of the operating and display elements	
Operating and display element (factory setting)	Description of function
 min. max.	<p>Min./max. fail-safe setting</p> <p>Maximum fail-safe: The relay de-energises if the signal rises above the limit value. The red LED lights up.</p> <p>Minimum fail-safe: The relay de-energises if the signal falls below the limit value. The red LED lights up.</p>
 Potentiometer m/s  Green LED	<p>Full-scale setting</p> <p>The full-scale setting is infinitely variable using this potentiometer between 1...5 m/s.</p> <p>Turning the potentiometer</p> <p>The transition from a green LED which is off to a lighted LED shows agreement between the momentary flow velocity and the set full-scale value, at which the current output will be set to 20 mA.</p> <p>Green LED</p> <p>Lit: When the actual flow rate is smaller than the set full-scale value, i.e. $I = <20$ mA.</p>
 Limit value switch	<p>Setting the limit value</p> <p>A limit value as a % of the full-scale value is set using this rotary switch. It is adjustable in 10 % steps from 10 % to 100 %.</p>
 Red LED	<p>Red LED</p> <p>Lit: Limit value reached</p> <p>Flashing: (1.5 Hz) Error indication (see page 17)</p>

 **Note!**

The function of the miniature switch for the test mode is described on page 17.

6 Troubleshooting and Remedies

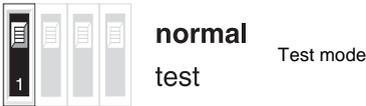
6.1 Response of the Measuring System to Faults

- Error messages which occur during measurement are always indicated via the current and, depending on the preset relay function, also via the relay output.
- In addition, a system or process error is always indicated when the red LED flashes.

Type of error		Relay (when set in "limit+ error" position)	Red LED	Current output
System errors:	Amplifier error EEPROM error	de-energised	flashing	2 mA
Process errors:	Overflow	de-energised	flashing	2 mA

6.2 Checking the Electronics

The Magphant can be set to a test mode using miniature switch No. 1:

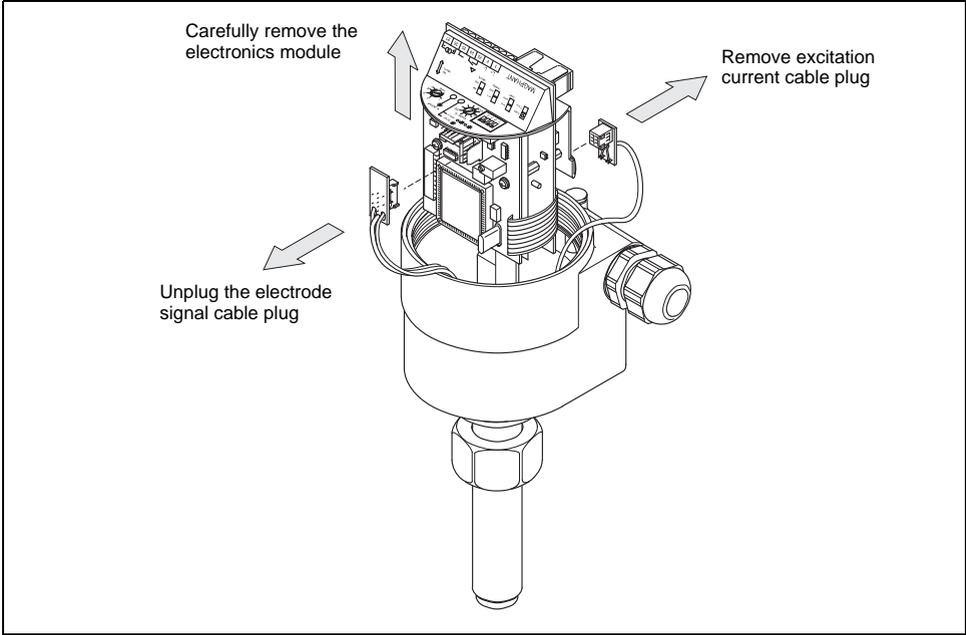


1. Set test mode switch to "test".
2. Turn the full-scale potentiometer anticlockwise until it comes to the mechanical stop, the current output must now be exactly 20 mA.
3. If this is not the case, then the electronics module must be replaced.

6.3 Replacing the Electronics Module

⚠ Warning!

Switch off the power supply before unscrewing the cover to the electronics compartment.



BA025Y15

 15 Replacing the electronics module

Procedure:

1. Switch off the power supply.
2. Unscrew the housing cover.
3. Remove all wires from the terminal block.
4. Undo the Phillips screws of the circuit board plate.
5. Undo the mounting screw of the ground wire (cable socket).
6. Carefully remove the board support plate from the housing.
7. Remove the excitation current cable plug from the power supply board.
8. Remove the electrode signal cable plug from the amplifier board.
9. Remove the old electronics module.
10. Replace with a new electronics module and reassemble in reverse order.

7.2 Technical Data

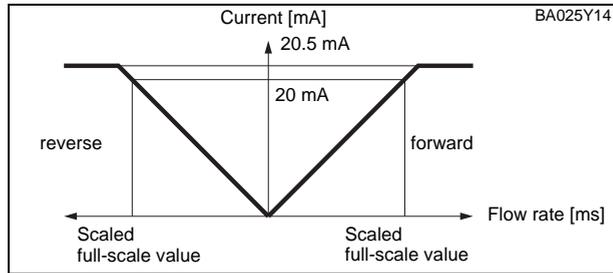
Power supply 24 V DC (20...30 V DC)

Power consumption <2.5 W

Outputs ■ Current output 4...20 mA, active

The measuring system can measure flow in both directions, i.e. bidirectionally.

The current output is always positive. The relay responds to both flow directions.

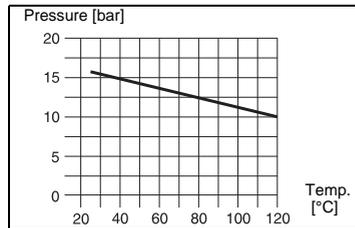


■ Relay output
Potential-free change-over contact
60 V AC / 0.4 A or 75 V DC / 0.5 A

Ambient temperature -20...60 °C

Process temperature -20...120 °C (weld stub 1.4435 with clamp ring)
-20...100 °C (weld stub St. 37 with clamp ring and NBR gasket)

Pressure 16 bar at 25 °C
10 bar at 120 °C



Full-scale value 1...5 m/s (infinitely variable)

Accuracy ±2% o.r. at measuring electrode with local calibration at flow velocities >1 m/s

Reproducibility ±2% o.r.

Conductivity	≥20 μS/cm
Interference immunity	acc. to CE EN 50081-1-2 and EN 50082-1-2
Protection type	IP 66 / NEMA 4X / Type 4X

Materials

Sensor	Sensor tip: PVDF, Viton O-ring Electrodes: 1.4435/316L Sensor sleeve: <ul style="list-style-type: none"> ■ 1.4435/316L with 1.4571/316Ti clamp ring for 1.4435/316L weld stub ■ 1.4435/316L with clamp ring and NBR gasket for St.37/A570 weld stub
Housing	Aluminium, epoxy powder coated
Weld stub (for steel piping)	1.4435/316L St.37/A570
Adapter piece (for plastic piping)	1.4435/316L (with 2 Viton O-rings)
Plastic union nut (for plastic piping)	PVC

Approvals

CENELEC:
 VDE 0165 manufacturers certificate for Zone 2
 SEV: Ex nV/W IIC T4...T6, Zone 2
 FM: NI Cl I Div 2 Gp ABCD; DIP/II, III/1/EFG, NEMA 4X
 CSA: Class I Div 2, Groups A,B,C and D;
 Class II E,F and G, Class III; Type 4X

Thermal data and temperature classes for Ex Zone 2

IEC 758	T _{fluid}	T _{ambient}
T1	100° C/120° C	60° C
T2	100° C/120° C	60° C
T3	100° C/120° C	60° C
T4	100° C/120° C	60° C
T5	95° C/ 95° C	60° C
T6	80° C/ 80° C	40° C

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