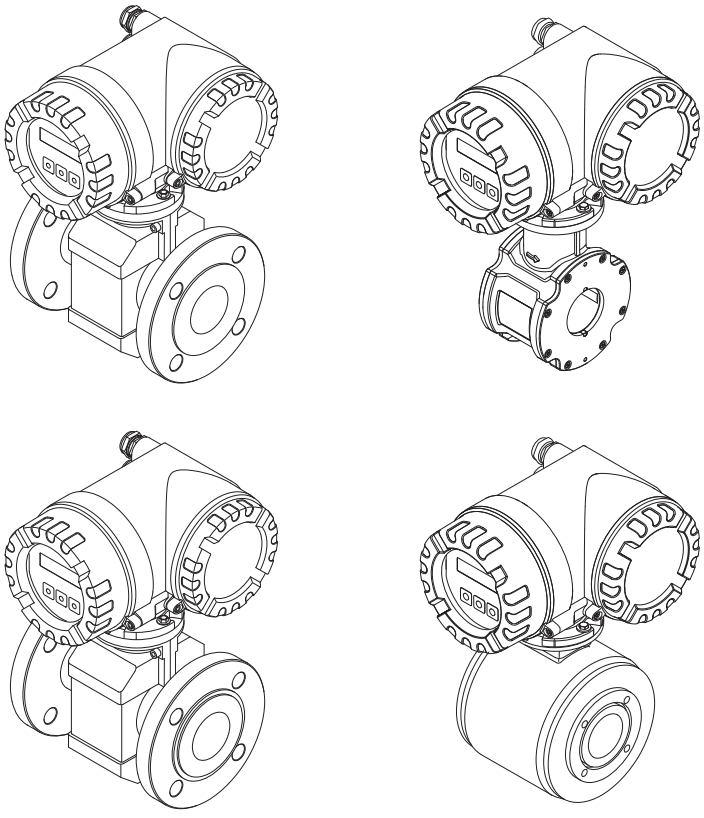
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71385935

Valid as of software version
V 2.04.XX (device software)

Operating Instructions
Proline Promag 50
HART

Electromagnetic flowmeter



Endress+Hauser
People for Process Automation

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People for Process Automation

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1 Safety instructions

1.1 Designated use

The measuring device described in this Operating Manual is to be used only for measuring the flow rate of conductive fluids in closed pipes.

A minimum conductivity of 20 µS/cm is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5 µS/cm.

Examples:
- Acids, alkalis
- Drinking water, wastewater, sewage sludge
- Milk, beer, wine, mineral water, etc.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

1.2 Installation, commissioning and operation

Please note the following:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood this Operating Manual and must follow the instructions it contains.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in the Operating Manual is mandatory.
- With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials. However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance. For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application.
  The user is responsible for the choice of suitable wetted materials in the process.
- If welding work is performed on the piping system, do not ground the welding appliance through the Promag flowmeter.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded apart from when special protective measures are taken (e.g. galvanically isolated SELV or PELV power supply)
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Please note the following:
- Measuring systems for use in hazardous environments are accompanied by separate Ex documentation, which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this Ex documentation indicates the approval and the certification body (e.g. Ex Europe, FM USA, CSA Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendations NE 21 and NE 43.
- Depending on the application, the seals of the process connections of the Promag H sensor require periodic replacement.

- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

1.4 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.
To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use".
The devices can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in this Operating Manual by the following icons:



Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.



Caution!
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.



Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Identification

2.1 Device designation

The flow measuring system consists of the following components:

- Promag 50 transmitter
- Promag D/E/H/L/P/W sensor

Two versions are available:
- Compact version: Transmitter and sensor form a single mechanical unit.
- Remote version: Transmitter and sensor are installed separately.

2.1.1 Nameplate of the transmitter

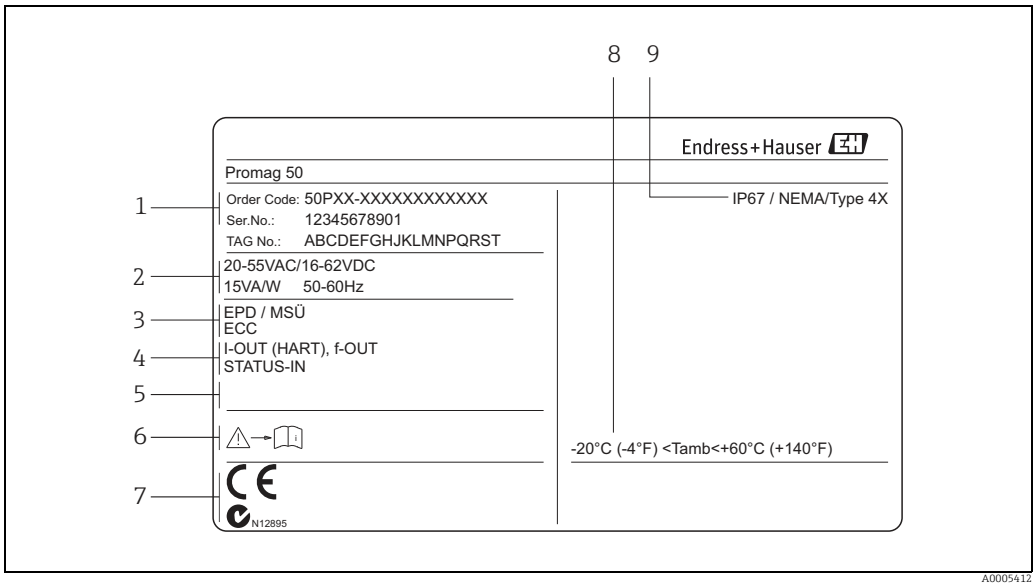


Fig. 1: Nameplate specifications for the "Promag 50" transmitter (example)

1 Ordering code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply, frequency, power consumption
3 Additional information:
EPD/MSÜ: with Empty Pipe Detection
ECC: with electrode cleaning
4 Available inputs and outputs:
I-OUT (HART): with current output (HART)
f-OUT (HART): with frequency output
STATUS-IN: with status input (power supply)
5 Reserved for information on special products
6 Observe device documentation
7 Reserved for additional information on device version (approvals, certificates)
8 Permitted ambient temperature range
9 Degree of protection

2.1.2 Nameplate of the sensor

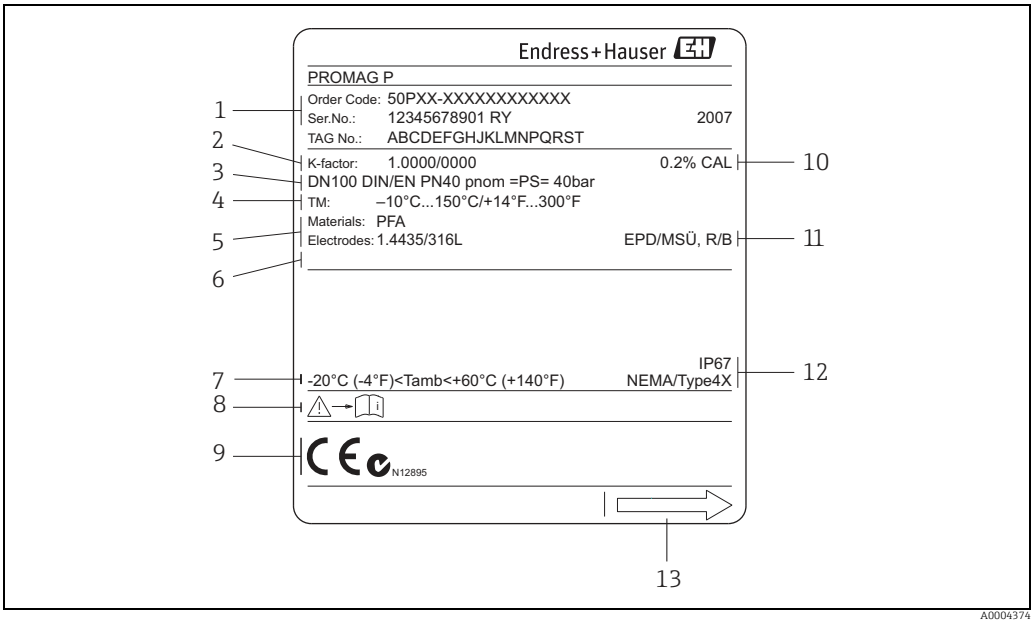


Fig. 2: Nameplate specifications for the "Promag" sensor (example)

1 Ordering code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Calibration factor with zero point
3 Nominal diameter / Pressure rating
4 Fluid temperature range
5 Materials: lining/measuring electrodes
6 Reserved for information on special products
7 Permitted ambient temperature range
8 Observe device documentation
9 Reserved for additional information on device version (approvals, certificates)
10 Calibration tolerance
11 Additional information (examples):
- *EPD/MSÜ: with Empty Pipe Detection electrode*
- *R/B: with reference electrode*

12 Degree of protection
13 Flow direction

2.1.3 Nameplate, connections

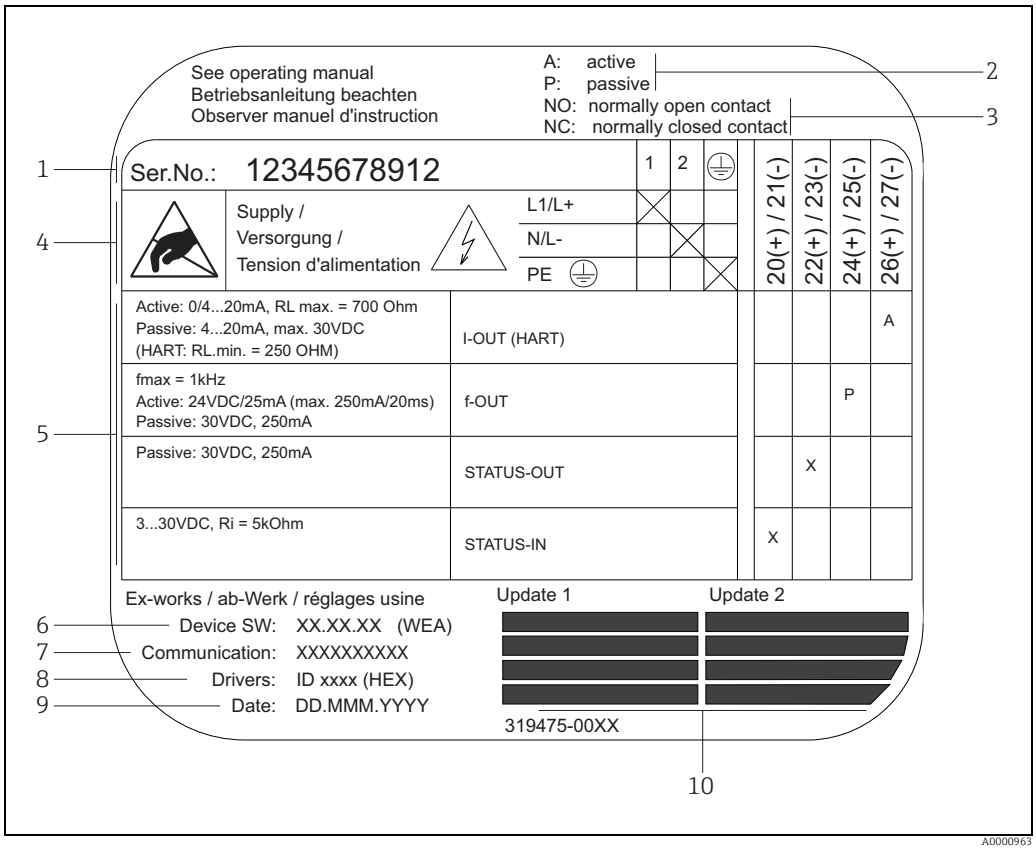


Fig. 3: Nameplate specifications for transmitter (example)

1 Serial number
2 Possible configuration of current output
3 Possible configuration of relay contacts
4 Terminal assignment, cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L– for DC*
5 Signals present at inputs and outputs, possible configuration and terminal assignment (20 to 27), see also "Electrical values of inputs/outputs"
6 Version of device software currently installed
7 Installed communication type, e.g.: HART, PROFIBUS PA, etc.
8 Information on current communication software (Device Revision and Device Description), e.g.: Dev. 01 / DD 01 for HART
9 Date of installation
10 Current updates to data specified in points 6 to 9

2.2 Certificates and approvals

The devices are designed to meet state-of-the-art safety requirements in accordance with sound engineering practice. They have been tested and left the factory in a condition in which they are safe to operate.

The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use" and with the EMC requirements of IEC/EN 61326/A1.

The measuring system described in this Operating Manual is therefore in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

2.3 Registered trademarks

KALREZ® and VITON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

HistoROM™, S-DAT®, Field Xpert™, FieldCare®, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of the Endress+Hauser Group.

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

On receipt of the goods, check the following:
- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2 Transport

The following instructions apply to unpacking and to transporting the device to its final location:
- Transport the devices in the containers in which they are delivered.
- Do not remove the protective plates or caps on the process connections until you are ready to install the device. This is particularly important in the case of sensors with PTFE linings.

Special notes on flanged devices

Caution!
- The wooden covers mounted on the flanges from the factory protect the linings on the flanges during storage and transportation. In case of Promag L they are additionally used to hold the lap joint flanges in place. Do not remove these covers until **immediately before** the device in the pipe.
- Do not lift flanged devices by the transmitter housing, or the connection housing in the case of the remote version.

Transporting flanged devices DN ≤ 300 (12")

Use webbing slings slung round the two process connections. Do not use chains, as they could damage the housing.

Warning!
Risk of injury if the measuring device slips. The center of gravity of the assembled measuring device might be higher than the points around which the slings are slung.
At all times, therefore, make sure that the device does not unexpectedly turn around its axis or slip.

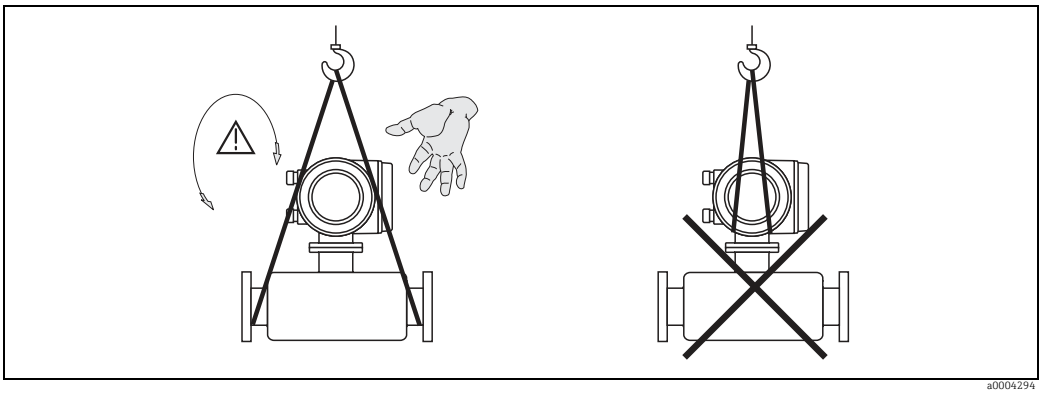


Fig. 4: Transporting sensors with DN ≤ 300 (12")

Transporting flanged devices DN ≥ 350 (14")

Use only the metal eyes on the flanges for transporting the device, lifting it and positioning the sensor in the piping.

Caution!
Do not attempt to lift the sensor with the tines of a fork-lift truck beneath the metal casing. This would buckle the casing and damage the internal magnetic coils.

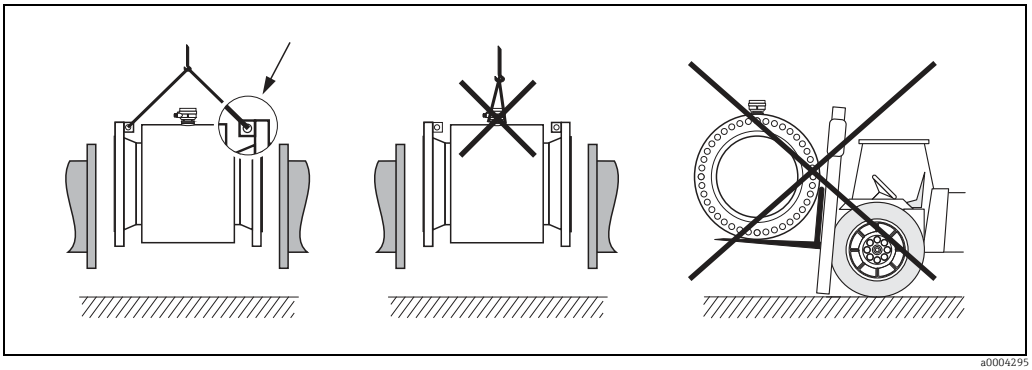


Fig. 5: Transporting sensors with DN ≥ 350 (14")

3.1.3 Storage

Please note the following:
- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors → 106.
- Do not remove the protective plates or caps on the process connections until you are ready to install the device. This is particularly important in the case of sensors with PTFE linings.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Choose a storage location where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

3.2 Installation conditions

3.2.1 Dimensions

The dimensions and installation lengths of the sensor and transmitter can be found in the "Technical Information" for the device in question. This document can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section on → 130.

3.2.2 Mounting location

Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following locations:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.

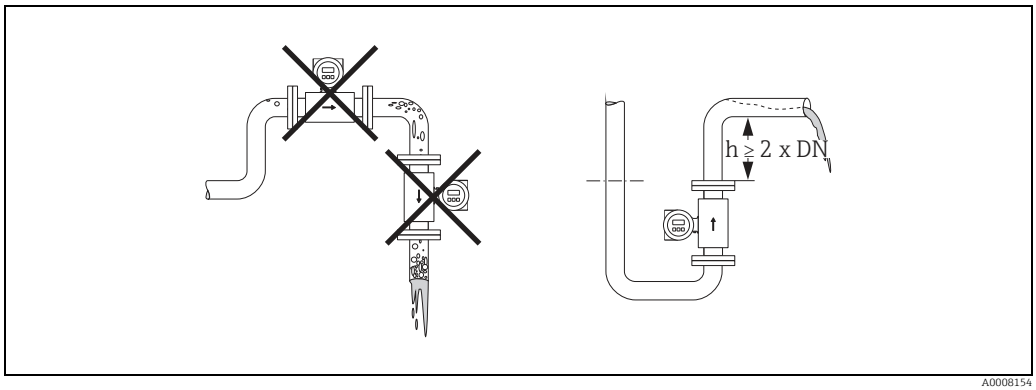


Fig. 6: Mounting location

Installation of pumps

Do **not** install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the lining's resistance to partial vacuum can be found on → 111.

It might be necessary to install pulse dampers in systems incorporating reciprocating, diaphragm or peristaltic pumps. Information on the measuring system's resistance to vibration and shock can be found on → 106.

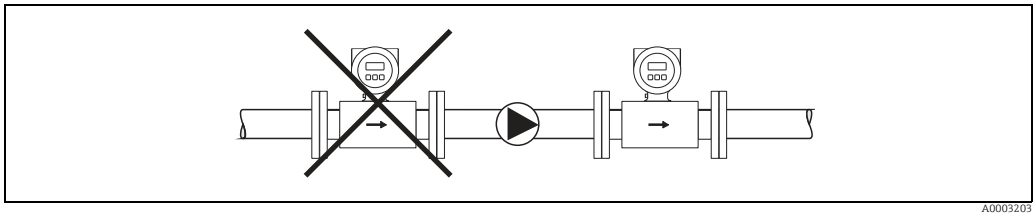


Fig. 7: Installation of pumps

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The Empty Pipe Detection function (EPD → 80) offers additional protection by detecting empty or partially filled pipes.

Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.

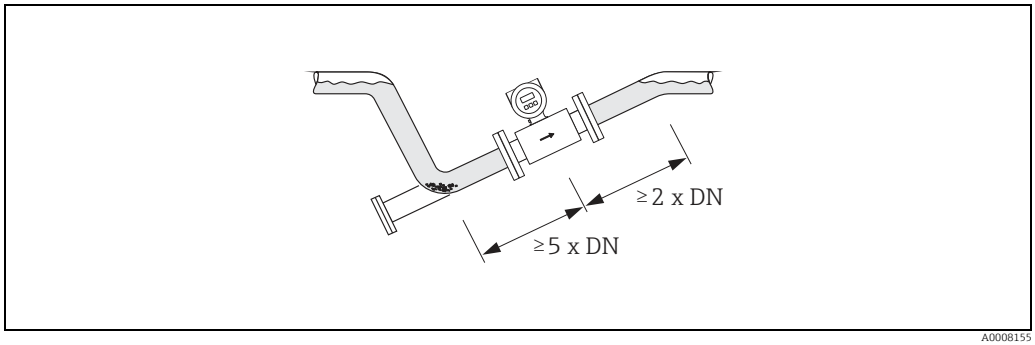


Fig. 8: Installation in a partially filled pipe

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube.
This measure also prevents the system losing prime, which could cause air pockets.
Information on the lining's resistance to partial vacuum can be found on → 111.

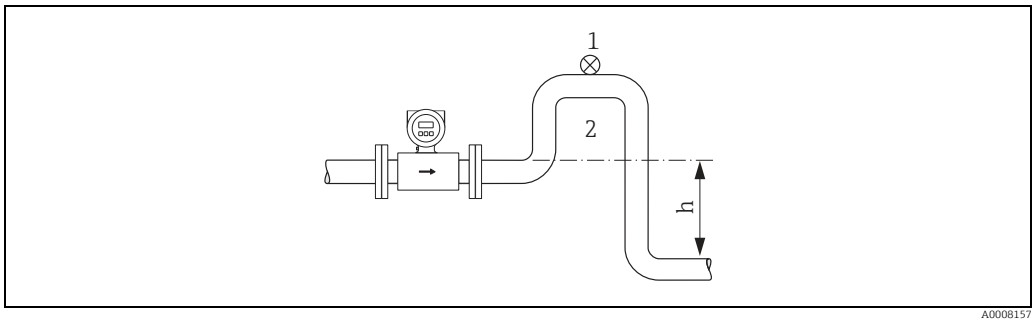


Fig. 9: Measures for installation in a down pipe

1 Vent valve
2 Pipe siphon
h Length of down pipe (h ≥ 5 m (16.3 ft)

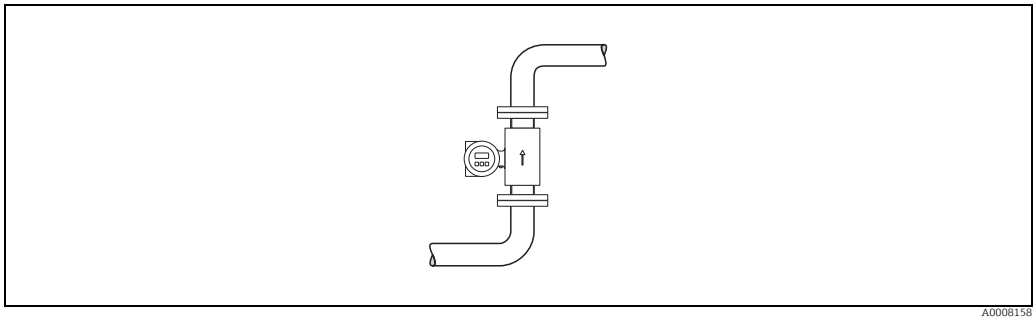
3.2.3 Orientation

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube. However, Promag offers the additional Empty Pipe Detection (EPD) function to ensure the detection of partially filled measuring tubes, e.g. in the case of degassing fluids or varying process pressure:

- Electrode Cleaning Circuit (ECC) for applications with accretive fluids, e.g. electrically conductive deposits (→ "Description of Device Functions" manual).
- Empty Pipe Detection (EPD) ensures the detection of partially filled measuring tubes, e.g. in the case of degassing fluids (→ 🖹 80).
- Exchangeable Measuring Electrodes for abrasive fluids (→ 🖹 99).

Vertical orientation

This is the ideal orientation for self-emptying piping systems and for use in conjunction with Empty Pipe Detection.



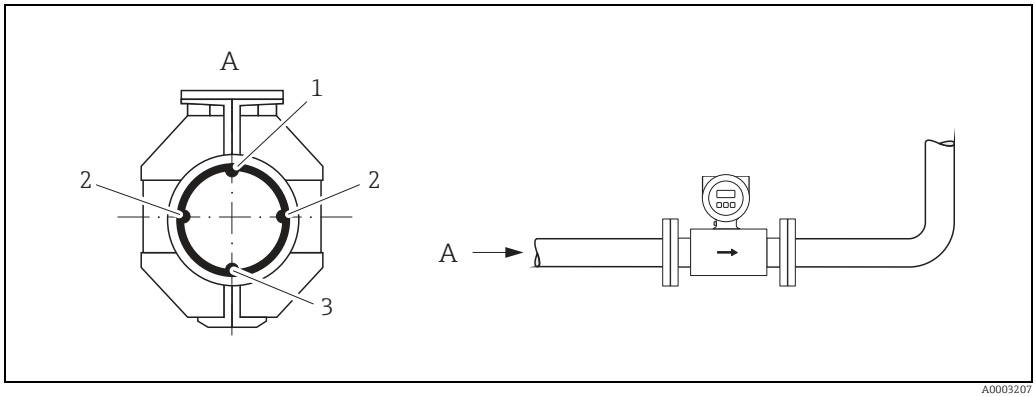
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Fig. 10: Vertical orientation

Horizontal orientation

The measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!
Empty Pipe Detection functions correctly only when the measuring device is installed horizontally and the transmitter housing is facing upward (→ 🖹 10). Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled or empty.



A0003207

Fig. 11: Horizontal orientation

1 EPD electrode for the detection of empty pipes (not with Promag D and Promag H (DN 2 to 8/ 1/12 to 5/16"))
2 Measuring electrodes for signal detection
3 Reference electrode for the potential equalization (not with Promag D and H)

Inlet and outlet run

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc. The following inlet and outlet runs must be observed in order to meet accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

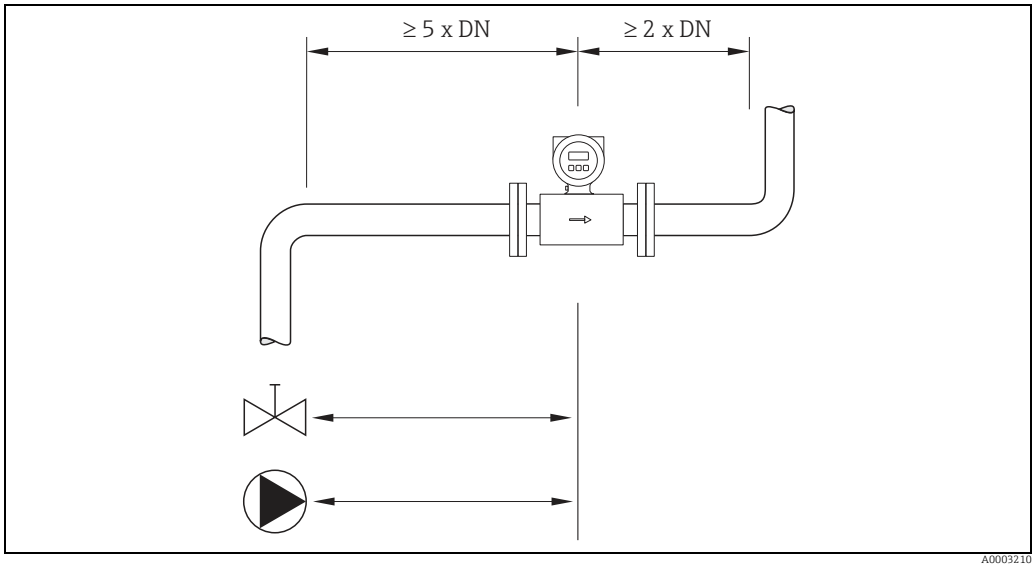


Fig. 12: Inlet and outlet runs

3.2.4 Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on resistance to vibration and shock can be found on → 106.

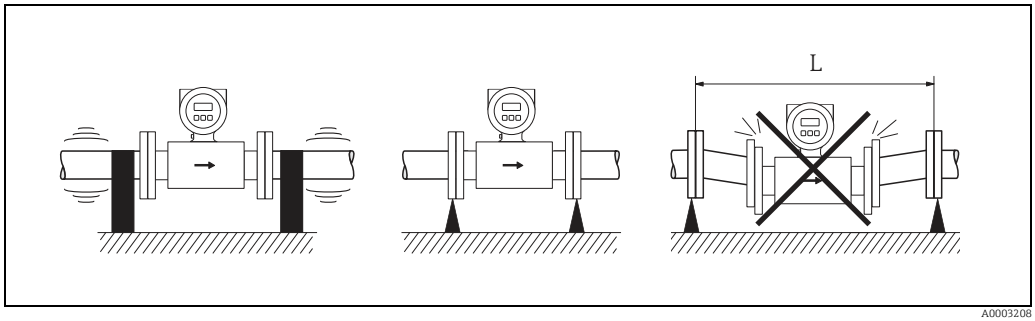


Fig. 13: Measures to prevent vibration of the device (L > 10 m (32.8 ft))

3.2.5 Foundations, supports

If the nominal diameter is DN ≥ 350 (14"), mount the sensor on a foundation of adequate load-bearing strength.

Caution!
Risk of damage.
Do not support the weight of the sensor on the metal casing: the casing would buckle and damage the internal magnetic coils.

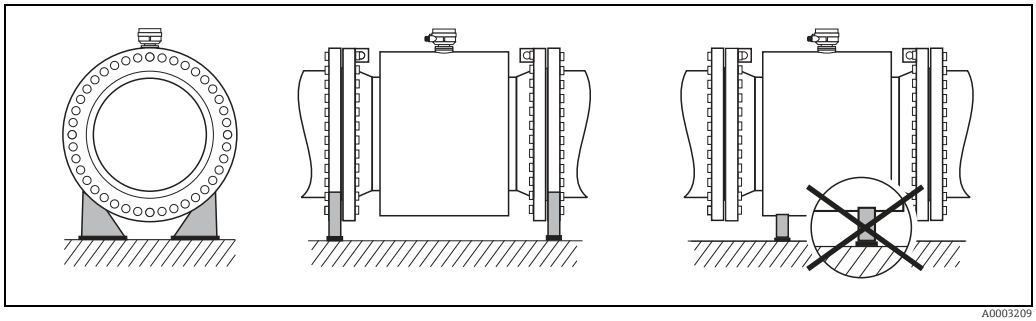


Fig. 14: Correct support for large nominal diameters (DN ≥ 350 / 14")

3.2.6 Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes.
The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
- The nomogram only applies to liquids of viscosity similar to water.
- For Promag H the selection of a pipe with larger diameter for high viscosities of the fluid may be considered to reduce the pressure loss.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (*downstream* from the reduction) and the d/D ratio.

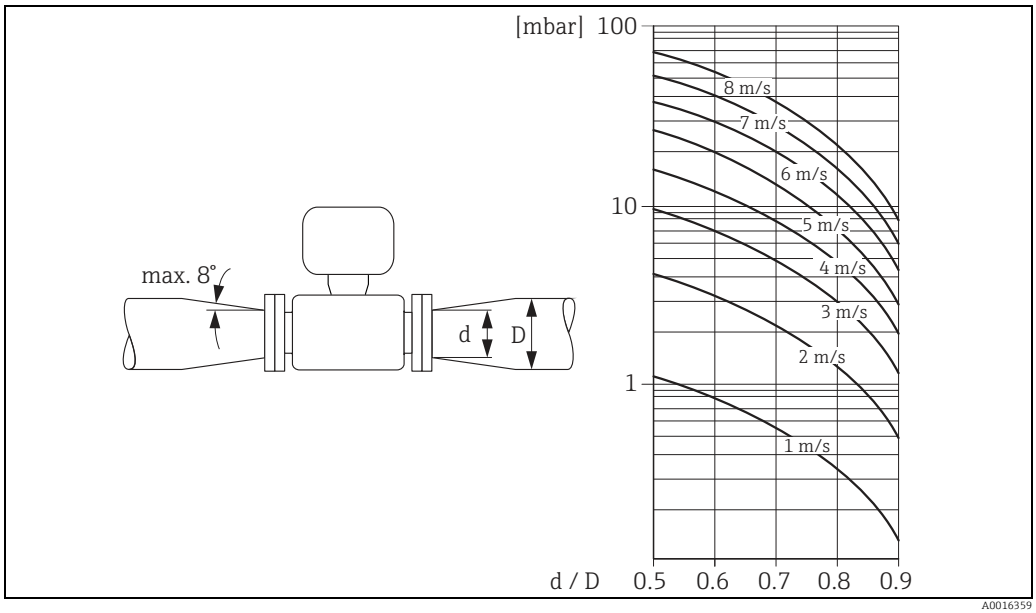


Fig. 15: Pressure loss due to adapters

3.2.7 Nominal diameter and flow rate

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 and 3 m/s (6.5 to 9.8 ft/s).

The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:
- v < 2 m/s (v < 6.5 ft/s): for low conductivity values
- v > 2 m/s (v > 6.5 ft/s): for media that produce buildup (e.g. milk with high fat content)

Note!
- A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter → 16.
- For Promag H the selection of a pipe with nominal diameter > DN 8 (⅜") for fluids with high levels of solids may be considered, to improve the stability of the signal and cleanability due to larger electrodes.

Recommended flow (SI units)

Nominal diameter	Promag D	Promag E/P	Promag H	Promag L	Promag W
[mm]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [dm³/min]				
2	–	–	0.06 to 1.8	–	–
4	–	–	0.25 to 7	–	–
8	–	–	1 to 30	–	–
15	–	4 to 100	4 to 100	–	–
25	9 to 300	9 to 300	9 to 300	9 to 300	9 to 300
32	–	15 to 500	–	15 to 500	15 to 500
40	25 to 700	25 to 700	25 to 700	25 to 700	25 to 700
50	35 to 1100	35 to 1100	35 to 1100	35 to 1100	35 to 1100
65	60 to 2000	60 to 2000	60 to 2000	60 to 2000	60 to 2000
80	90 to 3000	90 to 3000	90 to 3000	90 to 3000	90 to 3000
100	145 to 4700	145 to 4700	145 to 4700	145 to 4700	145 to 4700
125	–	220 to 7500	220 to 7500	220 to 7500	220 to 7500
[mm]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [m³/h]				
150	–	20 to 600	20 to 600	20 to 600	20 to 600
200	–	35 to 1100	–	35 to 1100	35 to 1100
250	–	55 to 1700	–	55 to 1700	55 to 1700
300	–	80 to 2400	–	80 to 2400	80 to 2400
350	–	110 to 3300	–	110 to 3300	110 to 3300
375	–	–	–	140 to 4200	140 to 4200
400	–	140 to 4200	–	140 to 4200	140 to 4200
450	–	180 to 5400	–	180 to 5400	180 to 5400
500	–	220 to 6600	–	220 to 6600	220 to 6600
600	–	310 to 9600	–	310 to 9600	310 to 9600
700	–	–	–	420 to 13500	420 to 13500
750	–	–	–	480 to 15000	480 to 15000
800	–	–	–	550 to 18000	550 to 18000
900	–	–	–	690 to 22500	690 to 22500
1000	–	–	–	850 to 28000	850 to 28000
1200	–	–	–	1250 to 40000	1250 to 40000
1400	–	–	–	1700 to 55000	1700 to 55000
1600	–	–	–	2200 to 70000	2200 to 70000
1800	–	–	–	2800 to 90000	2800 to 90000
2000	–	–	–	3400 to 110000	3400 to 110000
2200	–	–	–	4100 to 136000	–
2400	–	–	–	4800 to 162000	–

Recommended flow (US units)

Nominal diameter	Promag D	Promag E/P	Promag H	Promag L	Promag W
[inch]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [gal/min]				
1/12"	–	–	0.015 to 0.5	–	–
1/8"	–	–	0.07 to 2	–	–
3/8	–	–	0.25 to 8	–	–
½"	–	1.0 to 27	1.0 to 27	–	–
1"	2.5 to 80	2.5 to 80	2.5 to 80	2.5 to 80	2.5 to 80
1 ½"	7 to 190	7 to 190	7 to 190	7 to 190	7 to 190
2"	10 to 300	10 to 300	10 to 300	10 to 300	10 to 300
3"	24 to 800	24 to 800	24 to 800	24 to 800	24 to 800
4"	40 to 1250	40 to 1250	40 to 1250	40 to 1250	40 to 1250
6"	–	90 to 2650	90 to 2650	90 to 2650	90 to 2650
8"	–	155 to 4850	–	155 to 4850	155 to 4850
10"	–	250 to 7500	–	250 to 7500	250 to 7500
12"	–	350 to 10600	–	350 to 10600	350 to 10600
14"	–	500 to 15000	–	500 to 15000	500 to 15000
15"	–	–	–	600 to 19000	600 to 19000
16"	–	600 to 19000	–	600 to 19000	600 to 19000
18"	–	800 to 24000	–	800 to 24000	800 to 24000
20"	–	1000 to 30000	–	1000 to 30000	1000 to 30000
24"	–	1400 to 44000	–	1400 to 44000	1400 to 44000
28"	–	–	–	1900 to 60000	1900 to 60000
30"	–	–	–	2150 to 67000	2150 to 67000
32"	–	–	–	2450 to 80000	2450 to 80000
36"	–	–	–	3100 to 100000	3100 to 100000
40"	–	–	–	3800 to 125000	3800 to 125000
42"	–	–	–	4200 to 135000	4200 to 135000
48"	–	–	–	5500 to 175000	5500 to 175000
[inch]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [Mgal/d]				
54"	–	–	–	9 to 300	9 to 300
60"	–	–	–	12 to 380	12 to 380
66"	–	–	–	14 to 500	14 to 500
72"	–	–	–	16 to 570	16 to 570
78"	–	–	–	18 to 650	18 to 650
84"	–	–	–	24 to 800	–
90"	–	–	–	27 to 910	–

3.2.8 Length of connecting cable

In order to ensure measuring accuracy, comply with the following instructions when installing the remote version:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between sensor and transmitter, if necessary.
- The permissible cable length Lmax depends on the fluid conductivity (→ 16).
- The maximum connecting cable length is 10 m (32.8 ft) when empty pipe detection (EPD → 80) is switched on.

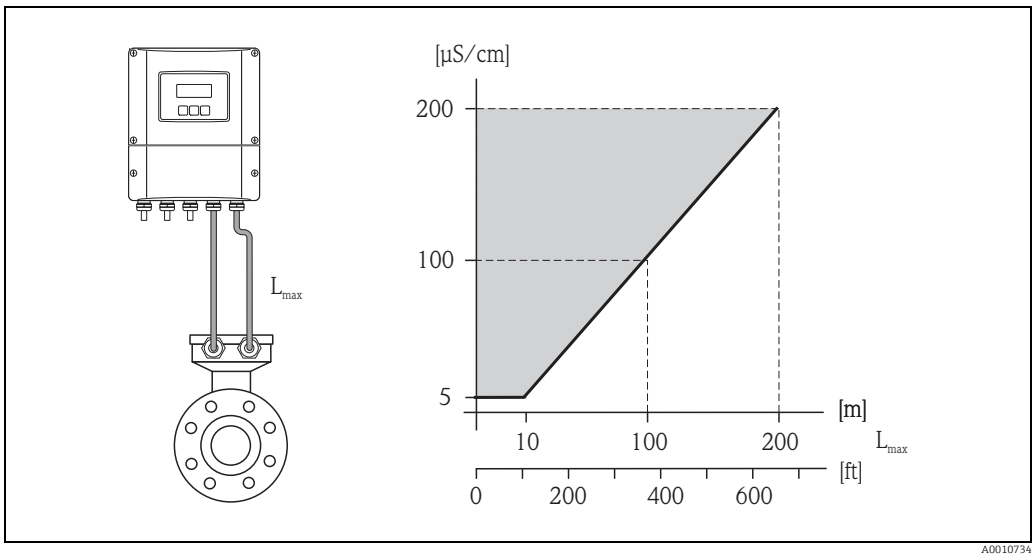


Fig. 16: Permissible cable length for the remote version

Area shaded gray = permitted range
L_{max} = connecting cable length

3.3 Installation instructions

3.3.1 Installing the Promag D sensor

The sensor is installed between the pipe flanges with a mounting kit. The device is centered using recesses on the sensor (→ 🖹 21).

Note!
A mounting kit consisting of mounting bolts, seals, nuts and washers can be ordered separately (→ 🖹 83). Centering sleeves are provided with the device if they are required for the installation.

Caution!
When installing the transmitter in the pipe, observe the necessary torques (→ 🖹 22).

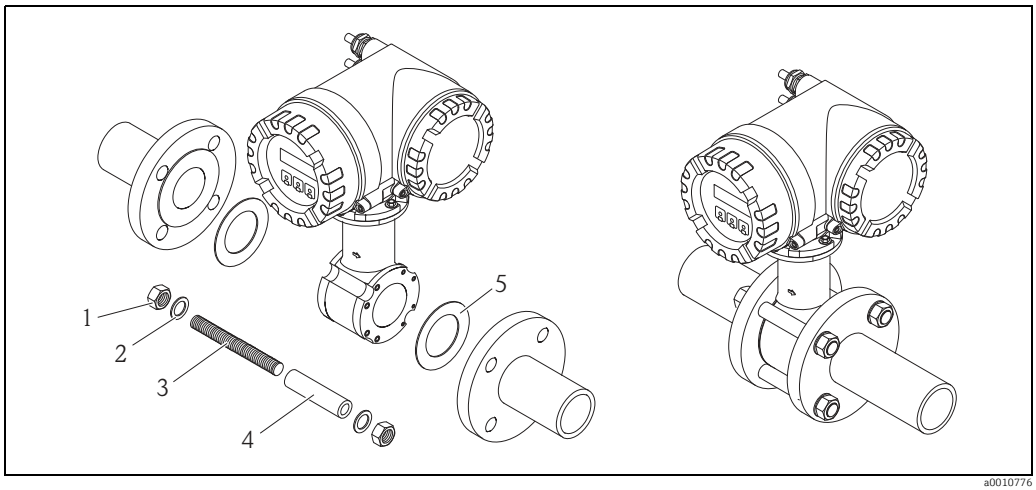


Fig. 17: Mounting the sensor

1 Nut
2 Washer
3 Mounting bolt
4 Centering sleeve
5 Seal

Seals

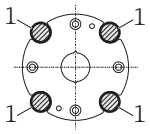
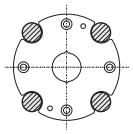
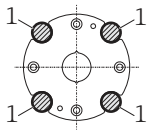
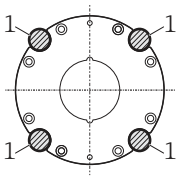
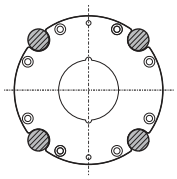
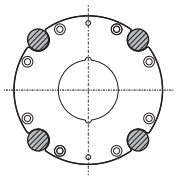
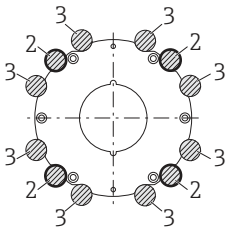
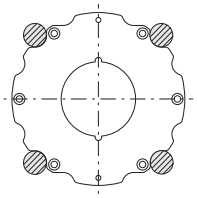
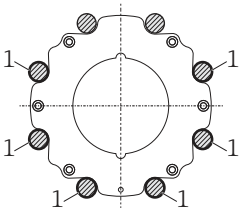
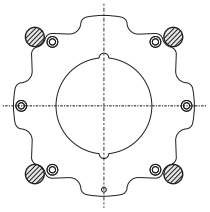
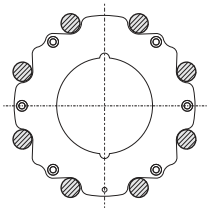
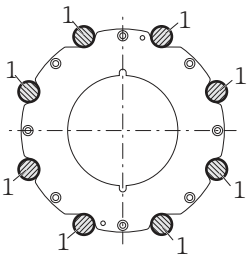
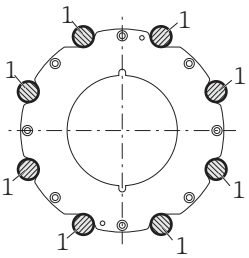
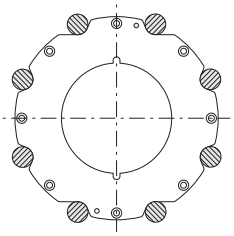
When installing the sensor, make sure that the seals used do not project into the pipe cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Note!
Use seals with a hardness rating of 70° Shore A.

Arrangement of the mounting bolts and centering sleeves

The device is centered using recesses on the sensor. The arrangement of the mounting bolts and the use of the centering sleeves supplied depend on the nominal diameter, the flange standard und the pitch circle diameter.

	Process connection		
	EN (DIN)	ASME	JIS
DN 25 to 40 (1 to 1 ½")	 A0010896	 A0010824	 A0010896
DN 50 (2")	 A0010897	 A0010825	 A0010825
DN 65 (–)	 A0012170	– – – – – – – – – – – – – – – –	 A0012171
DN 80 (3")	 A0010898	 A0010827	 A0010826
DN 100 (4")	 A0012168	 A0012168	 A0012169

1 = Mounting bolts with centering sleeves
2 = EN (DIN) flanges: 4-hole → with centering sleeves
3 = EN (DIN) flanges: 8-hole → without centering sleeves

Screw tightening torques (Promag D)

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

The tightening torques apply to situations where an EPDM soft material flat seal (e.g. 70° Shore A) is used.

Promag D screw tightening torques, mounting bolts and centering sleeves for EN 1092-1 (DIN 2501), PN 16

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque with a process flange with a smooth seal face [Nm]	Tightening torque with a process flange with a raised face [Nm]
25	4 × M12 × 145	54	19	19
40	4 × M16 × 170	68	33	33
50	4 × M16 × 185	82	41	41
65[1]	4 × M16 × 200	92	44	44
65[2]	8 × M16 × 200	–[3]	29	29
80	8 × M16 × 225	116	36	36
100	8 × M16 × 260	147	40	40

[1] EN (DIN) flanges: 4-hole → with centering sleeves
[2] EN (DIN) flanges: 8-hole → without centering sleeves
[3] A centering sleeve is not required. The device is centered directly via the sensor housing.

Promag D screw tightening torques, mounting bolts and centering sleeves for JIS B2220, 10K

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque with a process flange with a smooth seal face [Nm]	Tightening torque with a process flange with a raised face [Nm]
25	4 × M16 × 170	54	24	24
40	4 × M16 × 170	68	32	25
50	4 × M16 × 185	– *	38	30
65	4 × M16 × 200	– *	42	42
80	8 × M16 × 225	– *	36	28
100	8 × M16 × 260	– *	39	37

* A centering sleeve is not required. The device is centered directly via the sensor housing.

Promag D screw tightening torques, mounting bolts and centering sleeves for ASME B16.5, Class 150

Nominal diameter [inch]	Mounting bolts [inch]	Centering sleeve length [inch]	Tightening torque with a process flange with a smooth seal face [lbf · ft]	Tightening torque with a process flange with a raised face [lbf · ft]
1"	4 × UNC ½" × 5.70"	– *	14	7
1 ½"	4 × UNC ½" × 6.50"	– *	21	14
2"	4 × UNC 5/8" × 7.50"	– *	30	27
3"	4 × UNC 5/8" × 9.25"	– *	31	31
4"	8 × UNC 5/8" × 10.4"	5.79	28	28

* A centering sleeve is not required. The device is centered directly via the sensor housing.

3.3.2 Installing the Promag E sensor

Caution!
- The protective covers mounted on the two sensor flanges guard the PTFE, which is turned over the flanges. Consequently, do not remove these covers until **immediately before** the sensor is installed in the pipe.
- The covers must remain in place while the device is in storage.
- Make sure that the lining is not damaged or removed from the flanges.

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 24.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

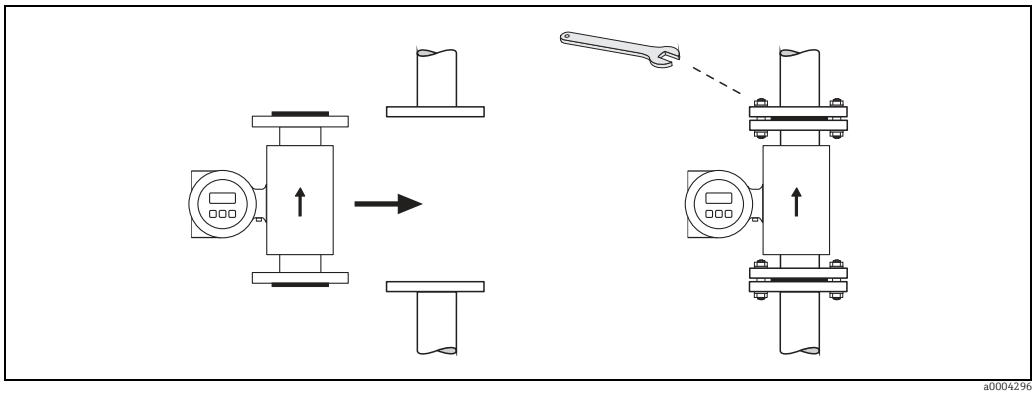


Fig. 18: Installing the Promag E sensor

Seals

Comply with the following instructions when installing seals:
- PFA or PTFE lining → **No** seals are required!
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 83).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 60.

Tightening torques for threaded fasteners (Promag E)

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Tightening torques for:
- EN (DIN) → 🖹 24
- ASME → 🖹 25
- JIS → 🖹 25

Promag E screw tightening torques for EN 1092-1 (DIN 2501), PN 6/10/16/40

Nominal diameter [mm]	EN (DIN) Pressure rating	Threaded fasteners	Flange thickness [mm]	Max. tightening torque PTFE [Nm]
15	PN 40	4 × M 12	16	11
25	PN 40	4 × M 12	18	26
32	PN 40	4 × M 16	18	41
40	PN 40	4 × M 16	18	52
50	PN 40	4 × M 16	20	65
65 *	PN 16	8 × M 16	18	43
80	PN 16	8 × M 16	20	53
100	PN 16	8 × M 16	20	57
125	PN 16	8 × M 16	22	75
150	PN 16	8 × M 20	22	99
200	PN 10	8 × M 20	24	141
200	PN 16	12 × M 20	24	94
250	PN 10	12 × M 20	26	110
250	PN 16	12 × M 24	26	131
300	PN 10	12 × M 20	26	125
300	PN 16	12 × M 24	28	179
350	PN 6	12 × M 20	22	200
350	PN 10	16 × M 20	26	188
350	PN 16	16 × M 24	30	254
400	PN 6	16 × M 20	22	166
400	PN 10	16 × M 24	26	260
400	PN 16	16 × M 27	32	330
450	PN 6	16 × M 20	22	202
450	PN 10	20 × M 24	28	235
450	PN 16	20 × M 27	40	300
500	PN 6	20 × M 20	24	176
500	PN 10	20 × M 24	28	265
500	PN 16	20 × M 30	34	448
600	PN 6	20 × M 24	30	242
600	PN 10	20 × M 27	28	345
600 *	PN 16	20 × M 33	36	658
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag E screw tightening torques for EN 1092-1, PN 6/10/16, P245GH/stainless-steel; Calculated according to EN 1591-1:2014 for flanges according to EN 1092-1:2013

Nominal diameter [mm]	EN(DIN) Pressure rating	Threaded fasteners	Flange thickness [mm]	Nom. tightening torque PTFE [Nm]
350	PN 10	16 × M 20	26	60
350	PN 16	16 × M 24	30	115

Nominal diameter [mm]	EN(DIN) Pressure rating	Threaded fasteners	Flange thickness [mm]	Nom. tightening torque PTFE [Nm]
400	PN 10	16 × M 24	26	90
400	PN 16	16 × M 27	32	155
450	PN 10	20 × M 24	28	90
450	PN 16	20 × M 27	34	155
500	PN 10	20 × M 24	28	100
500	PN 16	20 × M 30	36	205
600	PN 10	20 × M 27	30	150
600	PN 16	20 × M 33	40	310

Promag E screw tightening torques for ASME B16.5, Class 150

Nominal diameter		ASME	Threaded fasteners	Max. tightening torque PTFE	
[mm]	[inch]	Pressure rating		[Nm]	[lbf · ft]
15	½"	Class 150	4 × ½"	6	4
25	1"	Class 150	4 × ½"	11	8
40	1 ½"	Class 150	4 × ½"	24	18
50	2"	Class 150	4 × 5/8"	47	35
80	3"	Class 150	4 × 5/8"	79	58
100	4"	Class 150	8 × 5/8"	56	41
150	6"	Class 150	8 × ¾"	106	78
200	8"	Class 150	8 × ¾"	143	105
250	10"	Class 150	12 × 7/8"	135	100
300	12"	Class 150	12 × 7/8"	178	131
350	14"	Class 150	12 × 1"	260	192
400	16"	Class 150	16 × 1"	246	181
450	18"	Class 150	16 × 1 ⅛"	371	274
500	20"	Class 150	20 × 1 ⅛"	341	252
600	24"	Class 150	20 × 1 ¼"	477	352

Promag E screw tightening torques for JIS B2220, 10/20K

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque PTFE [Nm]
15	20K	4 × M 12	16
25	20K	4 × M 16	32
32	20K	4 × M 16	38
40	20K	4 × M 16	41
50	10K	4 × M 16	54
65	10K	4 × M 16	74
80	10K	8 × M 16	38
100	10K	8 × M 16	47
125	10K	8 × M 20	80
150	10K	8 × M 20	99
200	10K	12 × M 20	82
250	10K	12 × M 22	133
300	10K	16 × M 22	99

3.3.3 Installing the Promag H sensor

The sensor is supplied to order, with or without pre-installed process connections. Pre-installed process connections are secured to the sensor with 4 or 6 hex-head threaded fasteners.

Caution!
The sensor might require support or additional attachments, depending on the application and the length of the piping run. When plastic process connections are used, the sensor must be additionally supported mechanically. A wall-mounting kit can be ordered separately from Endress+Hauser as an accessory (→ 83).

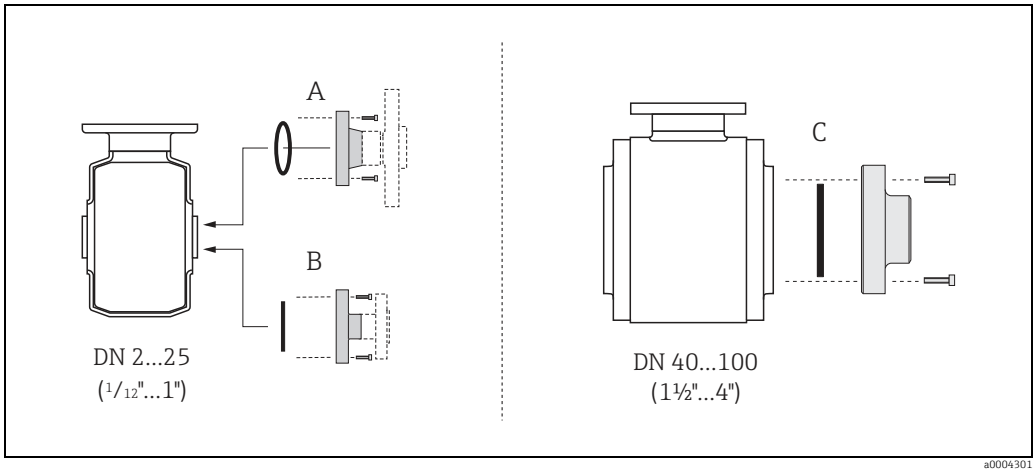


Fig. 19: Promag H process connections

A = DN 2 to 25 / 1/12 to 1": process connections with O-ring
- *Welding flanges (DIN EN ISO 1127, ODT / SMS),*
- *Flange (EN (DIN), ASME, JIS), flange PVDF (EN (DIN), ASME, JIS)*
- *External and internal thread, hose connection, PVC adhesive fitting*

B = DN 2 to 25 / 1/12 to 1": process connections with aseptic gasket vseal
- *Weld nipples (EN 10357 (DIN 11850), ODT/SMS)*
- *Clamp (ISO 2852, DIN 32676, L14 AM7)*
- *Coupling (DIN 11851, DIN 11864-1, SMS 1145)*
- *Flange DIN 11864-2*

C = DN 40 to 150 / 1½ to 6": process connections with aseptic gasket seal
- *Weld nipples (EN 10357 (DIN 11850), ODT/SMS)*
- *Clamp (ISO 2852, DIN 32676, L14 AM7)*
- *Coupling (DIN 11851, DIN 11864-1, ISO 2853, SMS 1145)*
- *Flange DIN 11864-2*

Seals

When installing the process connections, make sure that the seals are clean and correctly centered.

Caution!
- With metal process connections, you must fully tighten the screws. The process connection forms a metallic connection with the sensor, which ensures a defined compression of the seal.
- With plastic process connections, note the max. torques for lubricated threads (7 Nm / 5.2 lbf ft). With plastic flanges, always use seals between connection and counter flange.
- The seals must be replaced periodically, depending on the application, particularly in the case of gasket seals (aseptic version)!
  The period between changes depends on the frequency of cleaning cycles, the cleaning temperature and the fluid temperature. Replacement seals can be ordered as accessories → 83.

Usage and assembly of ground rings (DN 2 to 25 / 1/12 to 1")

In case the process connections are made of plastic (e.g. flanges or adhesive fittings), the potential between the sensor and the fluid must be equalized using additional ground rings. If the ground rings are not installed this can affect the accuracy of the measurements or cause the destruction of the sensor through the electrochemical erosion of the electrodes.

Caution!

- Depending on the option ordered, plastic disks may be installed at the process connections instead of ground rings. These plastic disks serve only as spacers and have no potential equalization function. In addition, they provide a sealing function at the interface between the sensor and process connection. For this reason, with process connections without ground rings, these plastic disks/seals must not be removed, or must always be installed.
- Ground rings can be ordered separately from Endress+Hauser as accessories (→ 🖹 83). When placing the order, make certain that the ground ring is compatible with the material used for the electrodes. Otherwise, there is a risk that the electrodes may be destroyed by electrochemical corrosion! Information about the materials can be found on → 🖹 123.
- Ground rings, including the seals, are mounted within the process connections. Therefore, the fitting length is not affected.

1. Loosen the four or six hexagonal headed bolts (1) and remove the process connection from the sensor (4).
2. Remove the plastic disk (3), including the two O-ring seals (2).
3. Place one seal (2) in the groove of the process connection.
4. Place the metal ground ring (3) on the process connection.
5. Now place the second seal (2) in the groove of the ground ring.
6. Finally, mount the process connection on the sensor again. With plastic process connections, note the max. torques for lubricated threads (7 Nm / 5.2 lbf ft).

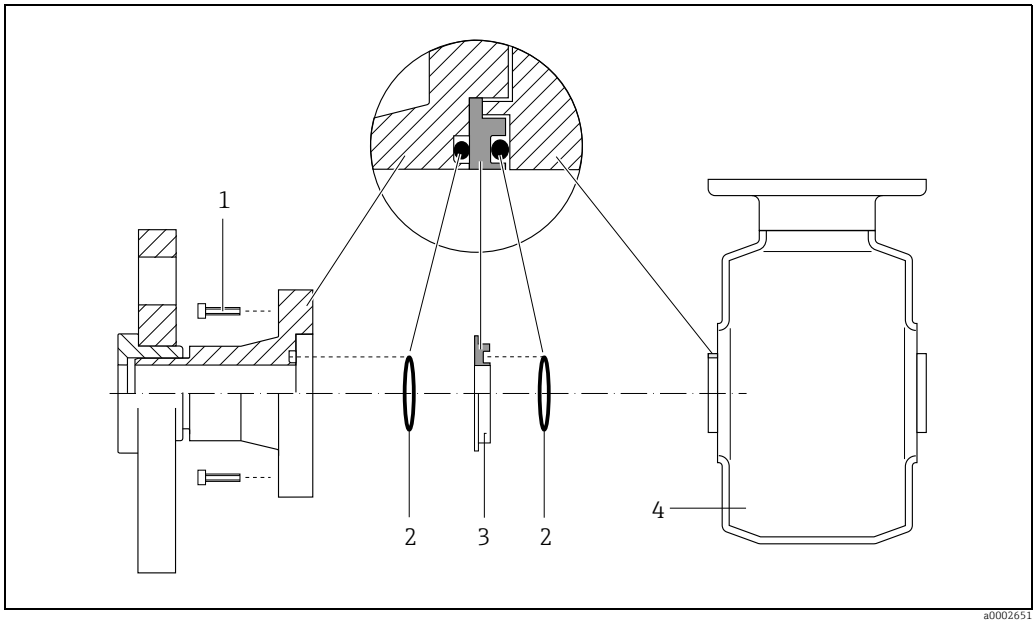


Fig. 20: Installing ground rings with Promag H (DN 2 to 25 / 1/12 to 1")

1 = Hexagonal-headed bolt (process connection)
2 = O-ring seals
3 = Ground ring or plastic disk (spacer)
4 = Sensor

Welding the transmitter into the piping (weld nipples)

Caution!
Risk of destroying the measuring electronics. Make sure that the welding machine is *not* grounded via the sensor or the transmitter.

1. Tack-weld the sensor into the pipe. A suitable welding jig can be ordered separately as an accessory (→ 🖹 83).
2. Loosen the screws on the process connection flange and remove the sensor, complete with the seal, from the pipe.
3. Weld the process connection to the pipe.
4. Reinstall the sensor in the pipe. Make sure that everything is clean and that the seal is correctly seated.

Note!
- If thin-walled foodstuffs pipes are not welded correctly, the heat could damage the installed seal. It is therefore advisable to remove the sensor and the seal prior to welding.
- The pipe has to be spread approximately 8 mm to permit disassembly.

Cleaning with pigs

If pigs are used for cleaning, it is essential to take the inside diameters of the measuring tube and process connection into account. All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation "Technical Documentation" → 🖹 130.

3.3.4 Installing the Promag L sensor

Caution!
- The protective covers mounted on the two sensor flanges (DN 25 to 300 / 1 to 12") are used to hold the lap joint flanges in place and to protect the PTFE liner during transportation. Consequently, do not remove these covers until immediately before the sensor is installed in the pipe.
- The covers must remain in place while the device is in storage.
- Make sure that the lining is not damaged or removed from the flanges.

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 30.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.
- To comply with the device specification, a concentrical installation in the measuring section is required.

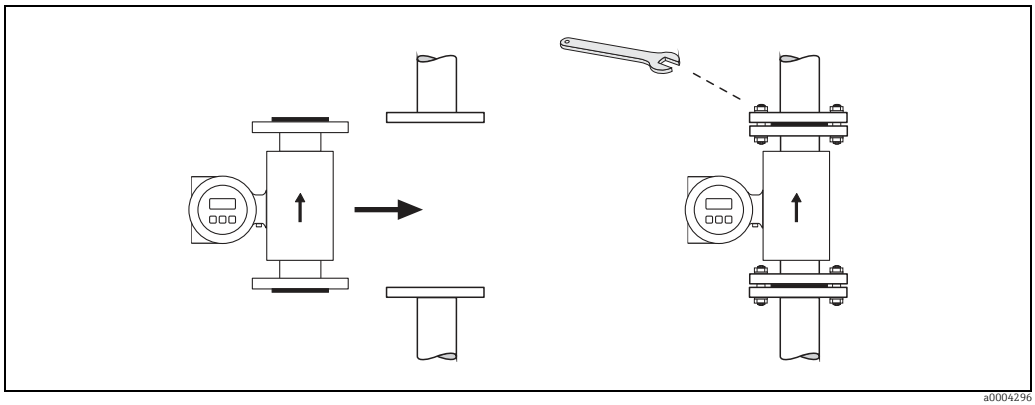


Fig. 21: Installing the Promag L sensor

Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** necessary.
- Polyurethane lining → **no** seals are required.
- PTFE lining → **no** seals are required.
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 83).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 62.

Screw tightening torques (Promag L)

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Promag L screw tightening torques for EN 1092-1 (DIN 2501), PN 6/10/16

Nominal diamter [mm]	EN (DIN) Pressure rating	Threaded fasteners	Flange thickness [mm]	Max. tightening torques		
				Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
25	PN 10/16	4 × M 12	18	-	6	11
32	PN 10/16	4 × M 16	18	-	16	27
40	PN 10/16	4 × M 16	18	-	16	29
50	PN 10/16	4 × M 16	18	-	15	40
65*	PN 10/16	8 × M 16	18	-	10	22
80	PN 10/16	8 × M 16	20	-	15	30
100	PN 10/16	8 × M 16	20	-	20	42
125	PN 10/16	8 × M 16	22	-	30	55
150	PN 10/16	8 × M 20	22	-	50	90
200	PN 16	12 × M 20	24	-	65	87
250	PN 16	12 × M 24	26	-	126	151
300	PN 16	12 × M 24	28	-	139	177
350	PN 6	12 × M 20	22	111	120	-
350	PN 10	16 × M 20	26	112	118	-
350	PN 16	16 × M 24	30	152	165	-
400	PN 6	16 × M 20	22	90	98	-
400	PN 10	16 × M 24	26	151	167	-
400	PN 16	16 × M 27	32	193	215	-
450	PN 6	16 × M 20	22	112	126	-
450	PN 10	20 × M 24	28	153	133	-
500	PN 6	20 × M 20	24	119	123	-
500	PN 10	20 × M 24	28	155	171	-
500	PN 16	20 × M 30	34	275	300	-
600	PN 6	20 × M 24	30	139	147	-
600	PN 10	20 × M 27	28	206	219	-
600*	PN 16	20 × M 33	36	415	443	-
700	PN 6	24 × M 24	24	148	139	-
700	PN 10	24 × M 27	30	246	246	-
700	PN 16	24 × M 33	36	278	318	-
800	PN 6	24 × M 27	24	206	182	-
800	PN 10	24 × M 30	32	331	316	-
800	PN 16	24 × M 36	38	369	385	-
900	PN 6	24 × M 27	26	230	637	-
900	PN 10	28 × M 30	34	316	307	-
900	PN 16	28 × M 36	40	353	398	-
1000	PN 6	28 × M 27	26	218	208	-
1000	PN 10	28 × M 33	34	402	405	-
1000	PN 16	28 × M 39	42	502	518	-
1200	PN 6	32 × M 30	28	319	299	-
1200	PN 10	32 × M 36	38	564	568	-
1200	PN 16	32 × M 45	48	701	753	-
1400	PN 6	36 × M 33	32	430	-	-
1400	PN 10	36 × M 39	42	654	-	-
1400	PN 16	36 × M 45	52	729	-	-
1600	PN 6	40 × M 33	34	440	-	-
1600	PN 10	40 × M 45	46	946	-	-

Nominal diamter [mm]	EN (DIN) Pressure rating	Threaded fasteners	Flange thickness [mm]	Max. tightening torques		
				Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
1600	PN 16	40 × M 52	58	1007	-	-
1800	PN 6	44 × M 36	36	547	-	-
1800	PN 10	44 × M 45	50	961	-	-
1800	PN 16	44 × M 52	62	1108	-	-
2000	PN 6	48 × M 39	38	629	-	-
2000	PN 10	48 × M 45	54	1047	-	-
2000	PN 16	48 × M 56	66	1324	-	-
2200	PN 6	52 × M 39	42	698	-	-
2200	PN 10	52 × M 52	58	1217	-	-
2400	PN 6	56 × M 39	44	768	-	-
2400	PN 10	56 × M 52	62	1229	-	-
* Designed acc. to EN 1092-1 (not to DIN 2501)						

Promag L screw tightening torques for EN 1092-1, PN 6/10/16, P245GH/stainless-steel; Calculated according to EN 1591-1:2014 for flange according to EN 1092-1:2013

Nominal diameter [mm]	EN(DIN) pressure rating	Threaded fastener	Flange thickness [mm]	Nom. tightening torques	
				Hard rubber [Nm]	Polyurethane [Nm]
350	PN 6	12 × M 20	22	60	75
350	PN 10	16 × M 20	26	70	80
400	PN 6	16 × M 20	22	65	70
400	PN 10	16 × M 24	26	100	120
400	PN 16	16 × M 27	32	175	190
450	PN 6	16 × M 20	22	70	90
450	PN 10	20 × M 24	28	100	110
500	PN 6	20 × M 20	24	65	70
500	PN 10	20 × M 24	28	110	120
500	PN 16	20 × M 30	36	225	235
600	PN 6	20 × M 24	30	105	105
600	PN 10	20 × M 27	30	165	160
600	PN 16	20 × M 33	40	340	340
700	PN 6	24 × M 24	30	110	110
700	PN 10	24 × M 27	35	190	190
700	PN 16	24 × M 33	40	340	340
800	PN 6	24 × M 27	30	145	145
800	PN 10	24 × M 30	38	260	260
800	PN 16	24 × M 36	41	465	455
900	PN 6	24 × M 27	34	170	180
900	PN 10	28 × M 30	38	265	275
900	PN 16	28 × M 36	48	475	475
1000	PN 6	28 × M 27	38	175	185
1000	PN 10	28 × M 33	44	350	360
1000	PN 16	28 × M 39	59	630	620
1200	PN 6	32 × M 30	42	235	250
1200	PN 10	32 × M 36	55	470	480
1200	PN 16	32 × M 45	78	890	900
1400	PN 6	36 × M 33	56	300	-
1400	PN 10	36 × M 39	65	600	-
1400	PN 16	36 × M 45	84	1050	-
1600	PN 6	40 × M 33	63	340	-
1600	PN 10	40 × M 45	75	810	-
1600	PN 16	40 × M 52	102	1420	-
1800	PN 6	44 × M 36	69	430	-

Nominal diameter [mm]	EN(DIN) pressure rating	Threaded fastener	Flange thickness [mm]	Nom. tightening torques	
				Hard rubber [Nm]	Polyurethane [Nm]
1800	PN 10	44 × M 45	85	920	-
1800	PN 16	44 × M 52	110	1600	-
2000	PN 6	48 × M 39	74	530	-
2000	PN 10	48 × M 45	90	1040	-
2000	PN 16	48 × M 56	124	1900	-
2200	PN 6	52 × M 39	81	580	-
2200	PN 10	52 × M 52	100	1290	-
2400	PN 6	56 × M 39	87	650	-
2400	PN 10	56 × M 52	110	1410	-

Promag L screw tightening torques for ASME B16.5, Class 150

Nominal diameter		ASME Pressure rating	Threaded fasteners	Max. tightening torque					
				Hard rubber		Polyurethane		PTFE	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
25	1"	Class 150	4 × 5/8"	-	-	5	4	14	13
40	1 ½"	Class 150	8 × 5/8"	-	-	10	17	21	15
50	2"	Class 150	4 × 5/8"	-	-	15	11	40	29
80	3"	Class 150	4 × 5/8"	-	-	25	18	65	48
100	4"	Class 150	8 × 5/8"	-	-	20	15	44	32
150	6"	Class 150	8 × ¾"	-	-	45	33	90	66
200	8"	Class 150	8 × ¾"	-	-	65	48	87	64
250	10"	Class 150	12 × 7/8"	-	-	126	93	151	112
300	12"	Class 150	12 × 7/8"	-	-	146	108	177	131
350	14"	Class 150	12 × 1"	135	100	158	117	-	-
400	16"	Class 150	16 × 1"	128	94	150	111	-	-
450	18"	Class 150	16 × 1 ⅛"	204	150	234	173	-	-
500	20"	Class 150	20 × 1 ⅛"	183	135	217	160	-	-
600	24"	Class 150	20 × 1 ¼"	268	198	307	226	-	-

Promag L screw tightening torques for AWWA, Class D

Nominal diameter		AWWA Pressure rating	Threaded fasteners	Max. tightening torque					
				Hard rubber		Polyurethane		PTFE	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
700	28"	Class D	28 × 1 ¼"	247	182	292	215	-	-
750	30"	Class D	28 × 1 ¼"	287	212	302	223	-	-
800	32"	Class D	28 × 1 ½"	394	291	422	311	-	-
900	36"	Class D	32 × 1 ½"	419	309	430	317	-	-
1000	40"	Class D	36 × 1 ½"	420	310	477	352	-	-
–	42"	Class D	36 × 1 ½"	528	389	518	382	-	-
1200	48"	Class D	44 × 1 ½"	552	407	531	392	-	-

Promag L screw tightening torques for AS 2129, Table E

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque		
			Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
350	Table E	12 × M 24	203	-	-
400	Table E	12 × M 24	226	-	-
450	Table E	16 × M 24	226	-	-
500	Table E	16 × M 24	271	-	-

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque		
			Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
600	Table E	16 × M 30	439	-	-
700	Table E	20 × M 30	355	-	-
750	Table E	20 × M 30	559	-	-
800	Table E	20 × M 30	631	-	-
900	Table E	24 × M 30	627	-	-
1000	Table E	24 × M 30	634	-	-
1200	Table E	32 × M 30	727	-	-

Promag L screw tightening torques for AS 4087, PN16

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque		
			Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
350	PN 16	12 × M 24	203	-	-
375	PN 16	12 × M 24	137	-	-
400	PN 16	12 × M 24	226	-	-
450	PN 16	12 × M 24	301	-	-
500	PN 16	16 × M 24	271	-	-
600	PN 16	16 × M 27	393	-	-
700	PN 16	20 × M 27	330	-	-
750	PN 16	20 × M 30	529	-	-
800	PN 16	20 × M 33	631	-	-
900	PN 16	24 × M 33	627	-	-
1000	PN 16	24 × M 33	595	-	-
1200	PN 16	32 × M 33	703	-	-

3.3.5 Installing the Promag P sensor

Caution!
- The protective covers mounted on the two sensor flanges guard the PTFE, which is turned over the flanges. Consequently, do not remove these covers until **immediately before** the sensor is installed in the pipe.
- The covers must remain in place while the device is in storage.
- Make sure that the lining is not damaged or removed from the flanges.

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 📄 35.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

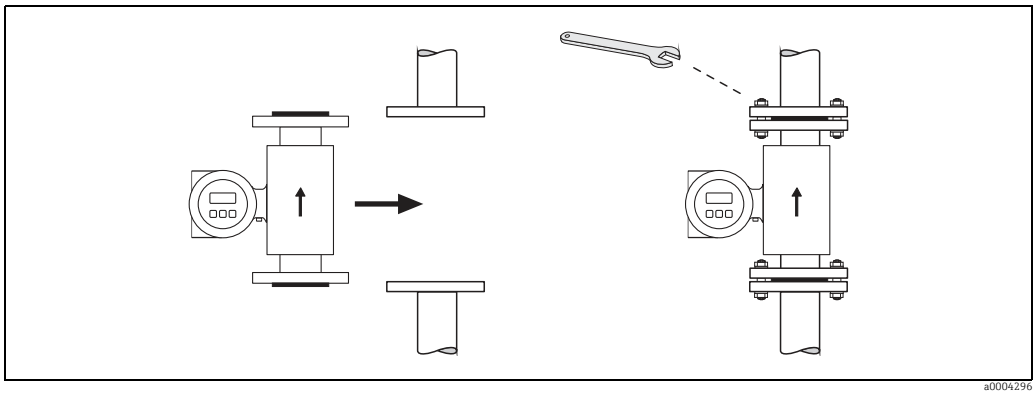


Fig. 22: Installing the Promag P sensor

Seals

Comply with the following instructions when installing seals:
- PFA or PTFE lining → **No** seals are required!
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 📄 83).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 📄 60.

Installing the high-temperature version (with PFA lining)

The high-temperature version has a housing support for the thermal separation of sensor and transmitter. The high-temperature version is always used for applications in which high ambient temperatures are encountered **in conjunction with** high fluid temperatures. The high-temperature version is obligatory if the fluid temperature exceeds +150 °C.

Note!
You will find information on permissible temperature ranges on → 107.

Insulation

Pipes generally have to be insulated if they carry very hot fluids, in order to avoid energy losses and to prevent accidental contact with pipes at temperatures that could cause injury. Guidelines regulating the insulation of pipes have to be taken into account.

Caution!
Risk of measuring electronics overheating. The housing support dissipates heat and its entire surface area must remain uncovered. Make sure that the sensor insulation does not extend past the top of the two sensor shells.

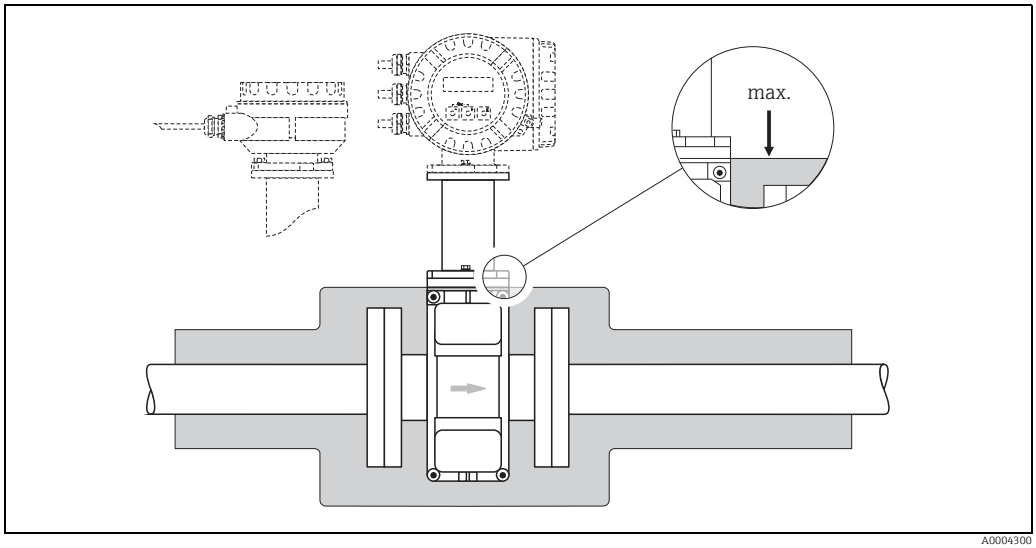


Fig. 23: Promag P (high-temperature version): Insulating the pipe

Tightening torques for threaded fasteners (Promag P)

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Tightening torques for:
- EN (DIN) → 36
- ASME → 37
- JIS → 37
- AS 2129 → 38
- AS 4087 → 38

Promag P screw tightening torques for EN 1092-1 (DIN 2501), PN 10/16/25/40

Nominal diameter [mm]	EN (DIN) pressure rating	Threaded fasteners	Flange thickness [mm]	Max. tightening torques PTFE [Nm]	Max. tightening torques PFA [Nm]
15	PN 40	4 × M 12	16	11	–
25	PN 40	4 × M 12	18	26	20
32	PN 40	4 × M 16	18	41	35
40	PN 40	4 × M 16	18	52	47
50	PN 40	4 × M 16	20	65	59
65 *	PN 16	8 × M 16	18	43	40
65	PN 40	8 × M 16	22	43	40
80	PN 16	8 × M 16	20	53	48
80	PN 40	8 × M 16	24	53	48
100	PN 16	8 × M 16	20	57	51
100	PN 40	8 × M 20	24	78	70
125	PN 16	8 × M 16	22	75	67
125	PN 40	8 × M 24	26	111	99
150	PN 16	8 × M 20	22	99	85
150	PN 40	8 × M 24	28	136	120
200	PN 10	8 × M 20	24	141	101
200	PN 16	12 × M 20	24	94	67
200	PN 25	12 × M 24	30	138	105
250	PN 10	12 × M 20	26	110	–
250	PN 16	12 × M 24	26	131	–
250	PN 25	12 × M 27	32	200	–
300	PN 10	12 × M 20	26	125	–
300	PN 16	12 × M 24	28	179	–
300	PN 25	16 × M 27	34	204	–
350	PN 10	16 × M 20	26	188	–
350	PN 16	16 × M 24	30	254	–
350	PN 25	16 × M 30	38	380	–
400	PN 10	16 × M 24	26	260	–
400	PN 16	16 × M 27	32	330	–
400	PN 25	16 × M 33	40	488	–
450	PN 10	20 × M 24	28	235	–
450	PN 16	20 × M 27	40	300	–
450	PN 25	20 × M 33	46	385	–
500	PN 10	20 × M 24	28	265	–
500	PN 16	20 × M 30	34	448	–
500	PN 25	20 × M 33	48	533	–
600	PN 10	20 × M 27	28	345	–
600 *	PN 16	20 × M 33	36	658	–
600	PN 25	20 × M 36	58	731	–
* Designed acc. to EN 1092-1 (not to DIN 2501)					

Promag P screw tightening torques for EN 1092-1, PN 10/16/25, P245GH/stainless-steel; Calculated according to EN 1591-1:2014 for flange according to EN 1092-1:2013

Nominal diamter [mm]	EN (DIN) pressure rating	Threaded fasteners	Flange thickness [mm]	Nom. tightening torques PTFE [Nm]
350	PN 10	16 × M 20	26	60
350	PN 16	16 × M 24	30	115
350	PN 25	16 × M 30	38	220
400	PN 10	16 × M 24	26	90
400	PN 16	16 × M 27	32	155
400	PN 25	16 × M 33	40	290

Nominal diamter [mm]	EN (DIN) pressure rating	Threaded fasteners	Flange thickness [mm]	Nom. tightening torques PTFE [Nm]
450	PN 10	20 × M 24	28	90
450	PN 16	20 × M 27	34	155
450	PN 25	20 × M 33	46	290
500	PN 10	20 × M 24	28	100
500	PN 16	20 × M 30	36	205
500	PN 25	20 × M 33	48	345
600	PN 10	20 × M 27	30	150
600	PN 16	20 × M 33	40	310
600	PN 25	20 × M 36	48	500

Promag P screw tightening torques for ASME B16.5, Class 150/300

Nominal diameter		ASME Pressure rating	Threaded fasteners	Max. tightening torque			
				PTFE		PFA	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
15	½"	Class 150	4 × ½"	6	4	–	–
15	½"	Class 300	4 × ½"	6	4	–	–
25	1"	Class 150	4 × ½"	11	8	10	7
25	1"	Class 300	4 × 5/8"	14	10	12	9
40	1 ½"	Class 150	4 × ½"	24	18	21	15
40	1 ½"	Class 300	4 × ¾"	34	25	31	23
50	2"	Class 150	4 × 5/8"	47	35	44	32
50	2"	Class 300	8 × 5/8"	23	17	22	16
80	3"	Class 150	4 × 5/8"	79	58	67	49
80	3"	Class 300	8 × ¾"	47	35	42	31
100	4"	Class 150	8 × 5/8"	56	41	50	37
100	4"	Class 300	8 × ¾"	67	49	59	44
150	6"	Class 150	8 × ¾"	106	78	86	63
150	6"	Class 300	12 × ¾"	73	54	67	49
200	8"	Class 150	8 × ¾"	143	105	109	80
250	10"	Class 150	12 × 7/8"	135	100	–	–
300	12"	Class 150	12 × 7/8"	178	131	–	–
350	14"	Class 150	12 × 1"	260	192	–	–
400	16"	Class 150	16 × 1"	246	181	–	–
450	18"	Class 150	16 × 1 ⅛"	371	274	–	–
500	20"	Class 150	20 × 1 ⅛"	341	252	–	–
600	24"	Class 150	20 × 1 ¼"	477	352	–	–

Promag P screw tightening torques for JIS B2220, 10/20K

Nominal diameter	JIS Pressure rating	Threaded fasteners	Max. tightening torque	
			PTFE	PFA
[mm]			[Nm]	[Nm]
25	10K	4 × M 16	32	27
25	20K	4 × M 16	32	27
32	10K	4 × M 16	38	–
32	20K	4 × M 16	38	–
40	10K	4 × M 16	41	37
40	20K	4 × M 16	41	37
50	10K	4 × M 16	54	46
50	20K	8 × M 16	27	23
65	10K	4 × M 16	74	63
65	20K	8 × M 16	37	31
80	10K	8 × M 16	38	32
80	20K	8 × M 20	57	46
100	10K	8 × M 16	47	38

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque PTFE [Nm]	Max. tightening torque PFA [Nm]
100	20K	8 × M 20	75	58
125	10K	8 × M 20	80	66
125	20K	8 × M 22	121	103
150	10K	8 × M 20	99	81
150	20K	12 × M 22	108	72
200	10K	12 × M 20	82	54
200	20K	12 × M 22	121	88
250	10K	12 × M 22	133	–
250	20K	12 × M 24	212	–
300	10K	16 × M 22	99	–
300	20K	16 × M 24	183	–

Promag P tightening torques for JIS B2220, 10/20K

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Nom. tightening torques Hard rubber [Nm]	Nom. tightening torques Polyurethane [Nm]
350	10K	16 × M 22	109	109
350	20K	16 × M 30 x3	217	217
400	10K	16 × M 24	163	163
400	20K	16 × M 30x3	258	258
450	10K	16 × M 24	155	155
450	20K	16 × M 30x3	272	272
500	10K	16 × M 24	183	183
500	20K	16 × M 30x3	315	315
600	10K	16 × M 30	235	235
600	20K	16 × M 36x3	381	381

Promag P screw tightening torques for AS 2129, Table E

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque PTFE [Nm]
25	Table E	4 × M 12	21
50	Table E	4 × M 16	42

Promag P screw tightening torques for AS 4087, PN16

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque PTFE [Nm]
50	PN 16	4 × M 16	42

3.3.6 Installing the Promag W sensor

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 📄 40.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

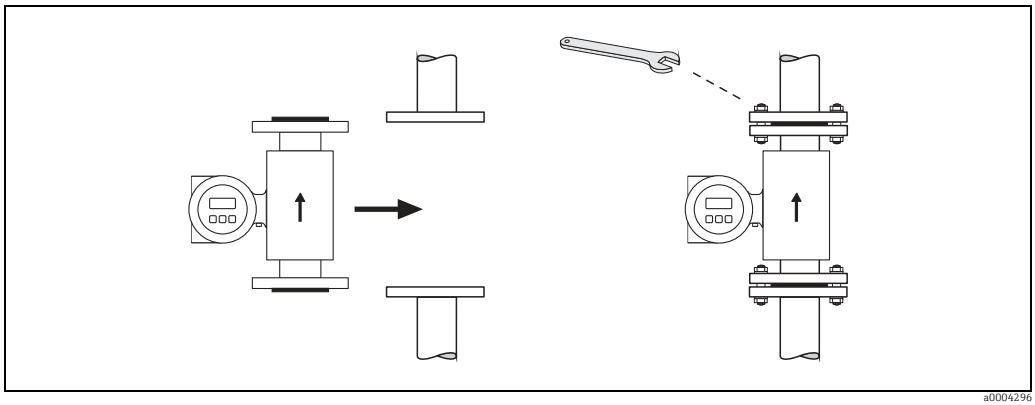


Fig. 24: Installing the Promag W sensor

Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** necessary.
- Polyurethane lining → **no** seals are required.
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 📄 83).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 📄 62.

Screw tightening torques (Promag W)

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Tightening torques for:
- EN (DIN)→ 🖹 40
- JIS→ 🖹 43
- ASME→ 🖹 42
- AWWA → 🖹 44
- AS 2129 → 🖹 44
- AS 4087 → 🖹 45

Promag W screw tightening torques for EN 1092-1 (DIN 2501), PN 6/10/16/25/40

Nominal diameter [mm]	EN (DIN) pressure rating	Threaded fasteners	Flange thickness [mm]	Max. tightening torque	
				Hard rubber [Nm]	Polyurethane [Nm]
25	PN 40	4 × M 12	18	-	15
32	PN 40	4 × M 16	18	-	24
40	PN 40	4 × M 16	18	-	31
50	PN 40	4 × M 16	20	48	40
65*	PN 16	8 × M 16	18	32	27
65	PN 40	8 × M 16	22	32	27
80	PN 16	8 × M 16	20	40	34
80	PN 40	8 × M 16	24	40	34
100	PN 16	8 × M 16	20	43	36
100	PN 40	8 × M 20	24	59	50
125	PN 16	8 × M 16	22	56	48
125	PN 40	8 × M 24	26	83	71
150	PN 16	8 × M 20	22	74	63
150	PN 40	8 × M 24	28	104	88
200	PN 10	8 × M 20	24	106	91
200	PN 16	12 × M 20	24	70	61
200	PN 25	12 × M 24	30	104	92
250	PN 10	12 × M 20	26	82	71
250	PN 16	12 × M 24	26	98	85
250	PN 25	12 × M 27	32	150	134
300	PN 10	12 × M 20	26	94	81
300	PN 16	12 × M 24	28	134	118
300	PN 25	16 × M 27	34	153	138
350	PN 6	12 × M 20	22	111	120
350	PN 10	16 × M 20	26	112	118
350	PN 16	16 × M 24	30	152	165
350	PN 25	16 × M 30	38	227	252
400	PN 6	16 × M 20	22	90	98
400	PN 10	16 × M 24	26	151	167
400	PN 16	16 × M 27	32	193	215
400	PN 25	16 × M 33	40	289	326
450	PN 6	16 × M 20	22	112	126
450	PN 10	20 × M 24	28	153	133
450	PN 16	20 × M 27	40	198	196
450	PN 25	20 × M 33	46	256	253
500	PN 6	20 × M 20	24	119	123
500	PN 10	20 × M 24	28	155	171
500	PN 16	20 × M 30	34	275	300

Nominal diameter [mm]	EN (DIN) pressure rating	Threaded fasteners	Flange thickness [mm]	Max. tightening torque	
				Hard rubber [Nm]	Polyurethane [Nm]
500	PN 25	20 × M 33	48	317	360
600	PN 6	20 × M 24	30	139	147
600	PN 10	20 × M 27	28	206	219
600 *	PN 16	20 × M 33	36	415	443
600	PN 25	20 × M 36	58	431	516
700	PN 6	24 × M 24	24	148	139
700	PN 10	24 × M 27	30	246	246
700	PN 16	24 × M 33	36	278	318
700	PN 25	24 × M 39	46	449	507
800	PN 6	24 × M 27	24	206	182
800	PN 10	24 × M 30	32	331	316
800	PN 16	24 × M 36	38	369	385
800	PN 25	24 × M 45	50	664	721
900	PN 6	24 × M 27	26	230	637
900	PN 10	28 × M 30	34	316	307
900	PN 16	28 × M 36	40	353	398
900	PN 25	28 × M 45	54	690	716
1000	PN 6	28 × M 27	26	218	208
1000	PN 10	28 × M 33	34	402	405
1000	PN 16	28 × M 39	42	502	518
1000	PN 25	28 × M 52	58	970	971
1200	PN 6	32 × M 30	28	319	299
1200	PN 10	32 × M 36	38	564	568
1200	PN 16	32 × M 45	48	701	753
1400	PN 6	36 × M 33	32	430	398
1400	PN 10	36 × M 39	42	654	618
1400	PN 16	36 × M 45	52	729	762
1600	PN 6	40 × M 33	34	440	417
1600	PN 10	40 × M 45	46	946	893
1600	PN 16	40 × M 52	58	1007	1100
1800	PN 6	44 × M 36	36	547	521
1800	PN 10	44 × M 45	50	961	895
1800	PN 16	44 × M 52	62	1108	1003
2000	PN 6	48 × M 39	38	629	605
2000	PN 10	48 × M 45	54	1047	1092
2000	PN 16	48 × M 56	66	1324	1261
* Designed acc. to EN 1092-1 (not to DIN 2501)					

Promag W screw tightening torques for EN 1092-1, PN 6/10/16/25, P245GH/stainless-steel; Calculated according to EN 1591-1:2014 for flange according to EN 1092-1:2013

Nominal diameter [mm]	EN (DIN) pressure rating	Threaded fasteners	flange thickness [mm]	Nom. tightening torque	
				Hard rubber [Nm]	Polyurethane [Nm]
350	PN 6	12 × M 20	22	60	75
350	PN 10	16 × M 20	26	70	80
350	PN 16	16 × M 24	30	125	135
350	PN 25	16 × M 30	38	230	235
400	PN 6	16 × M 20	22	65	70
400	PN 10	16 × M 24	26	100	120
400	PN 16	16 × M 27	32	175	190
400	PN 25	16 × M 33	40	315	325
450	PN 6	16 × M 20	22	70	90

Nominal diameter [mm]	EN (DIN) pressure rating	Threaded fasteners	flange thickness [mm]	Nom. tightening torque Hard rubber [Nm]	Polyurethane [Nm]
450	PN 10	20 × M 24	28	100	110
450	PN 16	20 × M 27	34	175	190
450	PN 25	20 × M 33	46	300	310
500	PN 6	20 × M 20	24	65	70
500	PN 10	20 × M 24	28	110	120
500	PN 16	20 × M 30	36	225	235
500	PN 25	20 × M 33	48	370	370
600	PN 6	20 × M 24	30	105	105
600	PN 10	20 × M 27	30	165	160
600	PN 16	20 × M 33	40	340	340
600	PN 25	20 × M 36	48	540	540
700	PN 6	24 × M 24	30	110	110
700	PN 10	24 × M 27	35	190	190
700	PN 16	24 × M 33	40	340	340
700	PN 25	24 × M 39	50	615	595
800	PN 6	24 × M 27	30	145	145
800	PN 10	24 × M 30	38	260	260
800	PN 16	24 × M 36	41	465	455
800	PN 25	24 × M 45	53	885	880
900	PN 6	24 × M 27	34	170	180
900	PN 10	28 × M 30	38	265	275
900	PN 16	28 × M 36	48	475	475
900	PN 25	28 × M 45	57	930	915
1000	PN 6	28 × M 27	38	175	185
1000	PN 10	28 × M 33	44	350	360
1000	PN 16	28 × M 39	59	630	620
1000	PN 25	28 × M 52	63	1300	1290
1200	PN 6	32 × M 30	42	235	250
1200	PN 10	32 × M 36	55	470	480
1200	PN 16	32 × M 45	78	890	900
1400	PN 6	36 × M 33	56	300	-
1400	PN 10	36 × M 39	65	600	-
1400	PN 16	36 × M 45	84	1050	-
1600	PN 6	40 × M 33	63	340	-
1600	PN 10	40 × M 45	75	810	-
1600	PN 16	40 × M 52	102	1420	-
1800	PN 6	44 × M 36	69	430	-
1800	PN 10	44 × M 45	85	920	-
1800	PN 16	44 × M 52	110	1600	-
2000	PN 6	48 × M 39	74	530	-
2000	PN 10	48 × M 45	90	1040	-
2000	PN 16	48 × M 56	124	1900	-

Promag W screw tightening torques for ASME B16.5, Class 150/300

Nominal diameter [mm]	[inch]	ASME Pressure rating	Threaded fasteners	Max. tightening torque Hard rubber [Nm]	[lbf · ft]	Polyurethane [Nm]	[lbf · ft]
25	1"	Class 150	4 × ½"	-	-	7	5
25	1"	Class 300	4 × 5/8"	-	-	8	6
40	1 ½"	Class 150	4 × ½"	-	-	10	7
40	1 ½"	Class 300	4 × ¾"	-	-	15	11
50	2"	Class 150	4 × 5/8"	35	26	22	16

Nominal diameter		ASME	Threaded fasteners	Max. tightening torque			
				Hard rubber		Polyurethane	
[mm]	[inch]	Pressure rating		[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
50	2"	Class 300	8 × 5/8"	18	13	11	8
80	3"	Class 150	4 × 5/8"	60	44	43	32
80	3"	Class 300	8 × ¾"	38	28	26	19
100	4"	Class 150	8 × 5/8"	42	31	31	23
100	4"	Class 300	8 × ¾"	58	43	40	30
150	6"	Class 150	8 × ¾"	79	58	59	44
150	6"	Class 300	12 × ¾"	70	52	51	38
200	8"	Class 150	8 × ¾"	107	79	80	59
250	10"	Class 150	12 × 7/8"	101	74	75	55
300	12"	Class 150	12 × 7/8"	133	98	103	76
350	14"	Class 150	12 × 1"	135	100	158	117
400	16"	Class 150	16 × 1"	128	94	150	111
450	18"	Class 150	16 × 1 ⅛"	204	150	234	173
500	20"	Class 150	20 × 1 ⅛"	183	135	217	160
600	24"	Class 150	20 × 1 ¼"	268	198	307	226

Promag W screw tightening torques for JIS B2220, 10/20K

Nominal diameter	JIS	Threaded fasteners	Max. tightening torque	
	Pressure rating		Hard rubber	Polyurethane
[mm]			[Nm]	[Nm]
25	10K	4 × M 16	-	19
25	20K	4 × M 16	-	19
32	10K	4 × M 16	-	22
32	20K	4 × M 16	-	22
40	10K	4 × M 16	-	24
40	20K	4 × M 16	-	24
50	10K	4 × M 16	40	33
50	20K	8 × M 16	20	17
65	10K	4 × M 16	55	45
65	20K	8 × M 16	28	23
80	10K	8 × M 16	29	23
80	20K	8 × M 20	42	35
100	10K	8 × M 16	35	29
100	20K	8 × M 20	56	48
125	10K	8 × M 20	60	51
125	20K	8 × M 22	91	79
150	10K	8 × M 20	75	63
150	20K	12 × M 22	81	72
200	10K	12 × M 20	61	52
200	20K	12 × M 22	91	80
250	10K	12 × M 22	100	87
250	20K	12 × M 24	159	144
300	10K	16 × M 22	74	63
300	20K	16 × M 24	138	124

Promag W screw tightening torques for JIS B2220, 10/20K

Nominal diameter	JIS	Threaded fasteners	Nom. tightening torque	
	Pressure rating		Hard rubber	Polyurethane
[mm]			[Nm]	[Nm]
350	10K	16 × M 22	109	109
350	20K	16 × M 30 x3	217	217
400	10K	16 × M 24	163	163
400	20K	16 × M 30x3	258	258

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Nom. tightening torque Hard rubber [Nm]	Polyurethane [Nm]
450	10K	16 × M 24	155	155
450	20K	16 × M 30x3	272	272
500	10K	16 × M 24	183	183
500	20K	16 × M 30x3	315	315
600	10K	16 × M 30	235	235
600	20K	16 × M 36x3	381	381
700	10K	16 × M 30	300	300
750	10K	16 × M 30	339	339

Promag W screw tightening torques for AWWA, Class D

Nominal diameter		AWWA Pressure rating	Threaded fasteners	Max. tightening torque Hard rubber		Polyurethane	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
700	28"	Class D	28 × 1 ¼"	247	182	292	215
750	30"	Class D	28 × 1 ¼"	287	212	302	223
800	32"	Class D	28 × 1 ½"	394	291	422	311
900	36"	Class D	32 × 1 ½"	419	309	430	317
1000	40"	Class D	36 × 1 ½"	420	310	477	352
–	42"	Class D	36 × 1 ½"	528	389	518	382
1200	48"	Class D	44 × 1 ½"	552	407	531	392
–	54"	Class D	44 × 1 ¾"	730	538	633	467
–	60"	Class D	52 × 1 ¾"	758	559	832	614
–	66"	Class D	52 × 1 ¾"	946	698	955	704
1800	72"	Class D	60 × 1 ¾"	975	719	1087	802
-	78"	Class D	64 × 2"	853	629	786	580
2000	–	Class D	64 × 2"	853	629	786	580

Promag W screw tightening torques for AS 2129, Table E

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque Hard rubber [Nm]
50	Table E	4 × M 16	32
80	Table E	4 × M 16	49
100	Table E	8 × M 16	38
150	Table E	8 × M 20	64
200	Table E	8 × M 20	96
250	Table E	12 × M 20	98
300	Table E	12 × M 24	123
350	Table E	12 × M 24	203
400	Table E	12 × M 24	226
450	Table E	16 × M 24	226
500	Table E	16 × M 24	271
600	Table E	16 × M 30	439
700	Table E	20 × M 30	355
750	Table E	20 × M 30	559
800	Table E	20 × M 30	631
900	Table E	24 × M 30	627
1000	Table E	24 × M 30	634
1200	Table E	32 × M 30	727

Promag W screw tightening torques for AS 4087, PN16

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque Hard rubber [Nm]
50	Table E	4 × M 16	32
80	PN 16	4 × M 16	49
100	PN 16	4 × M 16	76
150	PN 16	8 × M 20	52
200	PN 16	8 × M 20	77
250	PN 16	8 × M 20	147
300	PN 16	12 × M 24	103
350	PN 16	12 × M 24	203
375	PN 16	12 × M 24	137
400	PN 16	12 × M 24	226
450	PN 16	12 × M 24	301
500	PN 16	16 × M 24	271
600	PN 16	16 × M 27	393
700	PN 16	20 × M 27	330
750	PN 16	20 × M 30	529
800	PN 16	20 × M 33	631
900	PN 16	24 × M 33	627
1000	PN 16	24 × M 33	595
1200	PN 16	32 × M 33	703

3.3.7 Turning the transmitter housing

Turning the aluminum field housing

Warning!
The turning mechanism in devices with Ex d/de or FM/CSA Cl. I Div. 1 classification is not the same as that described here. The procedure for turning these housings is described in the Ex-specific documentation.

1. Loosen the two securing screws.
2. Turn the bayonet catch as far as it will go.
3. Carefully lift the transmitter housing:
   – Promag D: approx. 10 mm (0.39 in) above the securing screws
   – Promag E/H/L/P/W: to the stop
4. Turn the transmitter housing to the desired position:
   – Promag D: max. 180° clockwise or max. 180° counterclockwise
   – Promag E/H/L/P/W: max. 280° clockwise or max. 20° counterclockwise
5. Lower the housing into position and re-engage the bayonet catch.
6. Retighten the two securing screws.

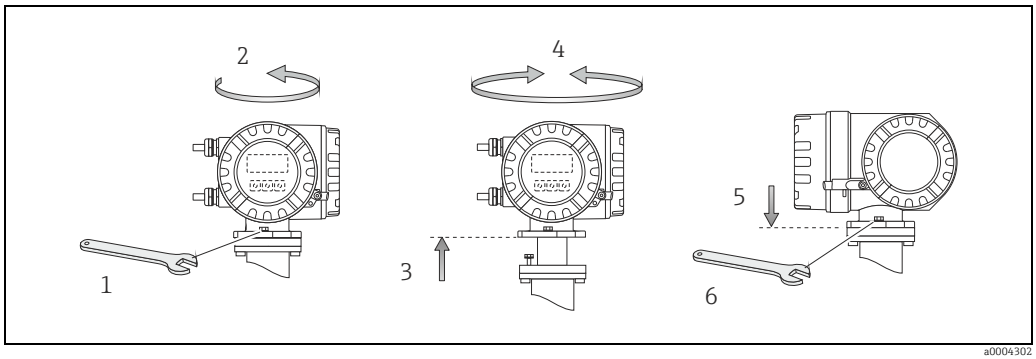


Fig. 25: Turning the transmitter housing (aluminum field housing)

Turning the stainless-steel field housing

a. Loosen the two securing screws.
b. Carefully lift the transmitter housing as far as it will go.
c. Turn the transmitter housing to the desired position (max. 2 × 90° in either direction).
d. Lower the housing into position.
e. Retighten the two securing screws.

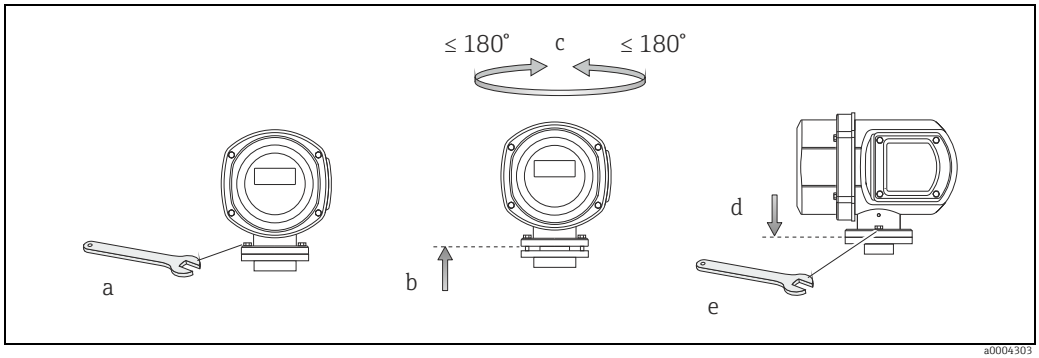


Fig. 26: Turning the transmitter housing (stainless-steel field housing)

3.3.8 Turning the onsite display

1. Unscrew the cover of the electronics compartment from the transmitter housing.
2. Press the side latches on the display module and remove it from the electronics compartment cover plate.
3. Turn the display to the desired position (max. 4 × 45° in both directions) and reset it onto the cover plate of the electronics compartment.
4. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

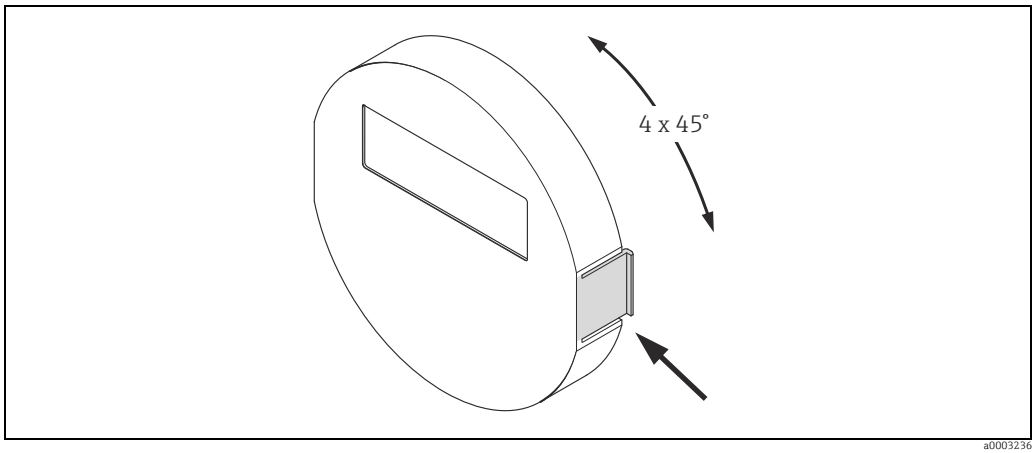


Fig. 27: Turning the local display (field housing)

3.3.9 Installing the wall-mount housing

There are various ways of installing the wall-mount transmitter housing:

- Direct wall mounting
- Installation in control panel (with separate mounting kit, accessories) → 📄 49
- Pipe mounting (with separate mounting kit, accessories) → 📄 49

Caution!

- Make sure that the ambient temperature does not exceed the permissible range at the mounting location, –20 to +60 °C (–4 to +140 °F), optional –40 to +60 °C (–40 to +140 °F). Install the device at a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Direct wall mounting

1. Drill the holes as illustrated in the graphic.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   – Securing screws (M6): max. Ø 6.5 mm (0.26")
   – Screw head: max. Ø 10.5 mm (0.41")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

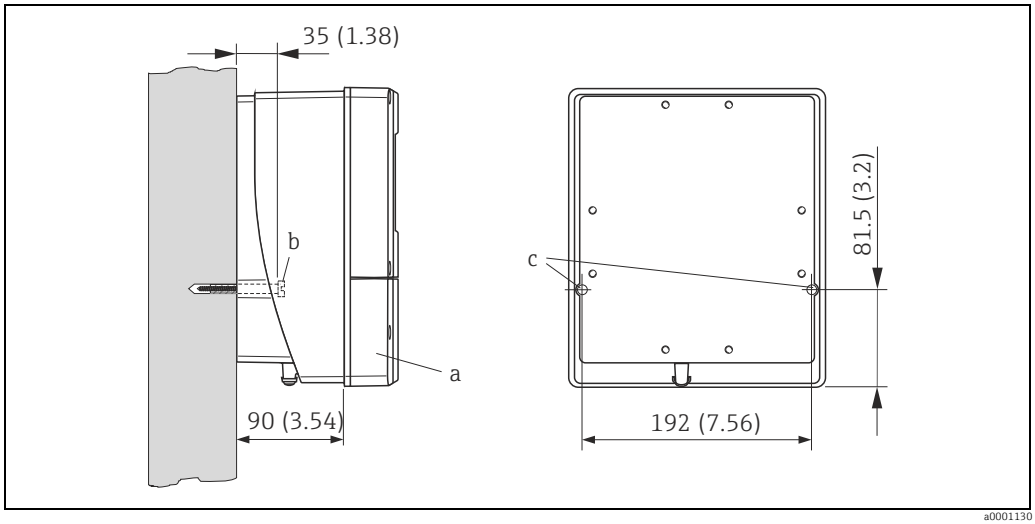


Fig. 28: Mounted directly on the wall. Engineering unit mm (inch)

Panel-mounted installation

1. Prepare the opening in the panel as illustrated in the graphic.
2. Slide the housing into the opening in the panel from the front.
3. Screw the fasteners onto the wall-mount housing.
4. Place the threaded rods in the fasteners and screw them down until the housing is seated tightly against the panel. Afterwards, tighten the locking nuts. Additional support is not necessary.

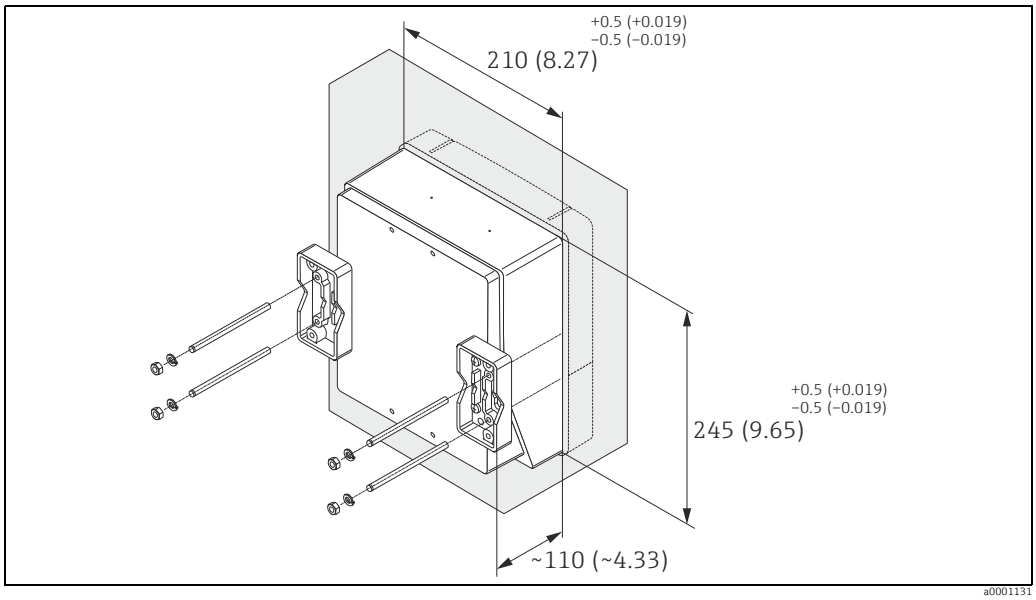


Fig. 29: Panel installation (wall-mount housing). Engineering unit mm (in)

Pipe mounting

The assembly should be performed by following the instructions in the graphic.

Caution!
If the device is mounted to a warm pipe, make certain that the housing temperature does not exceed +60 °C (+140 °F), which is the maximum permissible temperature.

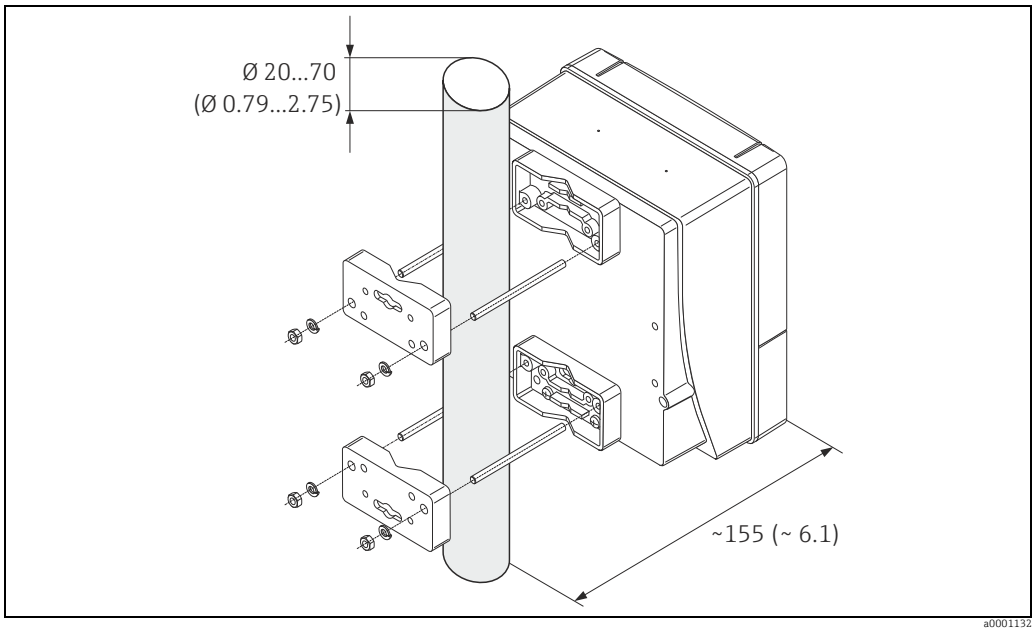


Fig. 30: Pipe mounting (wall-mount housing). Engineering unit mm (in)

3.4 Post-installation check

Perform the following checks after installing the measuring device in the pipe:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	-
Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, minimum fluid conductivity, measuring range, etc.?	→ 🖹 107
Installation	**Notes**
Does the arrow on the sensor nameplate match the actual direction of flow through the pipe?	-
Is the position of the measuring electrode plane correct?	→ 🖹 14
Is the position of the empty pipe detection electrode correct?	→ 🖹 14
Were all screws tightened to the specified torques when the sensor was installed?	Promag D → 🖹 22 Promag E → 🖹 24 Promag L → 🖹 30 Promag P → 🖹 35 Promag W → 🖹 40
Were the correct seals used (type, material, installation)?	Promag D → 🖹 20 Promag E → 🖹 23 Promag H → 🖹 26 Promag L→ 🖹 29 Promag P → 🖹 34 Promag W → 🖹 39
Are the measuring point number and labeling correct (visual inspection)?	-
Process environment / process conditions	**Notes**
Were the inlet and outlet runs respected?	Inlet run ≥ 5 × DN Outlet run ≥ 2 × DN
Is the measuring device protected against moisture and direct sunlight?	-
Is the sensor adequately protected against vibration (attachment, support)?	Acceleration up to 2 g by analogy with IEC 600 68-2-8

4 Wiring

Warning!
When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.
Please do not hesitate to contact your Endress+Hauser representative if you have any questions.

Note!
The device does not have an internal circuit breaker. For this reason, assign the device a switch or power-breaker switch capable of disconnecting the power supply line from the mains.

4.1 Connecting the remote version

4.1.1 Connecting Promag D/E/H/L/P/W

Warning!
- Risk of electric shock! Switch off the power supply before opening the device. Do **not** install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock! Connect the protective conductor to the ground terminal on the housing before the power supply is applied.

Caution!
- Only sensors and transmitters with the same serial number can be connected to one another. Communication problems can occur if the devices are not connected in this way.
- Risk of damaging the coil driver. Always switch off the power supply before connecting or disconnecting the coil current cable.

Procedure

1. Transmitter: Remove the cover from the connection compartment (a).
2. Sensor: Remove the cover from the connection housing (b).
3. Feed the electrode cable (c) and the coil current cable (d) through the appropriate cable entries.

   Caution!
   Route the connecting cables securely (see "Connecting cable length" → 19).
4. Terminate the signal and coil current cable as indicated in the table:
   Promag D/E/L/P/W → Refer to the table → 54
   Promag H → Refer to the "Cable termination" table → 55
5. Establish the wiring between the sensor and the transmitter.
   The electrical wiring diagram that applies to your device can be found:
   – In the corresponding graphic:
   → 31 (Promag D) → 32 (Promag E/L/P/W); → 33 (Promag H)
   – In the cover of the sensor and transmitter

   Note!
   The cable shields of the Promag H sensor are grounded by means of the strain relief terminals (see also the "Cable termination" table → 55).

   Caution!
   Insulate the shields of cables that are not connected to eliminate the risk of short-circuits with neighboring cable shields inside the connection housing.
6. Transmitter: Screw the cover on the connection compartment (a).
7. Sensor: Secure the cover on the connection housing (b).

Promag D

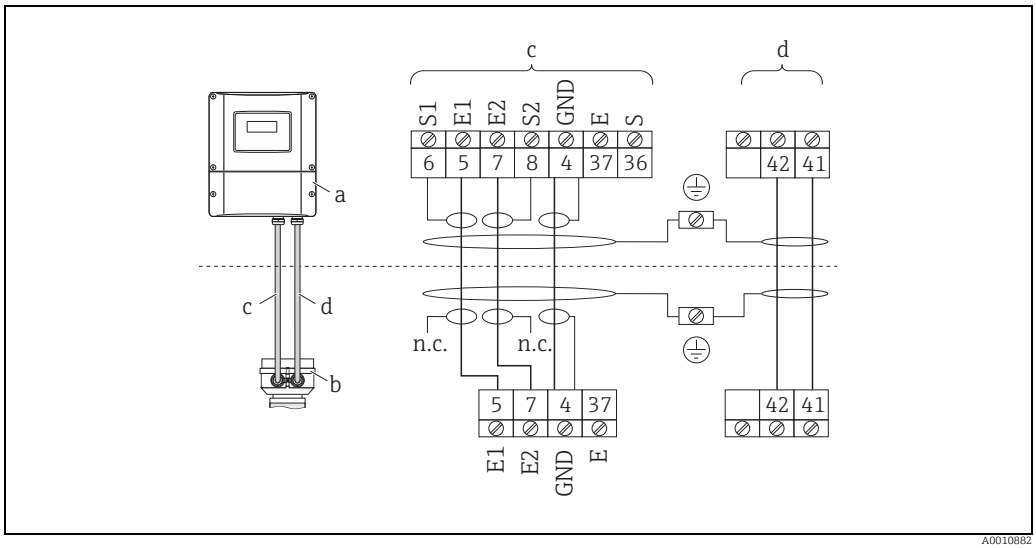


Fig. 31: Connecting the remote version of Promag D

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Electrode cable
d Coil current cable
n.c. Not connected, insulated cable shields

Wire colors/Terminal No.:
5/6 = braun, 7/8 = white, 4 = green, 37/36 = yellow

Promag E/L/P/W

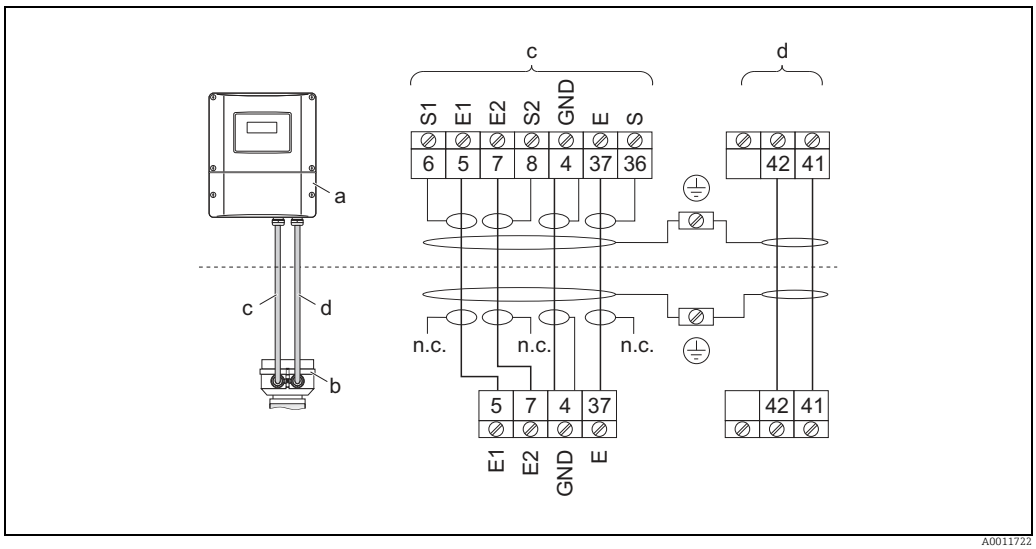


Fig. 32: Connecting the remote version of Promag E/L/P/W

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Electrode cable
d Coil current cable
n.c. Not connected, insulated cable shields

Wire colors/Terminal No.:
5/6 = braun, 7/8 = white, 4 = green, 37/36 = yellow

Promag H

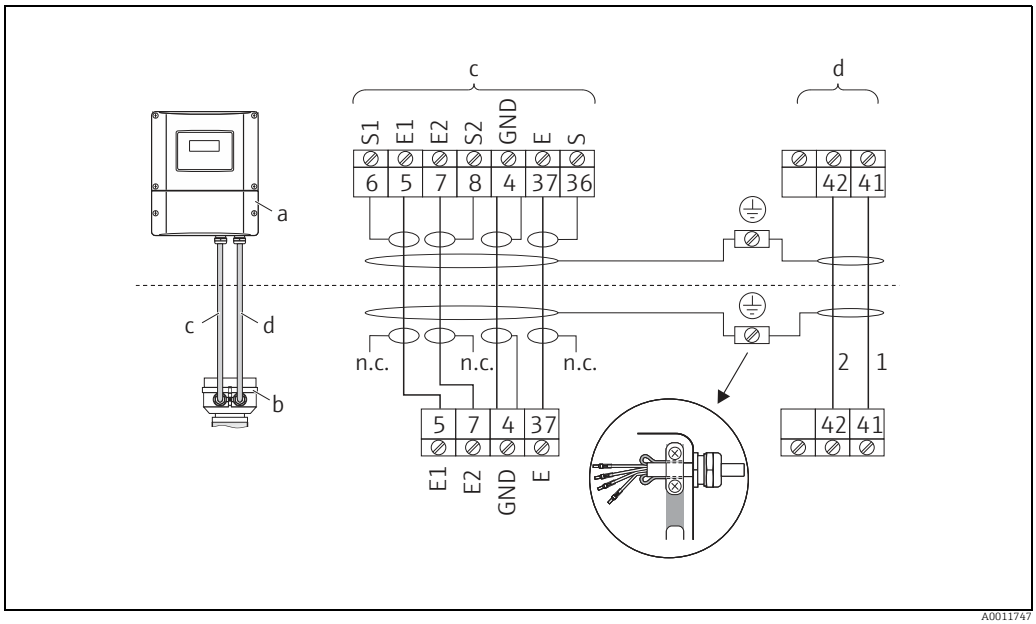


Fig. 33: Connecting the remote version of Promag H

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Electrode cable
d Coil current cable
n.c. Not connected, insulated cable shields

Wire colors/Terminal No.:
5/6 = braun, 7/8 = white, 4 = green, 37/36 = yellow

Cable termination for the remote version
Promag D/E/L/P/W

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Ferrules must be provided on the fine-wire cores (Detail B: ① = red ferrules, ø 1.0 mm; ② = white ferrules, ø 0.5 mm).
* Stripping only for reinforced cables

Caution!
When fitting the connectors, pay attention to the following points:
- *Electrode cable* → Make sure that the ferrules do not touch the wire shield on the sensor side.
  Minimum distance = 1 mm (exception "GND" = green cable)
- *Coil current cable* → Insulate one core of the three-core wire at the level of the core reinforcement; you only require two cores for the connection.

TRANSMITTER

Electrode cable

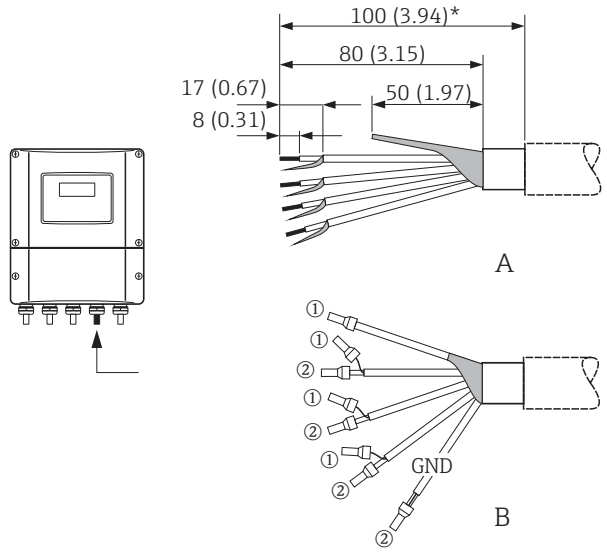


Fig. 34: Engineering unit mm (in)

Coil current cable

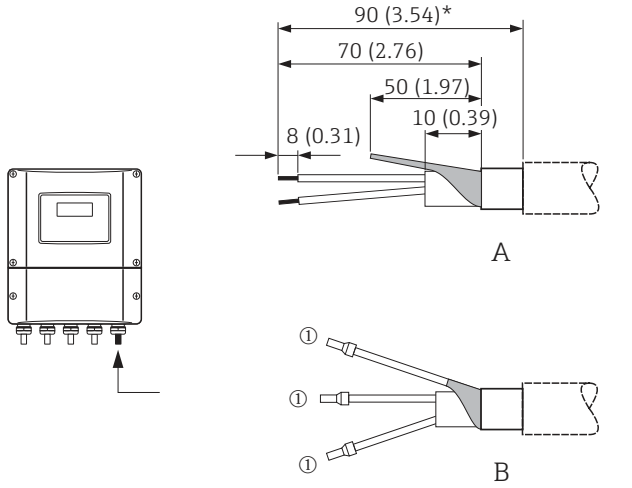


Fig. 35: Engineering unit mm (in)

SENSOR

Electrode cable

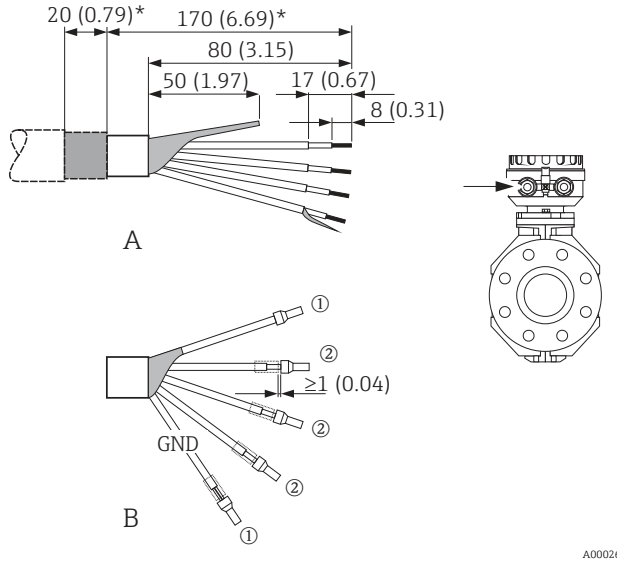


Fig. 36: Engineering unit mm (in)

Coil current cable

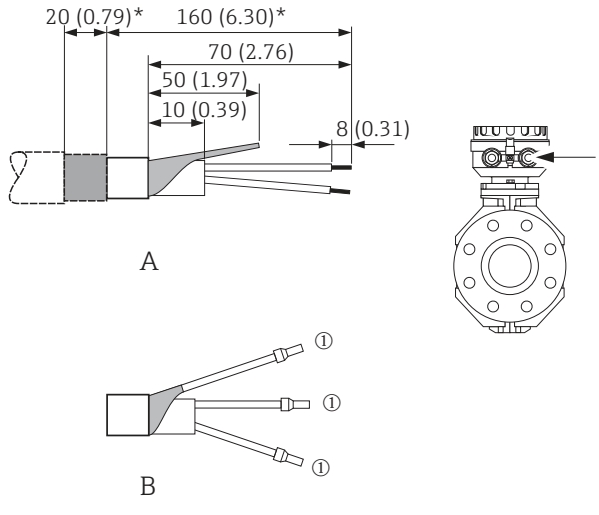


Fig. 37: Engineering unit mm (in)

Cable termination for the remote version
Promag H

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Ferrules must be provided on the fine-wire cores (Detail B: ① = red ferrules, ø 1.0 mm; ② = white ferrules, ø 0.5 mm).

Caution!
When fitting the connectors, pay attention to the following points:
- *Electrode* cable→ Make sure that the ferrules do not touch the wire shield on the sensor side. Minimum distance = 1 mm (exception "GND" = green cable).
- *Coil current cable* → Insulate one core of the three-core wire at the level of the core reinforcement; you only require two cores for the connection.
- On the sensor side, reverse both cable shields approx. 15 mm over the outer jacket. The strain relief ensures an electrical connection with the connection housing.

TRANSMITTER

Electrode cable

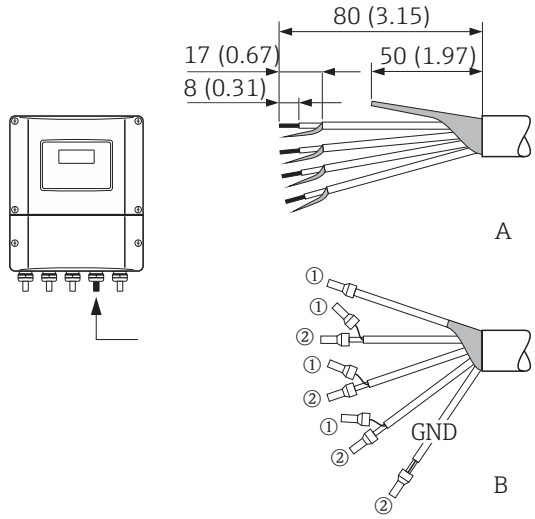


Fig. 38: Engineering unit mm (in)

Coil current cable

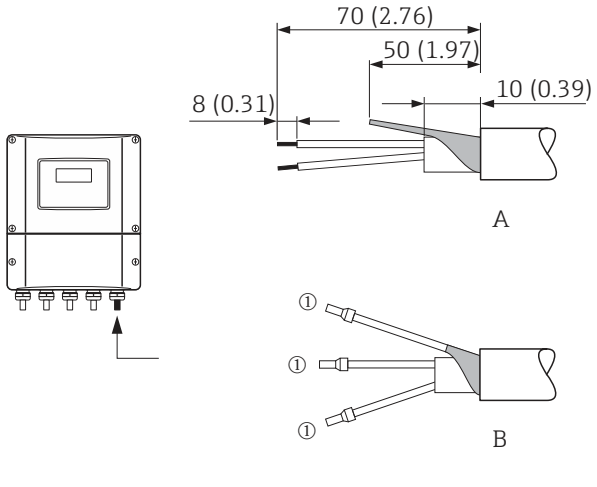


Fig. 39: Engineering unit mm (in)

SENSOR

Electrode cable

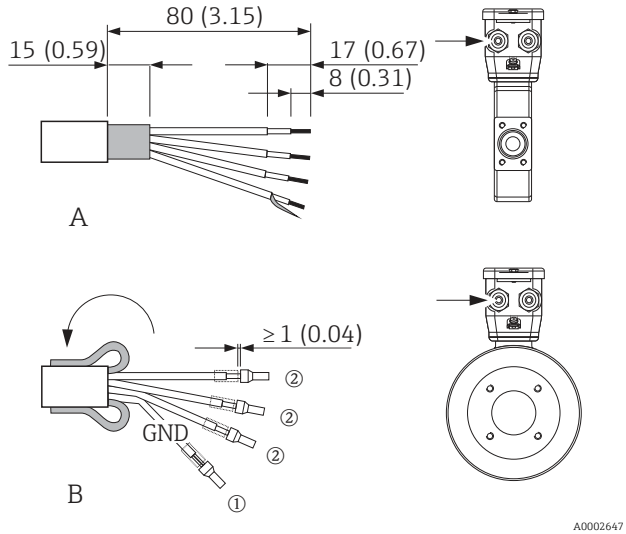


Fig. 40: Engineering unit mm (in)

Coil current cable

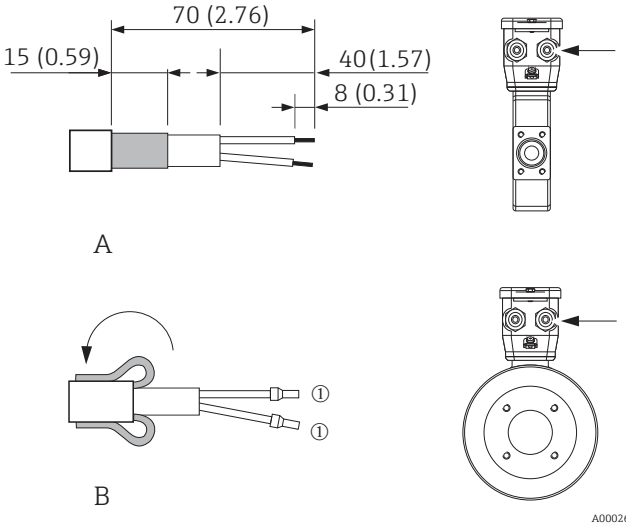


Fig. 41: Engineering unit mm (in)

4.1.2 Cable specifications

Electrode cable

- 3 × 0.38 mm² PVC cable with common, braided copper shield (Ø ~ 9.5 mm/ 0.37") and individually shielded cores
- With Empty Pipe Detection (EPD): 4 × 0.38 mm² PVC cable with common, braided copper shield (Ø ~ 9.5 mm/ 0.37") and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km
- Capacitance: core/shield: ≤ 420 pF/m
- Permanent operating temperature: –20 to +80 °C
- Cable cross-section: max. 2.5 mm²

Coil current cable

- 3 × 0.75 mm² PVC cable with common, braided copper shield (Ø~ 9 mm/ 0.35")
- Conductor resistance: ≤ 37 Ω/km
- Capacitance: core/core, shield grounded: ≤120 pF/m
- Operating temperature: –20 to +80 °C
- Cable cross-section: max. 2.5 mm²
- Test voltage for cable insulation: ≥ 1433 V AC r.m.s. 50/60 Hz or ≥ 2026 V DC

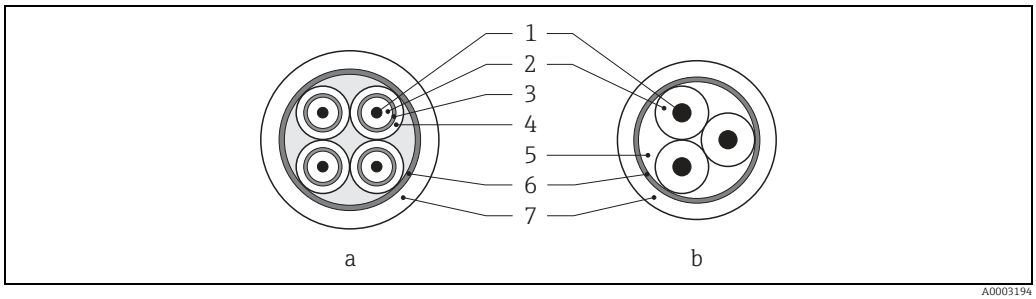


Fig. 42: Cable cross-section

a Electrode cable
b Coil current cable

1 Core
2 Core insulation
3 Core shield
4 Core jacket
5 Core reinforcement
6 Cable shield
7 Outer jacket

Reinforced connecting cables

As an option, Endress+Hauser can also deliver reinforced connecting cables with an additional, reinforcing metal braid. Reinforced connecting cables should be used when laying the cable directly in the ground, if there is a risk of damage from rodents or if using the measuring device below IP 68 degree of protection.

Operation in zones of severe electrical interference:

The measuring device complies with the general safety requirements in accordance with EN 61010 and the EMC requirements of IEC/EN 61326.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

4.2 Connecting the measuring unit

4.2.1 Connecting the transmitter

Warning!
- Risk of electric shock! Switch off the power supply before opening the device. Do not install or wire the device while it is energized. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock! Connect the protective conductor to the ground terminal on the housing before the power supply is applied (not necessary if the power supply is galvanically isolated).
- Compare the specifications on the nameplate with the local voltage supply and frequency. Also comply with national regulations governing the installation of electrical equipment.

1. Remove the cover of the connection compartment (f) from the transmitter housing.
2. Feed the power supply cable (a) and the electrode cable (b) through the appropriate cable entries.
3. Perform the wiring:
   – Wiring diagram (aluminum housing) → 43
   – Wiring diagram (stainless steel housing) → 44
   – Wiring diagram (wall-mount housing) → 45
   – Terminal assignment → 59
4. Screw the cover of the connection compartment (f) firmly onto the transmitter housing.

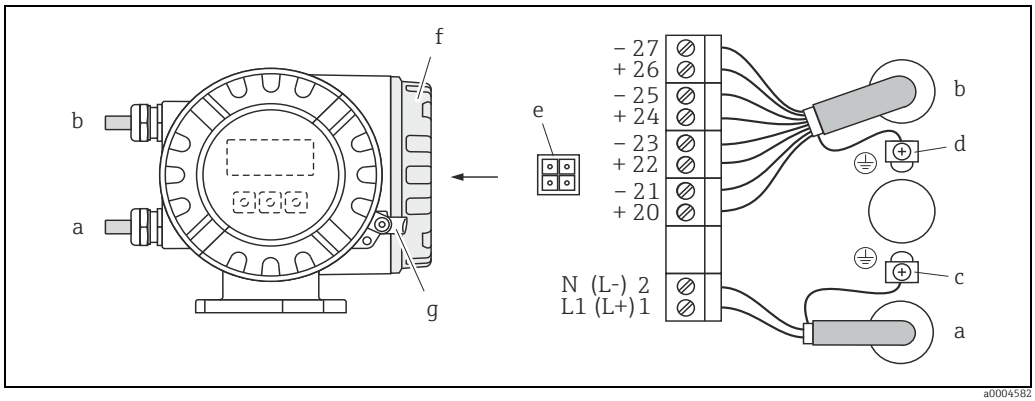


Fig. 43: Connecting the transmitter (aluminum field housing). Cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L- for DC*
*b Electrode cable: Terminals **Nos. 20–27** → 59*
c Ground terminal for protective ground
d Ground terminal for electrode cable shield
e Service connector for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment
g Securing clamp

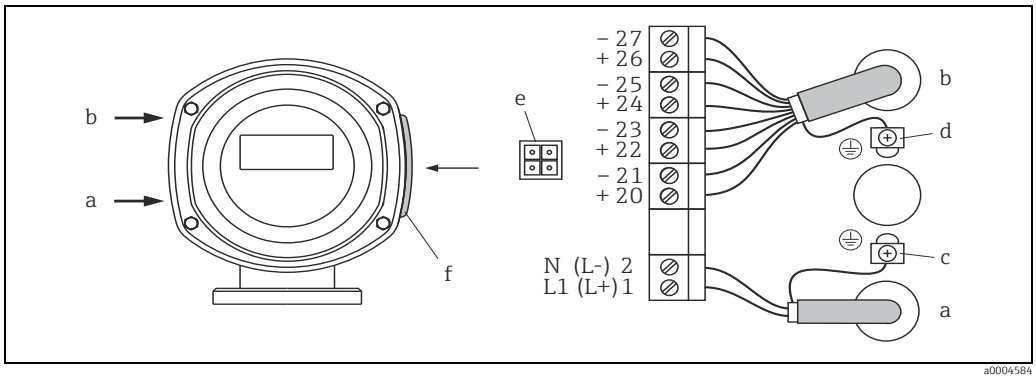


Fig. 44: Connecting the transmitter (stainless steel field housing); cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal **No. 1**: L1 for AC, L+ for DC
Terminal **No. 2**: N for AC, L- for DC
b Electrode cable: Terminals **Nos. 20–27** → 📄 59
c Ground terminal for protective ground
d Ground terminal for electrode cable shield
e Service connector for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment

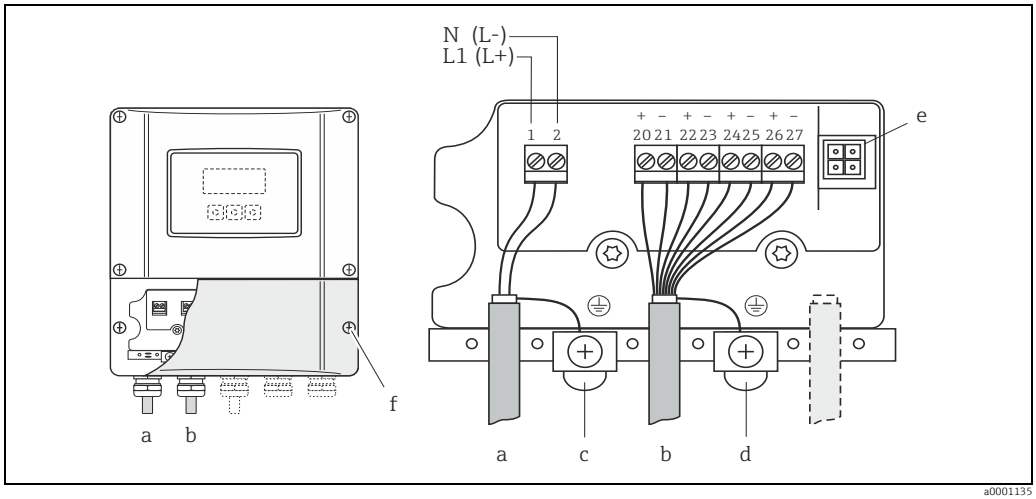


Fig. 45: Connecting the transmitter (wall-mount housing); cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal **No. 1**: L1 for AC, L+ for DC
Terminal **No. 2**: N for AC, L- for DC
b Electrode cable: Terminals **Nos. 20–27** → 📄 59
c Ground terminal for protective ground
d Ground terminal for electrode cable shield
e Service connector for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment

4.2.2 Terminal assignment

Order code for "Input / Output"	Terminal No. 20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
W	-	-	-	Current output HART
A	-	-	Frequency output	Current output HART
D	Status input	Status output	Frequency output	Current output HART
S	-	-	Frequency output Ex i	Current output, Ex i, active, HART
T	-	-	Frequency output Ex i	Current output, Ex i, passive, HART

Note!
Functional values of the inputs and outputs → 📄 103

4.2.3 HART connection

Users have the following connection options at their disposal:
- Direct connection to transmitter by means of terminals 26(+) and 27 (-)
- Connection by means of the 4 to 20 mA circuit.

Note!
- The measuring loop's minimum load must be at least 250 Ω.
- After commissioning, make the following settings:
- CURRENT SPAN function → "4–20 mA HART"
- Switch HART write protection on or off → 📄 70

Connection of the HART handheld communicator

See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".

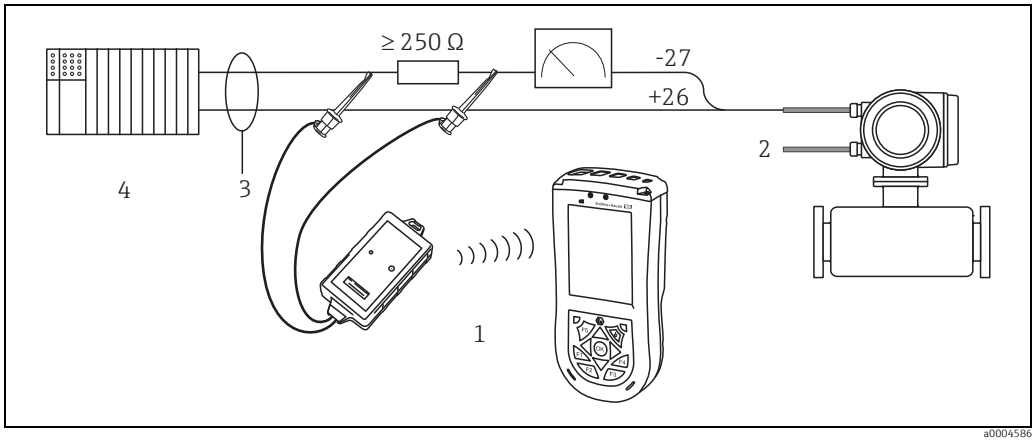


Fig. 46: Electrical connection of HART handheld Field Xpert SFX100

1 HART handheld Field Xpert SFX100
2 Auxiliary energy
3 Shielding
4 Other devices or PLC with passive input

Connection of a PC with an operating software

In order to connect a PC with operating software (e.g. "FieldCare"), a HART modem (e.g. "Commubox FXA195") is needed.

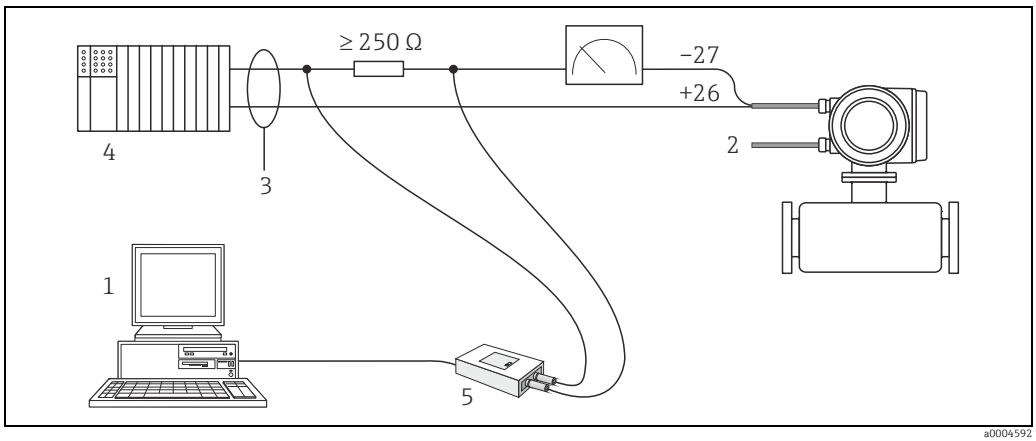


Fig. 47: Electrical connection of a PC with operating software

1 PC with operating software
2 Auxiliary energy
3 Shielding
4 Other devices or PLC with passive input
5 HART modem, e.g. Commubox FXA195

4.3 Potential equalization

Warning!
The measuring system must be included in the potential equalization.

Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes (see Table)

4.3.1 Potential equalization for Promag D

- No reference electrode is integrated!
  For the two ground disks of the sensor an electrical connection to the fluid is always ensured.
- Examples for connections → 61

4.3.2 Potential equalization for Promag E/L/P/W

- Reference electrode integrated in the sensor as standard
- Examples for connections → 62

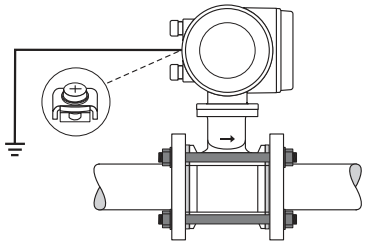
4.3.3 Potential equalization for Promag H

No reference electrode is integrated!
For the metal process connections of the sensor an electrical connection to the fluid is always ensured.

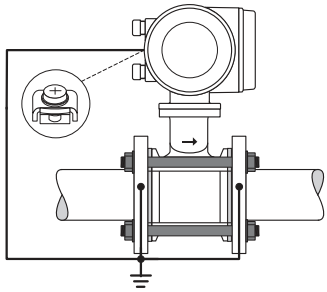
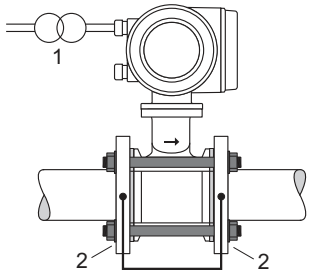
Caution!
If using process connections made of a synthetic material, ground rings have to be used to ensure that potential is equalized (→ 27). The necessary ground rings can be ordered separately from Endress+Hauser as accessories (→ 83).

4.3.4 Examples for potential equalization connections for Promag D

Standard case

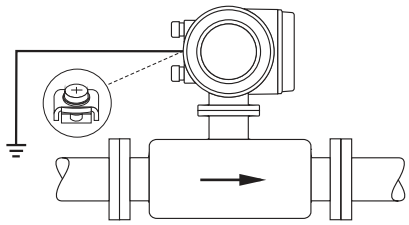
Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal, grounded pipe ▪ Plastic pipe ▪ Pipe with insulating lining Potential equalization takes place via the ground terminal of the transmitter (standard situation). ✎ Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 a00012172 *Fig. 48: Via the ground terminal of the transmitter*

Special cases

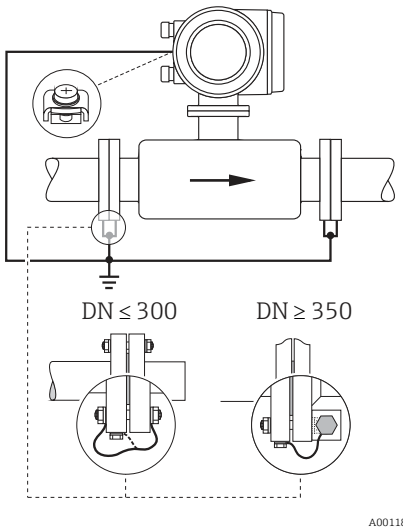
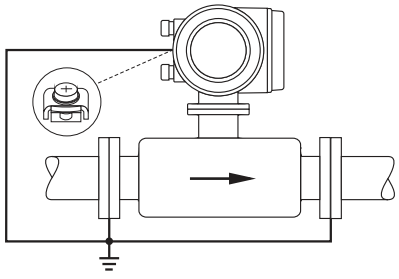
Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal pipe that is not grounded This connection method also applies in situations where: ▪ Customary potential equalization cannot be ensured ▪ Excessively high equalizing currents can be expected Potential equalization takes place via the ground terminal of the transmitter and the two pipe flanges. Here, the ground cable (copper wire, 6 mm² / 0.0093 in²) is mounted directly on the conductive flange coating with flange screws.	 a00012173 *Fig. 49: Via the ground terminal of the transmitter and the flanges of the pipe .*
When using the measuring device in a: ▪ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, 6 mm² (0.0093 in²)). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ▪ The applicable regulations regarding potential-free installation must be observed. ▪ There should be **no** electrically conductive connection between the pipe and the device. ▪ The mounting material must withstand the applicable torques.	 a00012174 *Fig. 50: Potential equalization and cathodic protection* *1 Power supply isolation transformer* *2 Electrically isolated*

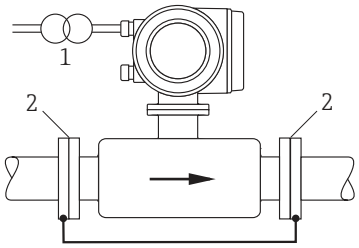
4.3.5 Examples for potential equalization connections for Promag E/L/P/W

Standard case

Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal, grounded pipe Potential equalization takes place via the ground terminal of the transmitter (standard situation). Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 A0011892 *Fig. 51: Via the ground terminal of the transmitter*

Special cases

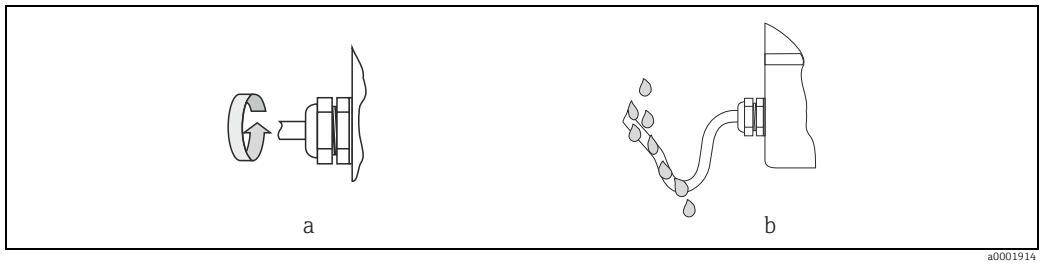
Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal pipe that is not grounded This connection method also applies in situations where: ▪ Customary potential equalization cannot be ensured ▪ Excessively high equalizing currents can be expected Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, 6 mm² / 0.0093 in²) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose. Ground cable installation depends on the nominal diameter: ▪ DN ≤ 300 (12"): The ground cable is mounted directly on the conductive flange coating with the flange screws. ▪ DN ≥ 350 (14"): The ground cable is mounted directly on the metal transport bracket. Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 A0011893 *Fig. 52: Via the ground terminal of the transmitter and the flanges of the pipe*
When using the measuring device in a: ▪ Plastic pipe ▪ Pipe with insulating lining This connection method also applies in situations where: ▪ Customary potential equalization cannot be ensured ▪ Excessively high equalizing currents can be expected Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, min. 6 mm² / 0.0093 in²). When installing the ground disks, please comply with the enclosed Installation Instructions.	 A0011895 *Fig. 53: Via the ground terminal of the transmitter*

Operating conditions	Potential equalization
When using the measuring device in a: ▪ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, 6 mm² / 0.0093 in²). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ▪ The applicable regulations regarding potential-free installation must be observed. ▪ There should be **no** electrically conductive connection between the pipe and the device. ▪ The mounting material must withstand the applicable torques.	 A0011896 *Fig. 54: Potential equalization and cathodic protection* *1 Power supply isolation transformer* *2 Electrically isolated*

4.4 Degree of protection

The devices meet all the requirements of IP 67 degree of protection.

Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP 67 protection is maintained:
- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter → 56.
- Firmly tighten the cable entries.
- The cables must loop down before they enter the cable entries ("water trap"). This arrangement prevents moisture penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.



a0001914

Fig. 55: Installation instructions, cable entries

Caution!
Do not loosen the threaded fasteners of the sensor housing, as otherwise the degree of protection guaranteed by Endress+Hauser no longer applies.

Note!
- The Promag E/L/P/W sensors can be supplied with IP 68 rating (permanent immersion in water to a depth of 3 meters (10 ft)). In this case the transmitter must be installed remote from the sensor.
- The Promag L sensors with IP 68 rating are only available with stainless steel flanges.

4.5 Post-connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	Notes
Are cables or the device damaged (visual inspection)?	-
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	▪ 85 to 250 V AC (50 to 60 Hz) ▪ 20 to 28 V AC (50 to 60 Hz) 11 to 40 V DC
Do the cables used comply with the necessary specifications?	→ 🖹 56
Do the cables have adequate strain relief?	-
Is the cable type route completely isolated? Without loops and crossovers?	-
Are the power-supply and electrode cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Only remote version: Is the flow sensor connected to the matching transmitter electronics?	Check serial number on nameplates of sensor and connected transmitter.
Only remote version: Is the connecting cable between sensor and transmitter connected correctly?	→ 🖹 51
Are all screw terminals firmly tightened?	-
Have the measures for grounding/potential equalization been correctly implemented?	→ 🖹 60
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as "water traps"?	→ 🖹 63
Are all housing covers installed and firmly tightened?	-

5 Operation

5.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device.
The display area consists of two lines; this is where measured values are displayed, and/or status variables (direction of flow, partially filled pipe, bar graph, etc.). You can change the assignment of display lines to variables at will in order to customize the display to suit your needs and preferences (→ "Description of Device Functions" manual).

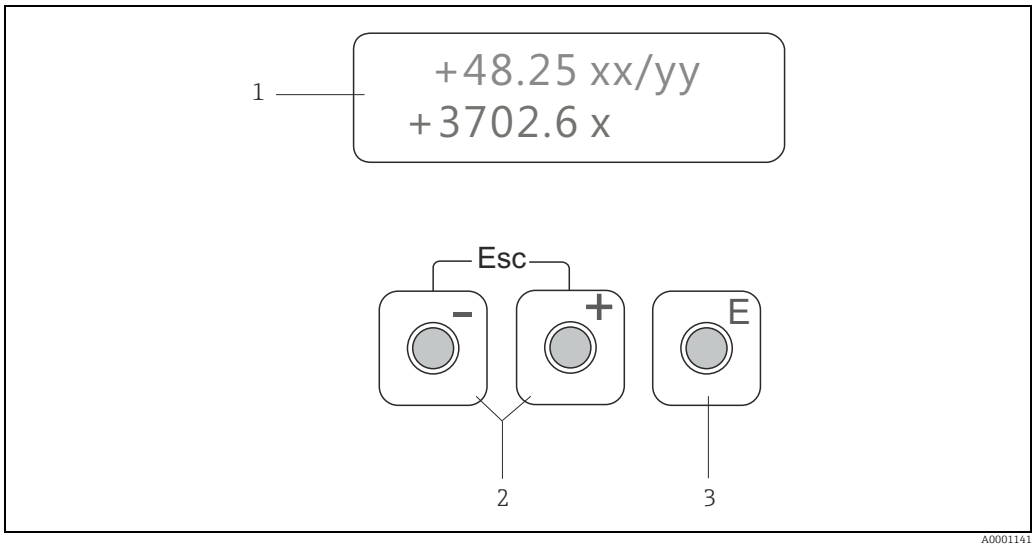


Fig. 56: Display and operating elements

1 Liquid crystal display
The two-line liquid-crystal display shows measured values, dialog texts, error messages and information messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode).
- *Upper display line: Shows primary measured values, e.g. volume flow in [ml/min] or in [%].*
- *Lower display line: Shows supplementary measured variables and status variables, e.g. totalizer reading in [m3], bar graph, measuring point designation*

2 Plus/minus keys
- *Enter numerical values, select parameters*
- *Select different function groups within the function matrix*

Press the +/- keys simultaneously to trigger the following functions:
- *Exit the function matrix step by step → HOME position*
- *Press and hold down +/- keys for longer than 3 seconds → Return directly to HOME position*
- *Cancel data entry*

3 Enter key
- *HOME position → Entry into the function matrix*
- *Save the numerical values you input or settings you change*

5.2 Brief operating instructions on the function matrix

Note!
- See the general notes on → 67.
- Detailed description of all the functions → "Description of Device Functions" manual

The function matrix comprises two levels, namely the function groups and the functions of the function groups.
The groups are the highest-level grouping of the control options for the device. A number of functions is assigned to each group. You select a group in order to access the individual functions for operating and configuring the device.

1. HOME position → E →Enter the function matrix.
2. Select a function group (e.g. OPERATION).
3. Select a function (e.g. LANGUAGE).
   Change parameter/enter numerical values:
   ± → select or enter enable code, parameters, numerical values.
   E → save your entries.
4. Exit the function matrix:
   – Press and hold down Esc key (Esc) for longer than 3 seconds → HOME position.
   – Repeatedly press Esc key (Esc) → return step by step to HOME position.

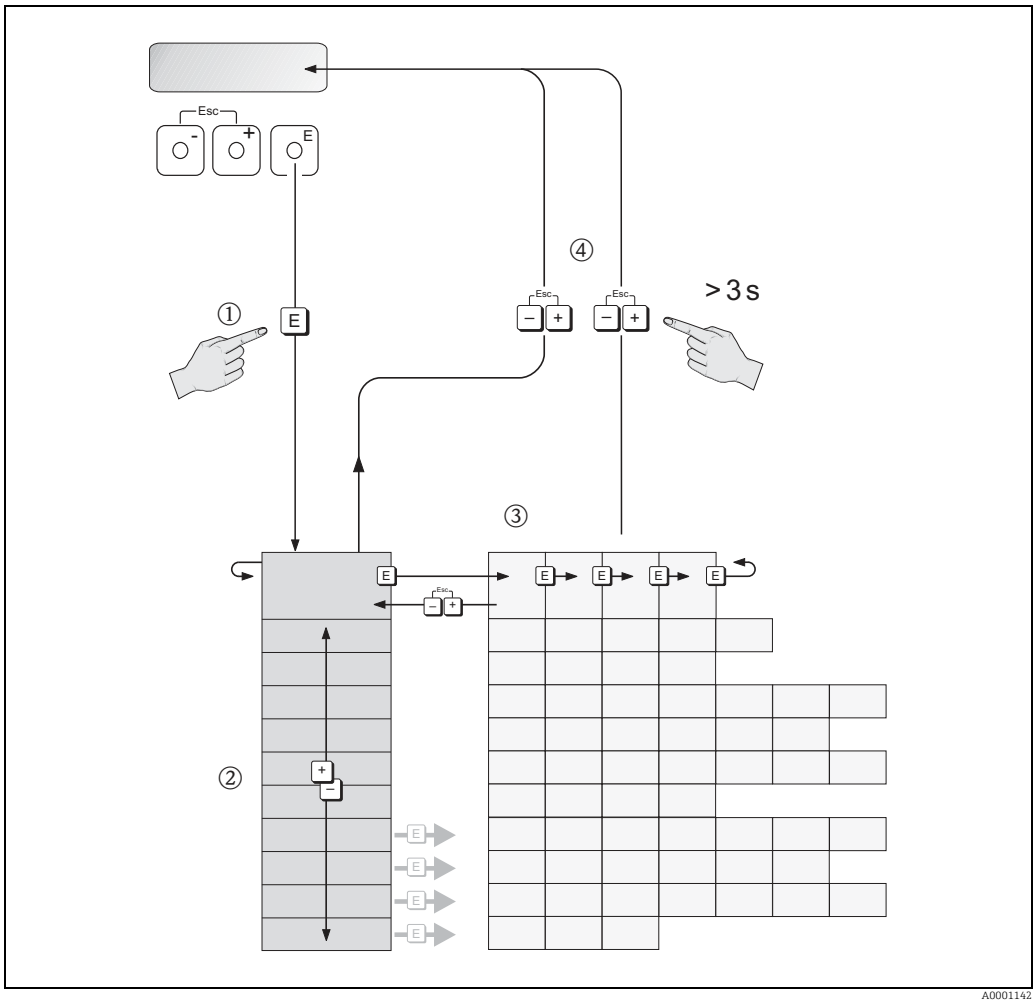


Fig. 57: Selecting functions and configuring parameters (function matrix)

5.2.1 General notes

The Quick Setup menu (→ 77) is adequate for commissioning in most instances. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customize to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged in a number of function groups.

Comply with the following instructions when configuring functions:
- You select functions as described on → 66.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries.
  Press ± to select "SURE [YES]" and press E again to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.

Note!
- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the power supply fails, all preset and configured values remain safely stored in the EEPROM.

Caution!
All functions are described in detail, including the function matrix itself, in the "Description of Device Functions" manual, which is a separate part of these Operating Instructions.

5.2.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 50) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ see the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the ± operating elements are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is specified as the customer's code, programming is always enabled.
- The Endress+Hauser service organization can be of assistance if you mislay your personal code.

Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy.
There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.

5.2.3 Disabling the programming mode

Programming is disabled if you do not press the operating elements within 60 seconds following automatic return to the HOME position.
You can also disable programming in the "ACCESS CODE" function by entering any number (other than the customer's code).

5.3 Displaying error messages

5.3.1 Type of error

Errors which occur during commissioning or measuring operation are displayed immediately. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:
- *System errors* → 📄 *87:*
  This group comprises all device errors, e.g. communication errors, hardware faults, etc.
- *Process errors* → 📄 89:
  This group comprises all application errors, e.g. empty pipe, etc.

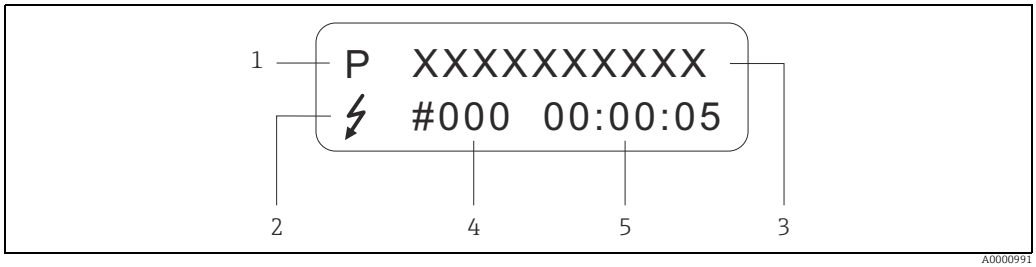


Fig. 58: Error messages on the display (example)

1 Error type:
– P = process error
– S = system error
2 Error message type:
– ϟ = fault message
– ! = notice message
3 Error designation: e.g. EMPTY PIPE = measuring tube is only partly filled or completely empty
4 Error number: e.g. #401
5 Duration of most recent error occurrence (in hours, minutes and seconds)

5.3.2 Error message types

Users have the option of weighting certain errors differently, in other words having them classed as "Fault messages" or "Notice messages". You can define messages in this way with the aid of the function matrix (→ "Description of Device Functions" manual).
Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)

- Displayed as → Exclamation mark (!), error type (S: system error, P: process error)
- The error in question has no effect on the outputs of the measuring device.

Fault message (ϟ)

- Displayed as → Lightning flash (ϟ), error type (S: system error, P: process error).
- The error in question has a direct effect on the outputs.
  The response of the individual outputs (failsafe mode) can be defined in the function matrix using the "FAILSAFE MODE" function (→ "Description of Device Functions" manual).

Note!
For security reasons, error messages should be output via the status output.

5.4 Communication

In addition to local operation, the measuring device can be configured and measured values can be obtained by means of the HART protocol. Digital communication takes place using the 4–20 mA current output HART → 59.

The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes.
The HART master, e.g. a handheld terminal or PC-based operating programs (such as FieldCare), require device description (DD) files which are used to access all the information in a HART device. Information is exclusively transferred using so-called "commands". There are three different command classes:

- *Universal commands:*
  All HART device support and use universal commands. The following functionalities are linked to them:
  – Identify HART devices
  – Reading digital measured values (volume flow, totalizer, etc.)
- *Common practice commands:*
  Common practice commands offer functions which are supported and can be executed by most but not all field devices.
- *Device-specific commands:*
  These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, amongst other things, such as empty/full pipe calibration values, low flow cutoff settings, etc.

Note!
The device has access to all three command classes. A list of all the "Universal commands" and "Common practice commands" is provided on → 71.

5.4.1 Operating options

For the complete operation of the measuring device, including device-specific commands, there are DD files available to the user to provide the following operating aids and programs:

Field Xpert HART Communicator

Selecting device functions with a HART Communicator is a process involving a number of menu levels and a special HART function matrix.
The HART manual in the carrying case of the HART Communicator contains more detailed information on the device.

Operating program "FieldCare"

FieldCare is Endress+Hauser's FDT-based plant Asset Management Tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flow measuring devices are accessed via a service interface or via the service interface FXA193.

Operating program "SIMATIC PDM" (Siemens)

SIMATIC PDM is a standardized, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

Operating program "AMS" (Emerson Process Management)

AMS (Asset Management Solutions): program for operating and configuring devices.

5.4.2 Current device description files

The following table illustrates the suitable device description file for the operating tool in question and then indicates where these can be obtained.

HART protocol:

Valid for device software:	2.04.XX	→ Function DEVICE SOFTWARE
Device data HART Manufacturer ID: Device ID:	 11_{hex} (ENDRESS+HAUSER) 41_{hex}	 → Function MANUFACTURER ID → Function DEVICE ID
HART version data:	Device Revision 6/ DD Revision 1	
Software release:	01.2011	

Operating program:	**Sources for obtaining device descriptions:**
Handheld Field Xpert SFX100	Use update function of handheld terminal
FieldCare / DTM	▪ www.endress.com → Download ▪ CD-ROM (Endress+Hauser order number 56004088) ▪ DVD (Endress+Hauser order number 70100690)
AMS	www.endress.com → Download
SIMATIC PDM	www.endress.com → Download

Tester/simulator:	**Sources for obtaining device descriptions:**
Fieldcheck	Update by means of FieldCare with the flow device FXA193/291 DTM in the Fieldflash module

Note!
The "Fieldcheck" tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.

5.4.3 Device variables

The following device variables are available using the HART protocol:

Code (decimal)	Device variable
0	OFF (not assigned)
1	Volume flow
250	Totalizer 1
251	Totalizer 2

At the factory, the process variables are assigned to the following device variables:
- Primary process variable (PV) → Volume flow
- Second process variable (SV) → Totalizer 1
- Third process variable (TV) → not assigned
- Fourth process variable (FV) → not assigned

Note!
You can set or change the assignment of device variables to process variables using Command 51.

5.4.4 Switching HART write protection on/off

The HART write protection can be switched on and off using the HART WRITE PROTECT device function (→ "Description of Device Functions" manual).

5.4.5 Universal and common practice HART commands

The following table contains all the universal commands supported by the device.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Universal commands			
0	Read unique device identifier Access type = read	None	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID: ▪ Byte 0: fixed value 254 ▪ Byte 1: Manufacturer ID, 17 = E+H ▪ Byte 2: Device type ID, 65 = Promag 50 ▪ Byte 3: Number of preambles ▪ Byte 4: Universal commands rev. no. ▪ Byte 5: Device-specific commands rev. no. ▪ Byte 6: Software revision ▪ Byte 7: Hardware revision ▪ Byte 8: Additional device information ▪ Bytes 9-11: Device identification
1	Read primary process variable Access type = read	None	▪ Byte 0: HART unit code of the primary process variable ▪ Bytes 1-4: Primary process variable Factory setting: Primary process variable = Volume flow ✎ Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.
2	Read the primary process variable as current in mA and percentage of the set measuring range Access type = read	None	▪ Bytes 0-3: actual current of the primary process variable in mA ▪ Bytes 4-7: % value of the set measuring range Factory setting: Primary process variable = Volume flow ✎ Note! You can change the assignment of device variables to process variables using Command 51.
3	Read the primary process variable as current in mA and four dynamic process variables Access type = read	None	24 bytes are sent as a response: ▪ Bytes 0-3: primary process variable current in mA ▪ Byte 4: HART unit code of the primary process variable ▪ Bytes 5-8: Primary process variable ▪ Byte 9: HART unit code of the second process variable ▪ Bytes 10-13: Second process variable ▪ Byte 14: HART unit code of the third process variable ▪ Bytes 15-18: Third process variable ▪ Byte 19: HART unit code of the fourth process variable ▪ Bytes 20-23: Fourth process variable *Factory setting:* ▪ Primary process variable = Volume flow ▪ Second process variable = Totalizer 1 ▪ Third process variable = OFF (not assigned) ▪ Fourth process variable = OFF (not assigned) ✎ Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
6	Set HART shortform address Access type = write	Byte 0: desired address (0 to 15) Factory setting: 0 ✎ Note! With an address >0 (multidrop mode), the current output of the primary process variable is set to 4 mA.	Byte 0: active address
11	Read unique device identification using the TAG (measuring point designation) Access type = read	Bytes 0-5: TAG	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID if the given TAG agrees with the one saved in the device: ▪ Byte 0: fixed value 254 ▪ Byte 1: Manufacturer ID, 17 = E+H ▪ Byte 2: Device type ID, 65 = Promag 50 ▪ Byte 3: Number of preambles ▪ Byte 4: Universal commands rev. no. ▪ Byte 5: Device-specific commands rev. no. ▪ Byte 6: Software revision ▪ Byte 7: Hardware revision ▪ Byte 8: Additional device information ▪ Bytes 9-11: Device identification
12	Read user message Access type = read	None	Bytes 0-24: User message ✎ Note! You can write the user message using Command 17.
13	Read TAG, descriptor and date Access type = read	None	▪ Bytes 0-5: TAG ▪ Bytes 6-17: descriptor ▪ Bytes 18-20: Date ✎ Note! You can write the TAG, descriptor and date using Command 18.
14	Read sensor information on primary process variable	None	▪ Bytes 0-2: Sensor serial number ▪ Byte 3: HART unit code of sensor limits and measuring range of the primary process variable ▪ Bytes 4-7: Upper sensor limit ▪ Bytes 8-11: Lower sensor limit ▪ Bytes 12-15: Minimum span ✎ Note! ▪ The data relate to the primary process variable (= volume flow). ▪ Manufacturer-specific units are represented using the HART unit code "240".
15	Read output information of primary process variable Access type = read	None	▪ Byte 0: Alarm selection ID ▪ Byte 1: Transfer function ID ▪ Byte 2: HART unit code for the set measuring range of the primary process variable ▪ Bytes 3-6: upper range, value for 20 mA ▪ Bytes 7-10: lower range, value for 4 mA ▪ Bytes 11-14: Damping constant in [s] ▪ Byte 15: Write protection ID ▪ Byte 16: OEM dealer ID, 17 = E+H Factory setting: Primary process variable = Volume flow ✎ Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.
16	Read the device production number Access type = read	None	Bytes 0-2: Production number

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
17	Write user message Access = write	You can save any 32-character long text in the device under this parameter: Bytes 0-23: Desired user message	Displays the current user message in the device: Bytes 0-23: Current user message in the device
18	Write TAG, descriptor and date Access = write	With this parameter, you can store an 8 character TAG, a 16 character descriptor and a date: ▪ Bytes 0-5: TAG ▪ Bytes 6-17: descriptor ▪ Bytes 18-20: Date	Displays the current information in the device: ▪ Bytes 0-5: TAG ▪ Bytes 6-17: descriptor ▪ Bytes 18-20: Date
19	Write the device production number Access = write	Bytes 0-2: Production number	Bytes 0-2: Production number

The following table contains all the common practice commands supported by the device.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Common practice commands			
34	Write damping value for primary process variable Access = write	Bytes 0-3: Damping value of the primary process variable "volume flow" in seconds *Factory setting:* Primary process variable = Current output damping	Displays the current damping value in the device: Bytes 0-3: Damping value in seconds
35	Write measuring range of primary process variable Access = write	Write the desired measuring range: ▪ Byte 0: HART unit code of the primary process variable ▪ Bytes 1-4: upper range, value for 20 mA ▪ Bytes 5-8: lower range, value for 4 mA *Factory setting:* Primary process variable = Volume flow ✎ Note! ▪ The start of the measuring range (4 mA) must correspond to the zero flow. ▪ If the HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.	The currently set measuring range is displayed as a response: ▪ Byte 0: HART unit code for the set measuring range of the primary process variable ▪ Bytes 1-4: upper range, value for 20 mA ▪ Bytes 5-8: lower range, value for 4 mA ✎ Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.
38	Device status reset (configuration changed) Access = write	None	None ✎ Note! It is also possible to execute this HART command when write protection is activated (= ON)!
40	Simulate input current of primary process variable Access = write	Simulation of the desired output current of the primary process variable. An entry value of 0 exits the simulation mode: Bytes 0-3: Output current in mA *Factory setting:* Primary process variable = Volume flow ✎ Note! You can set the assignment of device variables to process variables using Command 51.	The momentary output current of the primary process variable is displayed as a response: Bytes 0-3: Output current in mA
42	Perform master reset Access = write	None	None

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
44	Write unit of primary process variable Access = write	Set unit of primary process variable. Only units which are suitable for the process variable are transferred to the device: Byte 0: HART unit code *Factory setting:* Primary process variable = Volume flow Note! ▪ If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit. ▪ If you change the unit of the primary process variable, this has a direct impact on the system units.	The current unit code of the primary process variable is displayed as a response: Byte 0: HART unit code Note! Manufacturer-specific units are represented using the HART unit code "240".
48	Read additional device status Access = read	None	The device status is displayed in extended form as the response: Coding: see table → 75
50	Read assignment of the device variables to the four process variables Access = read	None	Display of the current variable assignment of the process variables: ▪ Byte 0: Device variable code to the primary process variable ▪ Byte 1: Device variable code to the second process variable ▪ Byte 2: Device variable code to the third process variable ▪ Byte 3: Device variable code to the fourth process variable *Factory setting:* ▪ Primary process variable: Code 1 for volume flow ▪ Second process variable: Code 250 for totalizer ▪ Third process variable: Code 0 for OFF (not assigned) ▪ Fourth process variable: Code 0 for OFF (not assigned)
51	Write assignment of the device variables to the four process variables Access = write	Setting of the device variables to the four process variables: ▪ Byte 0: Device variable code to the primary process variable ▪ Byte 1: Device variable code to the second process variable ▪ Byte 2: Device variable code to the third process variable ▪ Byte 3: Device variable code to the fourth process variable *Factory setting:* ▪ Primary process variable: Volume flow ▪ Second process variable: Totalizer 1 ▪ Third process variable: OFF (not assigned) ▪ Fourth process variable: OFF (not assigned)	The variable assignment of the process variables is displayed as a response: ▪ Byte 0: Device variable code to the primary process variable ▪ Byte 1: Device variable code to the second process variable ▪ Byte 2: Device variable code to the third process variable ▪ Byte 3: Device variable code to the fourth process variable
53	Write device variable unit Access = write	This command sets the unit of the given device variables. Only those units which suit the device variable are transferred: ▪ Byte 0: Device variable code ▪ Byte 1: HART unit code Code of the supported device variables: See information → 70 Note! ▪ If the written unit is not the correct one for the device variable, the device will continue with the last valid unit. ▪ If you change the unit of the device variable, this has a direct impact on the system units.	The current unit of the device variables is displayed in the device as a response: ▪ Byte 0: Device variable code ▪ Byte 1: HART unit code Note! Manufacturer-specific units are represented using the HART unit code "240".
59	Write number of preambles in response message Access = write	This parameter sets the number of preambles which are inserted in the response messages: Byte 0: Number of preambles (4 to 20)	The current number of preambles is displayed in the response telegram: Byte 0: Number of preambles

5.4.6 Device status and error messages

You can read the extended device status, in this case, current error messages, via Command "48". The command delivers information which is partly coded in bits (see table below).

Note!
- You can find a detailed explanation of the device status and error messages and their elimination on → 75.
- Bits and bytes not listed are not assigned.

Byte	Bit	Error No.	Short error description
0	0	001	Serious device error
	1	011	Measuring amplifier has faulty EEPROM
	2	012	Error when accessing data of the measuring amplifier EEPROM
1	1	031	S-DAT: defective or missing
	2	032	S-DAT: Error accessing saved values
	5	051	I/O and the amplifier are not compatible.
3	3	111	Totalizer checksum error
	4	121	I/O board and amplifier not compatible.
4	3	251	Internal communication fault on the amplifier board.
	4	261	No data reception between amplifier and I/O board
5	0	321	Coil current of the sensor is outside the tolerance.
	7	339	Flow buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
6	0	340	
	1	341	
	2	342	
	3	343	Frequency buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
	4	344	
	5	345	
	6	346	
	7	347	Pulse buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
7	0	348	
	1	349	
	2	350	
	3	351	Current output: Flow is out of range.
	4	352	
	5	353	
	6	354	
	7	355	Frequency output: Flow is out of range.
8	0	356	
	1	357	
	2	358	

Byte	Bit	Error No.	Short error description
8	3	359	Pulse output: Flow is out of range.
	4	360	
	5	361	
	6	362	
10	7	401	Measuring tube partially filled or empty
11	2	461	EPD calibration not possible because the fluid's conductivity is either too low or too high.
	4	463	The EPD calibration values for empty pipe and full pipe are identical, and therefore incorrect.
12	1	474	Maximum flow value entered is overshot
	7	501	Amplifier software version is loaded. Currently no other commands are possible.
13	0	502	Upload/download of device files. Currently no other commands are possible.
14	3	601	Positive zero return active
	7	611	Simulation current output active
15	0	612	
	1	613	
	2	614	
	3	621	Simulation frequency output active
	4	622	
	5	623	
	6	624	
	7	631	Simulation pulse output active
16	0	632	
	1	633	
	2	634	
	3	641	Simulation status output active
	4	642	
	5	643	
	6	644	
17	7	671	Simulation of the status input active
18	0	672	
	1	673	
	2	674	
	3	691	Simulation of response to error (outputs) active
	4	692	Simulation of volume flow active

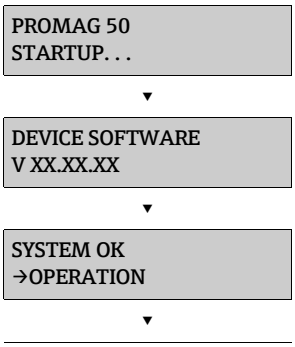
6 Commissioning

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist for "Post-installation check" → 📄 50
- Checklist for "Post-connection check" → 📄 64

6.2 Switching on the measuring device

Once the connection checks have been successfully completed, it is time to switch on the power supply. The device is now operational. The measuring device performs a number of post switch-on self-tests. As this procedure progresses the following sequence of messages appears on the local display:



Start-up message

Current software version

Beginning of normal measuring mode

Normal measuring mode commences as soon as start-up completes.
Various measured-value and/or status variables (HOME position) appear on the display.

Note!
If start-up fails, an error message indicating the cause is displayed.

6.3 Quick Setup

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the operating program, e.g. FieldCare.
If the measuring device is equipped with a local display, all the important device parameters for standard operation, as well as additional functions, can be configured quickly and easily by means of the following Quick Setup menu.

6.3.1 "Commissioning" Quick Setup menu

This Quick Setup menu guides you systematically through the setup procedure for all the major device functions that have to be configured for standard measuring operation.

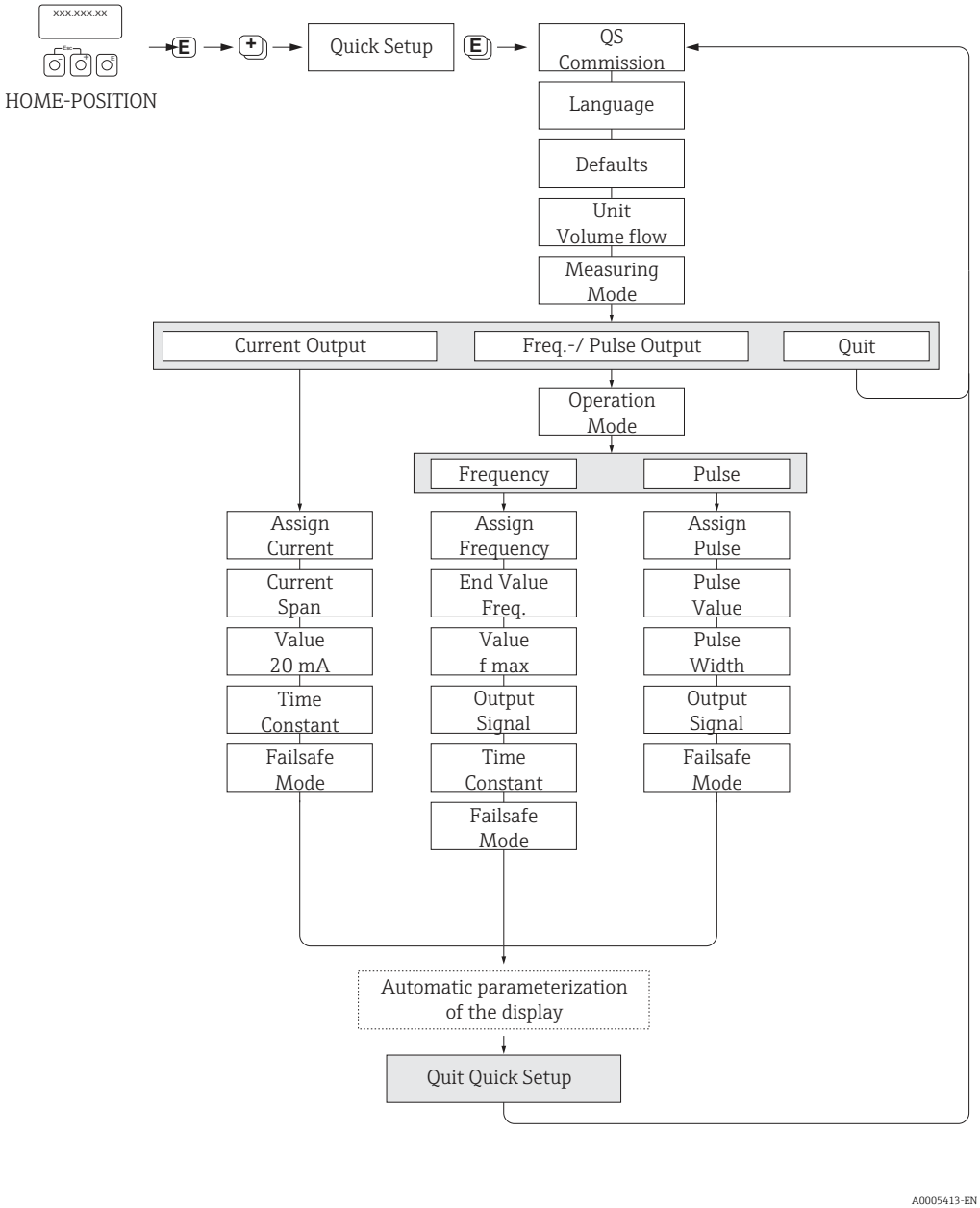


Fig. 59: "QUICK SETUP COMMISSIONING" menu for the rapid configuration of important device functions

6.4 Configuration

6.4.1 Current output: active/passive

The current output is configured as "active" or "passive" by means of various jumpers on the I/O board.

Warning!
Risk of electric shock! Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → 94.
3. Position the jumper → 60.

   Caution!
   Risk of destroying the measuring device. Set the jumpers exactly as shown in the graphic. Pay strict attention to the position of the jumpers as indicated in the graphic.
4. Installation of the I/O board is the reverse of the removal procedure.

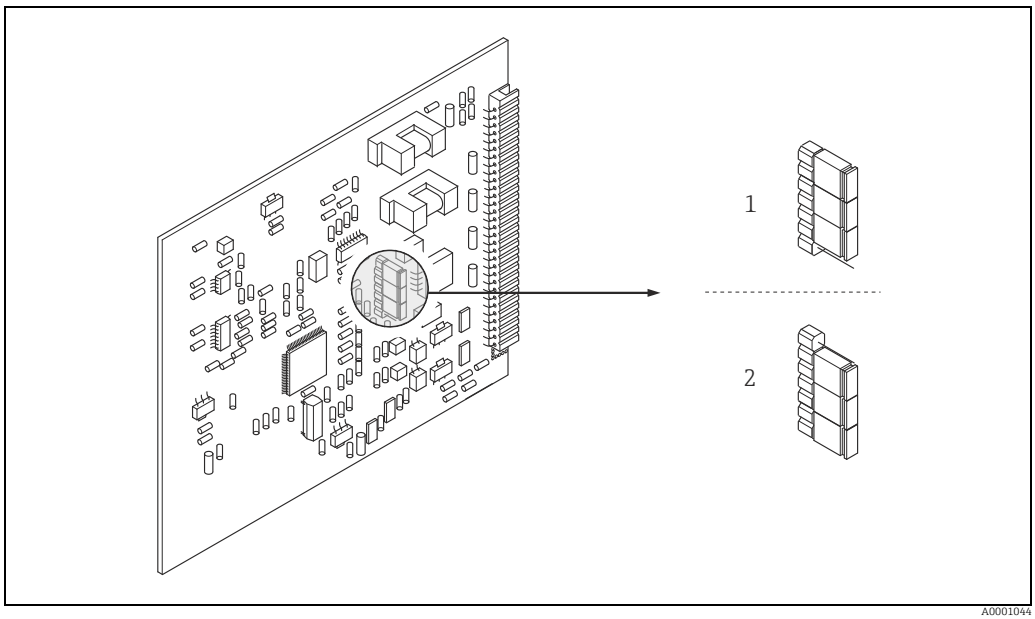


Fig. 60: Configuring current outputs using jumpers (I/O board)

1 Active current output (factory setting)
2 Passive current output

6.5 Adjustment

6.5.1 Empty-pipe/full-pipe adjustment

Flow cannot be measured correctly unless the measuring tube is completely full.
This status can be permanently monitored using the Empty Pipe Detection:

- EPD = Empty Pipe Detection (with the help of an EPD electrode)
- OED = Open Electrode Detection (Empty Pipe Detection with the help of the measuring electrodes, if the sensor is not equipped with an EPD electrode or the orientation is not suitable for using EPD).

Caution!
Detailed information on the empty-pipe/full-pipe adjustment procedure can be found in the "Description of Device Functions" manual:

- EPD/OED ADJUSTMENT (carrying out the adjustment).
- EPD (switching on and off EPD/OED).
- EPD RESPONSE TIME (input of the response time for EPD/OED).

Note!

- The EPD function is not available unless the sensor is fitted with an EPD electrode.
- The devices are already calibrated at the factory with water (approx. 500 µS/cm). If the fluid conductivity differs from this reference, empty-pipe/full-pipe adjustment has to be performed again on site.
- The default setting for EPD when the devices are delivered is OFF; the function has to be activated if required.
- The EPD process error can be output by means of the configurable relay output.

Performing empty-pipe and full-pipe adjustment (EPD)

1. Select the appropriate function in the function matrix:
   HOME → E → ± → PROCESS PARAMETER → E → ± → EPD ADJUSTMENT
2. Empty the piping:
   – The wall of the measuring tube should still be wet with fluid during EPD empty pipe adjustment
   – The wall of the measuring tube/the measuring electrodes should **no longer** be wet with fluid during OED empty pipe adjustment
3. Start empty-pipe adjustment: Select "EMPTY PIPE ADJUST" or "OED EMPTY ADJUST" and press E to confirm.
4. After empty-pipe adjustment, fill the piping with fluid.
5. Start full-pipe adjustment: Select "FULL PIPE ADJUST" or "OED FULL ADJUST" and press E to confirm.
6. Having completed the adjustment, select the setting "OFF" and exit the function by pressing E.
7. Switch on empty pipe detection in the EPD function:
   – EPD empty pipe adjustment: Select ON STANDARD or ON SPECIAL and press E to confirm
   – OED empty pipe adjustment: Select OED and confirm with E.

   Caution!
   The adjustment coefficients must be valid before you can activate the EPD function. If adjustment is incorrect the following messages might appear on the display:
   – FULL = EMPTY
     The adjustment values for empty pipe and full pipe are identical. In cases of this nature you must repeat empty-pipe or full-pipe adjustment!
   – ADJUSTMENT NOT OK
     Adjustment is not possible because the fluid's conductivity is out of range.

6.6 Data storage device (HistoROM)

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data are stored. It is possible to plug these modules into other devices to copy device configurations from one device to another, for example.

6.6.1 HistoROM/S-DAT (sensor-DAT)

The S-DAT is an exchangeable data storage device in which all sensor relevant parameters are stored, i.e., diameter, serial number, calibration factor, zero point.

7 Maintenance

No special maintenance work is required.

7.1 Exterior cleaning

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

7.2 Seals

The seals of the Promag H sensor must be replaced periodically, particularly in the case of gasket seals (aseptic version).
The period between changes depends on the frequency of cleaning cycles, the cleaning temperature and the fluid temperature.

Replacement seals (accessories) → 🖹 83.

8 Accessories

Various accessories, which can be ordered separately or with the device from Endress+Hauser, are available for the device. Detailed information can be provided by the Endress+Hauser service organization or can be found on the product page of the Endress+Hauser website: www.endress.com

8.1 Device-specific accessories

Accessory	Description	Order code
Proline Promag 50 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Degree of protection/version ▪ Cable for remote version ▪ Cable entry ▪ Display/power supply/operation ▪ Software ▪ Outputs/inputs	50XXX – XXXXX******

8.2 Measuring principle-specific accessories

Accessory	Description	Order code
Mounting set for Promag 50 transmitter	Mounting set for the transmitter (remote version). Suitable for: ▪ Wall mounting ▪ Pipe mounting ▪ Panel-mounted installation Mounting set for aluminum field housing. Suitable for: ▪ Pipe mounting	DK5WM – *
Wall-mounting kit for Promag H	Wall-mounting kit for the Promag H sensor.	DK5HM – **
Cable for remote version	Coil current and electrode cables, various lengths.	DK5CA – **
Mounting kit for Promag D, wafer version	▪ Mounting bolts ▪ Nuts incl. washers ▪ Flange seals ▪ Centering sleeves (if required for the flange)	DKD** – **
Set of seals for Promag D	Set of seals consisting of two flange seals.	DK5DD – ***
Mounting kit for Promag H	▪ 2 process connections ▪ Threaded fasteners ▪ Seals	DKH** – ****
Set of seals for Promag H	For regular replacement of the seals of the Promag H sensor.	DK5HS – ***
Welding jig for Promag H	Weld nipple as process connection: welding jig for installation in pipe.	DK5HW – ***
Adapter connection for Promag A, H	Adapter connections for installing a Promag 10 H instead of a Promag 30/33 A or Promag 30/33 H DN 25.	DK5HA – *****
Ground rings for Promag H	Ground rings for potential equalization.	DK5HR – ***
Ground cable for Promag E/L/P/W	Ground cable for potential equalization.	DK5GC – ***
Ground disk for Promag E/L/P/W	Ground disk for potential equalization.	DK5GD – * * ***
Process display RIA45	Multifunctional 1-channel display unit: ▪ Universal input ▪ Transmitter power supply ▪ Limit relay ▪ Analog output	RIA45 – ******

Accessory	Description	Order code
Process display RIA251	Digital display device for looping into the 4 to 20 mA current loop.	RIA251 – **
Field display unit RIA16	Digital field display device for looping into the 4 to 20 mA current loop.	RIA16 – ***
Application Manager RMM621	Electronic recording, display, balancing, control, saving and event and alarm monitoring of analog and digital input signals. Values and conditions determined are output by means of analog and digital output signals. Remote transmission of alarms, input values and calculated values using a PSTN or GSM modem.	RMM621 – **********

8.3 Communication-specific accessories

Accessory	Description	Order code
HART Communicator Field Xpert SFX 100	Handheld terminal for remote configuration and for obtaining measured values via the HART current output (4 to 20 mA) and FOUNDATION Fieldbus. Contact your Endress+Hauser representative for more information.	SFX100 – *******
Fieldgate FXA320	Gateway for remote interrogation of HART sensors and actuators via Web browser: ▪ 2-channel analog input (4 to 20 mA) ▪ 4 binary inputs with event counter function and frequency measurement ▪ Communication via modem, Ethernet or GSM ▪ Visualization via Internet/Intranet in Web browser and/or WAP cellular phone ▪ Limit value monitoring with alarm by e-mail or SMS ▪ Synchronized time stamping of all measured values.	FXA320 – *****
Fieldgate FXA520	Gateway for remote interrogation of HART sensors and actuators via Web browser: ▪ Web server for remote monitoring of up to 30 measuring points ▪ Intrinsically safe version [EEx ia]IIC for applications in hazardous areas ▪ Communication via modem, Ethernet or GSM ▪ Visualization via Internet/Intranet in Web browser and/or WAP cellular phone ▪ Limit value monitoring with alarm by e-mail or SMS ▪ Synchronized time stamping of all measured values ▪ Remote diagnosis and remote configuration of connected HART devices	FXA520 – ****
FXA195	The Commubox FXA195 connects intrinsically safe Smart transmitters with HART protocol to the USB port of a personal computer. This makes the remote operation of the transmitters possible with the aid of configuration programs (e.g. FieldCare). Power is supplied to the Commubox by means of the USB port	FXA195 – *

8.4 Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and planning flowmeters. The Applicator software can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.	DXA80 – *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser Web site: www.endress.com
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.	RSG40 – **********
FXA193	Service interface from the device to the PC for operation via FieldCare.	FXA193 – *

9 Troubleshooting

9.1 Troubleshooting instructions

Always start troubleshooting with the checklist below if faults occur after start-up or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

Caution!
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. The necessary procedures must be carried out before you return the device to Endress+Hauser → 🖹 5.
Always enclose a duly completed "Declaration of Contamination" form. You will find a preprinted blank of this form at the back of this manual.

Check the display	
No display visible and no output signals present.	1. Check the supply voltage → terminals 1, 2 2. Check the power line fuse → 🖹 98 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC / 16 to 62 V DC: 2 A slow-blow / 250 V 3. Measuring electronics defective → order spare parts → 🖹 93
No display visible, but output signals are present.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → 🖹 94 2. Display module defective → order spare parts → 🖹 93 3. Measuring electronics defective → order spare parts → 🖹 93
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the OS buttons and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
Measured value indicated, but no signal at the current or pulse output.	Electronics board defective → order spare parts → 🖹 93
↓	
Error messages on display	
Errors which occur during commissioning or measuring operation are displayed immediately. Error messages consist of a variety of icons: the meanings of these icons are as follows (example): – Error type: **S** = system error, **P** = process error – Error message type: ϟ = fault message, **!** = notice message – **EMPTY PIPE** = Type of error, e.g. measuring tube is only partly filled or completely empty – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – **#**401 = error number Caution! ▪ See the information on → 🖹 68! ▪ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice message only.	
Error number: No. 001 – 399 No. 501 – 699	System error (device error) has occurred → 🖹 87
Error number: No. 401 - 499	Process error (application error) has occurred → 🖹 89
↓	
Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → 🖹 90

9.2 System error messages

Serious system errors are **always** recognized by the device as "Fault message", and are shown as a lightning flash (ϟ) on the display. Fault messages immediately affect the outputs.

Caution!
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. The necessary procedures on → 🖹 5 must be carried out before you return a flowmeter to Endress+Hauser. Always enclose a duly completed "Declaration of Contamination" form. You will find a master copy of this form at the back of this manual.

Note!
Also observe the information on → 🖹 68.

No.	Error message / Type	Cause	Remedy (spare part → 🖹 93)
S = System error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
No. # 0xx → Hardware error			
001	S: CRITICAL FAILURE $: # 001	Serious device error	Replace the amplifier board.
011	S: AMP HW EEPROM $: # 011	Amplifier: Defective EEPROM	Replace the amplifier board.
012	S: AMP SW EEPROM $: # 012	Amplifier: Error accessing EEPROM data	The EEPROM data blocks in which an error has occurred are displayed in the TROUBLESHOOTING function. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the errored parameter values. Note! The measuring device has to be restarted if an error has occurred in a totalizer block (see error No. 111 / CHECKSUM TOTAL).
031	S: SENSOR HW DAT $: # 031	1. S-DAT is not plugged into the amplifier board correctly (or is missing). 2. S-DAT is defective.	1. Check whether the S-DAT is correctly plugged into the amplifier board. 2. Replace the S-DAT if it is defective. Check that the new replacement DAT is compatible with the measuring electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the S-DAT into the amplifier board.
032	S: SENSOR SW DAT $: # 032		
No. # 1xx → Software error			
101	S: GAIN ERROR AMP $: # 101	Gain deviation compared to reference gain > 25%.	Replace the amplifier board.
111	S: CHECKSUM TOTAL $: # 111	Totalizer checksum error.	1. Restart the measuring device. 2. Replace the amplifier board if necessary.
121	S: A / C COMPATIB. !: # 121	Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). Note! ▪ This message is only listed in the error history. ▪ Nothing is shown on the display.	Module with lower software version has either to be updated by FieldCare with the required software version or the module has to be replaced.

No.	Error message / Type	Cause	Remedy (spare part → 🖹 93)
No. # 2xx → Error in DAT / no communication			
251	S: COMMUNICATION I/O $: # 251	Internal communication fault on the amplifier board.	Replace the amplifier board.
261	S: COMMUNICATION I/O $: # 261	No data reception between amplifier and I/O board or faulty internal data transfer.	Check the BUS contacts.
No. # 3xx → System limits exceeded			
321	S: TOL. COIL CURR. $: # 321	Sensor: Coil current is out of tolerance.	⚠ Warning! Switch off power supply before manipulating the coil current cable, coil current cable connector or measuring electronics boards! Remote version: 1. Check wiring of terminals 41/42 → 🖹 51 2. Check coil current cable connector. Compact and remote version: Replace measuring electronics boards if necessary
339 to 342	S: STACK CUR OUT n !: # 339 to 342	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable. Recommendations in the event of fault category = FAULT MESSAGE ($) ▪ Configure the fault response of the output to "ACTUAL VALUE" so that the temporary buffer can be cleared. ▪ Clear the temporary buffer by the measures described under Item 1.
343 to 346	S: STACK FREQ. OUT n !: # 343 to 346		
347 to 350	S: STACK PULSE OUT n !: # 343 to 346	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Increase the setting for pulse weighting 2. Increase the max. pulse frequency if the totalizer can handle a higher number of pulses. 3. Increase or reduce flow, as applicable. Recommendations in the event of fault category = FAULT MESSAGE ($) ▪ Configure the fault response of the output to "ACTUAL VALUE" so that the temporary buffer can be cleared. ▪ Clear the temporary buffer by the measures described under Item 1.
351 to 354	S: CURRENT RANGE n !: # 351 to 354	Current output: flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
355 to 358	S: FREQ. RANGE n !: # 355 to 358	Frequency output: flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
359 to 362	S: PULSE RANGE !: # 359 to 362	Pulse output: the pulse output frequency is out of range.	1. Increase the setting for pulse weighting 2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.). *Determine the pulse width:* – Variant 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration. – Variant 2: Enter the maximum (pulse) frequency as the half "reciprocal value" that a pulse must be present at the connected counter to ensure its registration. Example: The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is: $\frac{1}{2 \cdot 10\ \text{Hz}} = 50\ \text{ms}$ a0004437 3. Reduce flow.

No.	Error message / Type	Cause	Remedy (spare part → 93)
No. # 5xx → Application error			
501	S: SW.-UPDATE ACT. !: # 501	New amplifier or communication (I/O module) software version is loaded. Currently no other functions are possible.	Wait until the procedure is finished. The device will restart automatically.
502	S: UP-/DOWNLOAD ACT !: # 502	Uploading or downloading the device data via operating program. Currently no other functions are possible.	Wait until the procedure is finished.
No. # 6xx → Simulation mode active			
601	S: POS. ZERO-RETURN !: # 601	Positive zero return active Caution! This message has the highest display priority!	Switch off positive zero return
611 to 614	S: SIM. CURR. OUT. n !: # 611 to 614	Simulation current output active	
621 to 624	S: SIM. FREQ. OUT. n !: # 621 to 624	Simulation frequency output active	Switch off simulation
631 to 634	S: SIM. PULSE n !: # 631 to 634	Simulation pulse output active	Switch off simulation
641 to 644	S: SIM. STAT. OUT n !: # 641 to 644	Simulation status output active	Switch off simulation
671 to 674	S: SIM. STATUS IN n !: # 671 to 674	Simulation status input active	Switch off simulation
691	S: SIM. FAILSAFE !: # 691	Simulation of response to error (outputs) active	Switch off simulation
692	S: SIM. MEASURAND !: # 692	Simulation of a measured variable active (e.g. mass flow).	Switch off simulation
698	S: DEV. TEST ACT. !: # 698	The measuring device is being checked on site via the test and simulation device.	–

9.3 Process error messages

Note!
Also observe the information on → 68.

No.	Error message / Type	Cause	Remedy (spare part → 93)
P = Process error $ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
401	EMPTY PIPE $: # 401	Measuring tube partially filled or empty	1. Check the process conditions of the plant 2. Fill the measuring tube
461	ADJ. NOT OK !: # 461	EPD calibration not possible because the fluid's conductivity is either too low or too high.	The EPD function cannot be used with fluids of this nature.
463	FULL = EMPTY $: # 463	The EPD calibration values for empty pipe and full pipe are identical, therefore incorrect.	Repeat calibration, making sure procedure is correct → 80.

9.4 Process errors without messages

Symptoms	Rectification
Remark: You may have to change or correct certain settings in functions in the function matrix in order to rectify the fault.	
Flow values are negative, even though the fluid is flowing forwards through the pipe.	1. Remote version: – Switch off the power supply and check the wiring → 🖹 51 – If necessary, reverse the connections at terminals 41 and 42 2. Change the setting in the "INSTALLATION DIRECTION SENSOR" function accordingly
Measured-value reading fluctuates even though flow is steady.	1. Check grounding and potential equalization → 🖹 60 2. Check the fluid for presence of gas bubbles. 3. In the "SYSTEM DAMPING" function → increase the value
Measured-value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	1. Check grounding and potential equalization → 🖹 60 2. Check the fluid for presence of gas bubbles. 3. Activate the "LOW FLOW CUTOFF" function, i.e. enter or increase the value for the switching point.
Measured-value reading on display, even though measuring tube is empty.	1. Perform empty-pipe/full-pipe adjustment and then switch on Empty Pipe detection → 🖹 80 2. Remote version: Check the terminals of the EPD cable → 🖹 51 3. Fill the measuring tube.
The current output signal is always 4 mA, irrespective of the flow signal at any given time.	1. Select the "BUS ADDRESS" function and change the setting to "0". 2. Value for creepage too high. Reduce the value in the "LOW FLOW CUTOFF" function.
The fault cannot be rectified or some other fault not described above has arisen. In these instances, please contact your Endress+Hauser service organization.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service organization to have a service technician sent out, please be ready to quote the following information: – Brief description of the fault – Nameplate specifications (→ 🖹 6): order code, serial number **Returning devices to Endress+Hauser** The necessary procedures (→ 🖹 5) must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. Always enclose a duly completed "Declaration of Conformity" form with the flowmeter. You will find a master copy of this form at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective →order spare parts → 🖹 93

9.5 Response of outputs to errors

Note!
The failsafe mode of totalizers, current, pulse and frequency outputs can be customized by means of various functions in the function matrix. You will find detailed information on these procedures in the "Description of Device Functions" manual.

You can use positive zero return to set the signals of the current, pulse and status outputs to their fallback value, for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions: simulations, for example, are suppressed.

Failsafe mode of outputs and totalizers		
	Process/system error is current	**Positive zero return is activated**
Caution! System or process errors defined as "Notice messages" have no effect whatsoever on the inputs and outputs. See the information on → 🖹 71		
Current output	MINIMUM VALUE 0–20 mA → 0 mA 4–20 mA → 2 mA 4–20 mA HART → 2 mA 4–20 mA NAMUR → 3.5 mA 4–20 mA HART NAMUR → 3.5 mA 4–20 mA US → 3.75 mA 4–20 mA HART US → 3.75 mA 0–20 mA (25 mA) → 0 mA 4–20 mA (25 mA) → 2 mA 4–20 mA (25 mA) HART → 2 mA MAXIMUM VALUE 0–20 mA → 22 mA 4–20 mA → 22 mA 4–20 mA HART → 22 mA 4–20 mA NAMUR → 22.6 mA 4–20 mA HART NAMUR → 22.6 mA 4–20 mA US → 22.6 mA 4–20 mA HART US → 22.6 mA 0–20 mA (25 mA) → 25 mA 4–20 mA (25 mA) → 25 mA 4–20 mA (25 mA) HART → 25 mA HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow"
Pulse output	MIN/MAX VALUE → FALLBACK VALUE Signal output → no pulses HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Fault is ignored, i.e. normal measured-value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"

Failsafe mode of outputs and totalizers		
	Process/system error is current	**Positive zero return is activated**
Frequency output	*FALLBACK VALUE* Signal output → 0 Hz *FAILSAFE LEVEL* Output of the frequency specified in the FALÌLSAFE VALUE function. *HOLD VALUE* Measured value display on the basis of the last saved value preceding occurrence of the fault. *ACTUAL VALUE* Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow"
Totalizer	*STOP* The totalizers are paused until the error is rectified. *ACTUAL VALUE* The fault is ignored. The totalizer continues to count in accordance with the current flow value. *HOLD VALUE* The totalizer continues to count the flow in accordance with the last valid flow value (before the error occurred).	Totalizer stops
Status output	In the event of a fault or power supply failure: Status output → non-conductive	No effect on status output

9.6 Spare parts

Detailed troubleshooting instructions are provided in the previous sections → 86.
The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.
Fault rectification can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your Endress+Hauser service organization by providing the serial number printed on the transmitter's nameplate → 6.

Spare parts are shipped as sets comprising the following parts:
- Spare part
- Additional parts, small items (threaded fasteners, etc.)
- Mounting instructions
- Packaging

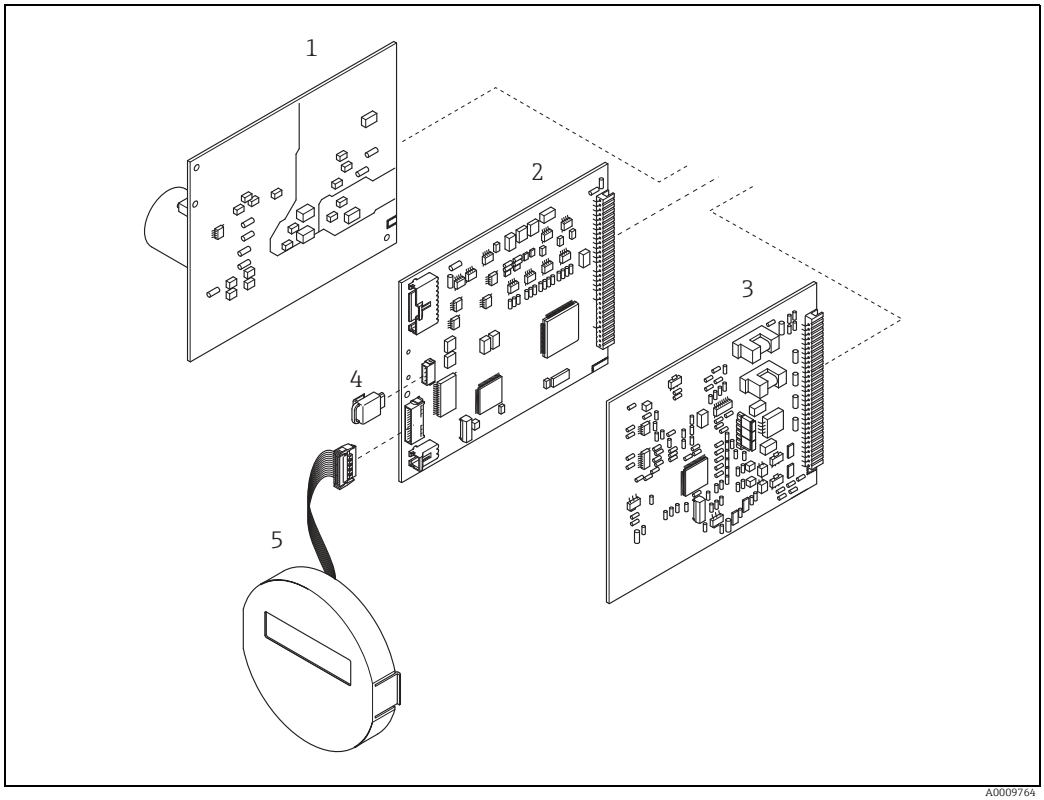


Fig. 61: Spare parts for Promag 50 transmitter (field and wall-mounted housings)

1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
2 Amplifier board
3 I/O board (COM module)
4 HistoROM / S-DAT (sensor data memory)
5 Display module

9.6.1 Removing and installing printed circuit boards

Field housing: removing and installing printed circuit boards → 62



Warning!
- Risk of electric shock!
  Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purpose-built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.



Caution!
Use only original Endress+Hauser parts.

1. Switch off power supply.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Remove the local display (1) as follows:
   – Press in the latches (1.1) at the side and remove the display module.
   – Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
4. Remove the screws and remove the cover (2) from the electronics compartment.
5. Remove the boards (4, 6): Insert a suitable tool into the hole (3) provided for the purpose and pull the board clear of its holder.
6. Remove amplifier board (5):
   – Disconnect the plug of the electrode cable (5.1) including S-DAT (5.3) from the board.
   – Loosen the plug locking of the coil current cable (5.2) and gently disconnect the plug from the board, i.e. without moving it to and fro.
   – Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.

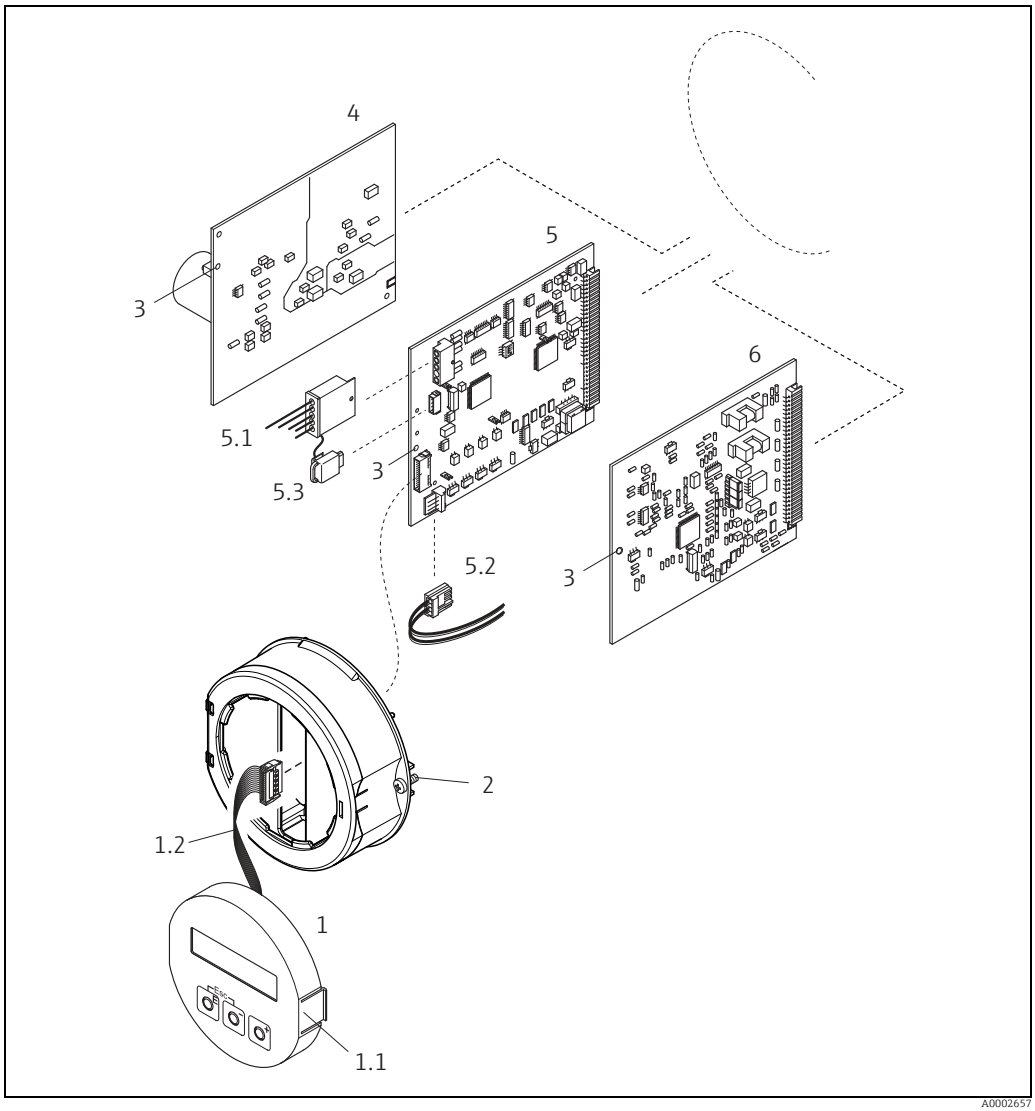


Fig. 62: Field housing: removing and installing printed circuit boards

1 Local display
1.1 Latch
1.2 Ribbon cable (display module)
2 Screws of electronics compartment cover
3 Aperture for installing/removing boards
4 Power supply board
5 Amplifier board
5.1 Electrode cable (sensor)
5.2 Coil current cable (sensor)
5.3 Histo-ROM / S-DAT (sensor data memory)
6 I/O board

Wall-mount housing: removing and installing printed circuit boards → 63



Warning!
- Risk of electric shock!
  Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purpose-built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.



Caution!
Use only original Endress+Hauser parts.

1. Switch off power supply.
2. Remove the screws and open the hinged cover (1) of the housing. Remove screws of the electronics module (2).
3. Then push up electronics module and pull it as far as possible out of the wall-mounted housing.
4. Disconnect the following cable plugs from amplifier board (7):
   – Electrode electrode cable plug (7.1) including S-DAT (7.3).
   – Plug of coil current cable (7.2). To do so, loosen the plug locking of the coil current cable and gently disconnect the plug from the board, i.e. without moving it to and fro.
   – Ribbon cable plug (3) of the display module.
5. Remove the screws and remove the cover (4) from the electronics compartment.
6. Remove the boards (6, 7, 8): Insert a suitable tool into the hole (5) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.

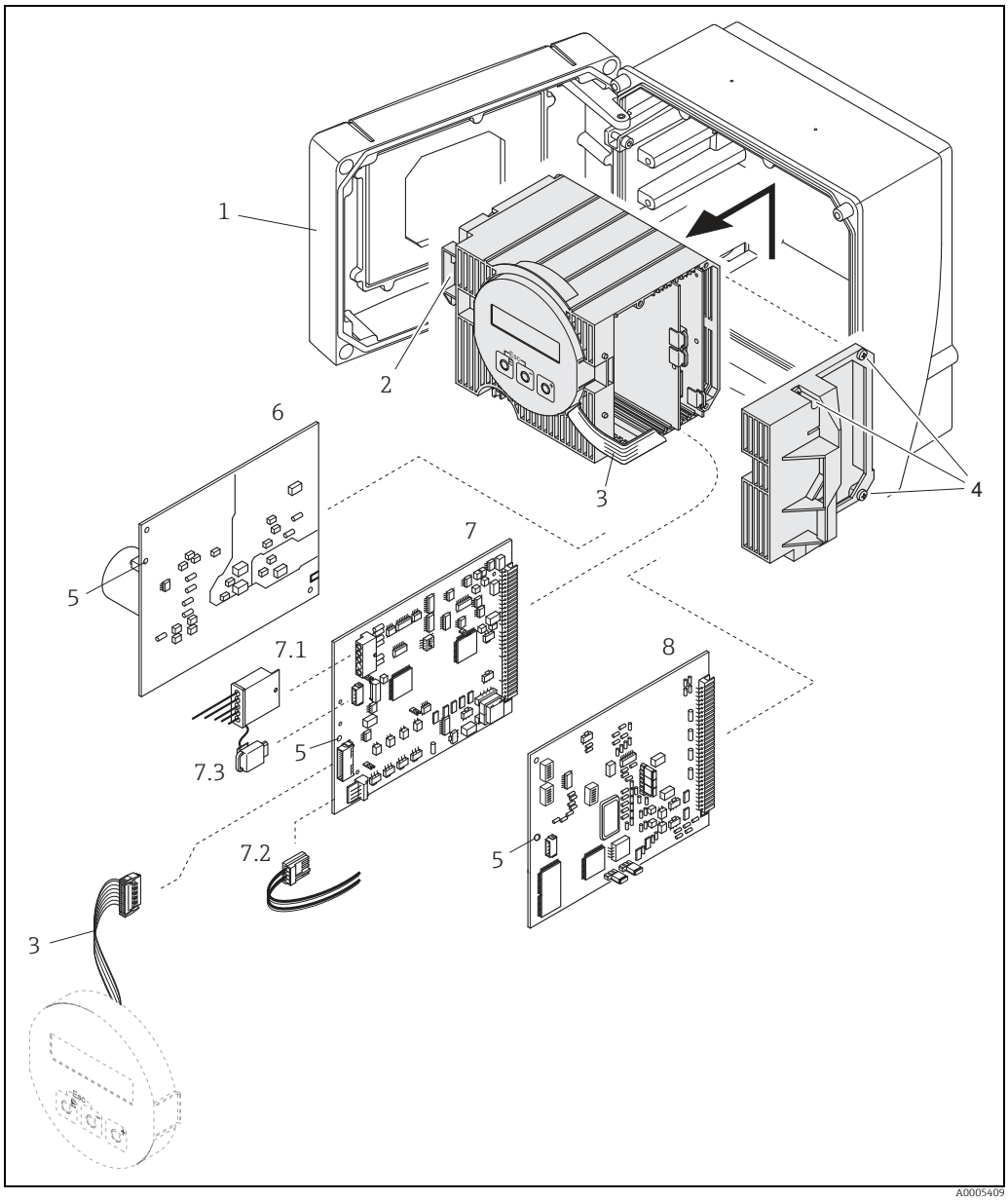


Fig. 63: Wall-mount housing: removing and installing printed circuit boards

1 Housing cover
2 Electronics module
3 Ribbon cable (display module)
4 Cover of electronics compartment (3 screws)
5 Aperture for installing/removing boards
6 Power supply board
7 Amplifier board
7.1 Electrode cable (sensor)
7.2 Coil current cable (sensor)
7.3 Histo-ROM / S-DAT (sensor data memory)
8 I/O board

9.6.2 Replacing the device fuse

Warning!
Risk of electric shock! Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is on the power supply board (→ 64).
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power supply board: field housing → 94, wall-mount housing → 96.
3. Remove cap (1) and replace the device fuse (2).
   Use only fuses of the following type:
   – Power supply 20 to 55 V AC / 16 to 62 V DC → 2.0 A slow-blow / 250 V; 5.2 × 20 mm
   – Power supply 85 to 260 V AC → 0.8 A slow-blow / 250 V; 5.2 × 20 mm
   – Ex-rated devices → see the Ex documentation.
4. Installation is the reverse of the removal procedure.

Caution!
Use only original Endress+Hauser parts.

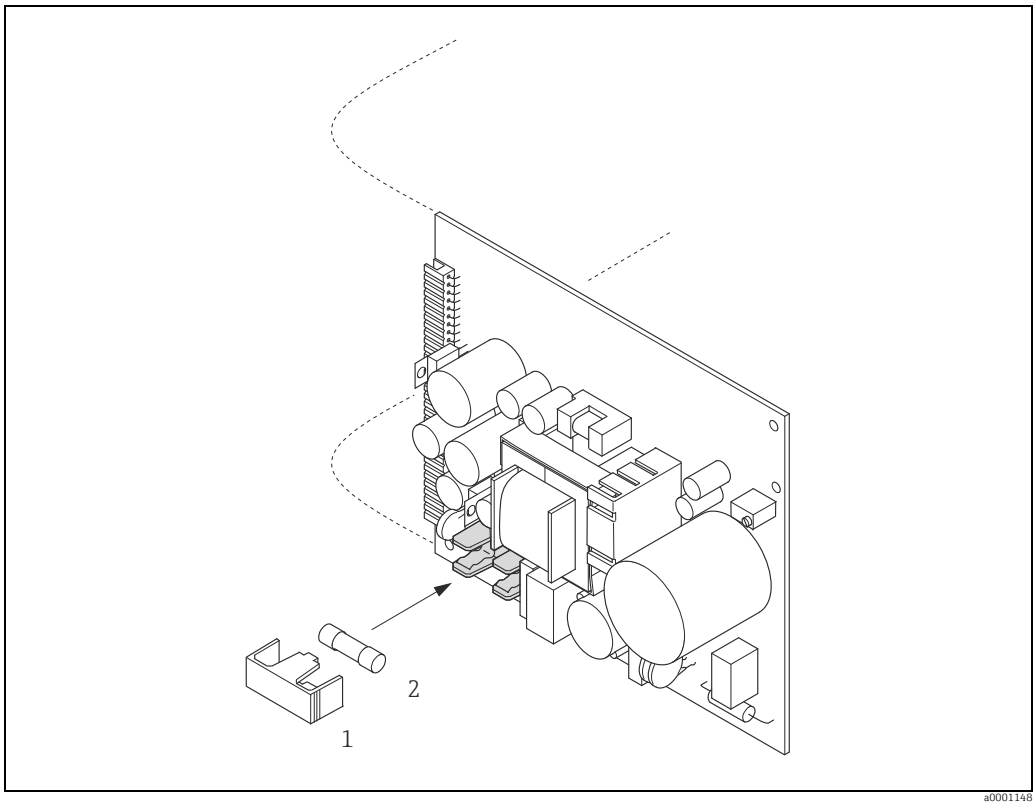


Fig. 64: Replacing the device fuse on the power supply board

1 Protective cap
2 Device fuse

9.6.3 Replacing the exchangeable electrode

The Promag W sensor (DN 350 to 2000 / 14 to 78") is available with exchangeable measuring electrodes as an option. This design permits the measuring electrodes to be replaced or cleaned under process conditions.

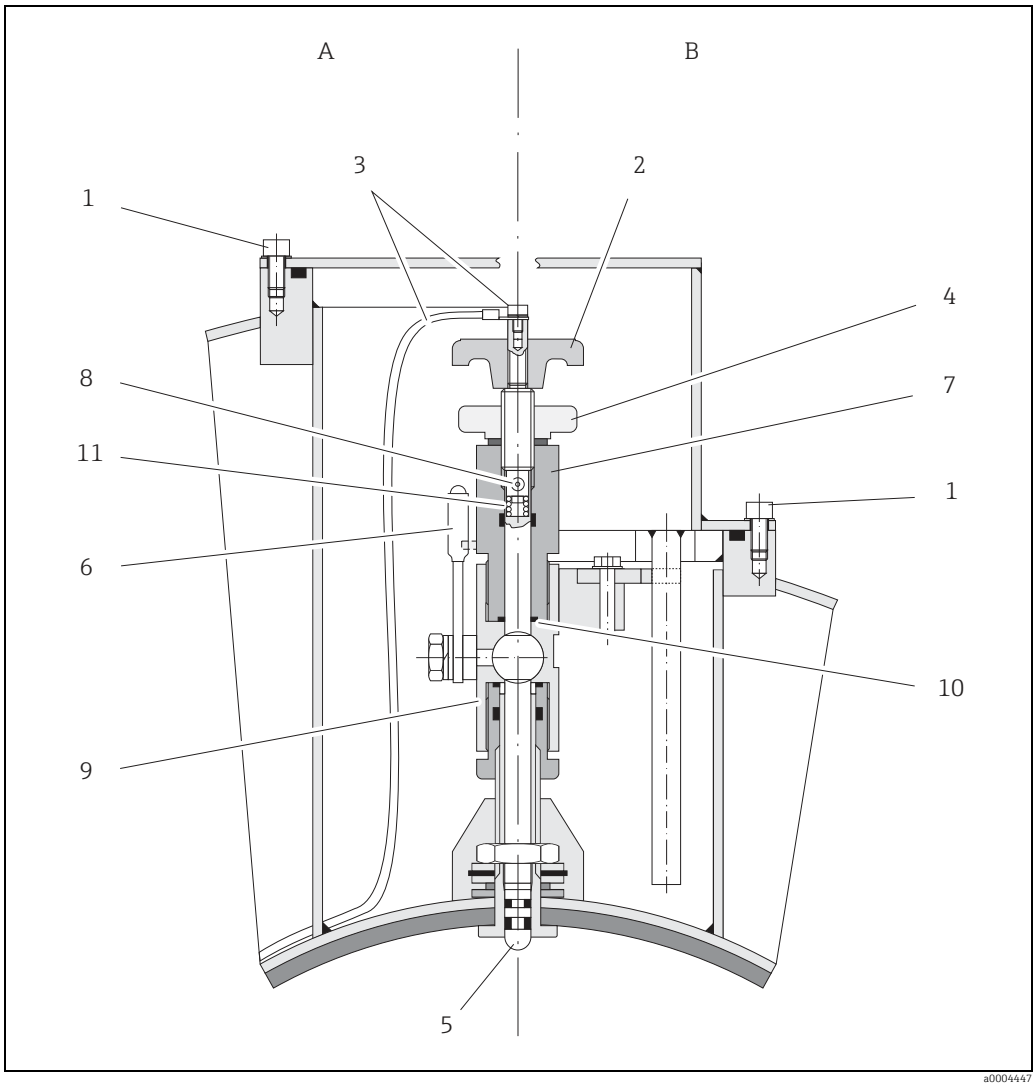


Fig. 65: Apparatus for replacing exchangeable measuring electrodes

View A = DN 1200 to 2000 (48 to 78")

View B = DN 350 to 1050 (14 to 42")

1 Allen screw
2 Handle
3 Electrode cable
4 Knurled nut (locknut)
5 Measuring electrode
6 Stop cock (ball valve)
7 Retaining cylinder
8 Locking pin (for handle)
9 Ball-valve housing
10 Seal (retaining cylinder)
11 Coil spring

Removing the electrode	Installing the electrode
1 Loosen Allen screw (1) and remove the cover.	1 Insert new electrode (5) into retaining cylinder (7) from below. Make sure that the seals at the tip of the electrode are clean.
2 Remove electrode cable (3) secured to handle (2).	2 Mount handle (2) on the electrode and insert locking pin (8) to secure it in position. Caution! Make sure that coil spring (11) is inserted. This is essential to ensure correct electrical contact and correct measuring signals.
3 Loosen knurled nut (4) by hand. This knurled nut acts as a locknut.	3 Pull the electrode back until the tip of the electrode no longer protrudes from retaining cylinder (7).
4 Remove electrode (5) by turning handle (2). The electrode can now be pulled out of retaining cylinder (7) as far as a defined stop. Warning! Risk of injury. Under process conditions (pressure in the piping system) the electrode can recoil suddenly against its stop. Apply counter-pressure while releasing the electrode.	4 Screw the retaining cylinder (7) onto ball-valve housing (9) and tighten it by hand. Seal (10) on the cylinder must be correctly seated and clean. Note! Make sure that the rubber hoses on retaining cylinder (7) and stop cock (6) are of the same color (red or blue).
5 Close stop cock (6) after pulling out the electrode as far as it will go. Warning! Do not subsequently open the stop cock, in order to prevent fluid escaping.	5 Open stop cock (6) and turn handle (2) to screw the electrode all the way into the retaining cylinder.
6 Remove the electrode complete with retaining cylinder (7).	6 Screw knurled nut (4) onto the retaining cylinder. This firmly locates the electrode in position.
7 Remove handle (2) from electrode (5) by pressing out locking pin (8). Take care not to lose coil spring (11).	7 Use the Allen screw to secure electrode cable (3) to handle (2). Caution! Make sure that the machine screw securing the electrode cable is firmly tightened. This is essential to ensure correct electrical contact and correct measuring signals.
8 Remove the old electrode and insert the new electrode. Replacement electrodes can be ordered separately from Endress+Hauser.	8 Reinstall the cover and tighten Allen screw (a) .

9.7 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.
To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

9.8 Disposal

Observe the regulations applicable in your country!

9.9 Software history

Date	Software version	Changes to software	Operating Instructions
01.2011	Amplifier: V 2.04.XX	Introduction of new nominal diameters; calf values to 2.5	71249447 / 15.14
11.2009	Amplifier: V 2.03.XX	Introduction of Calf history	71106181 / 12.09 71105332 / 11.09
06.2009	Amplifier: V 2.02.XX	Introduction of Promag L	71095684 / 06.09
03.2009	Amplifier: V 2.02.XX	Introduction of Promag D Introduction of new nominal diameter	71088677 / 03.09
11.2004	Amplifier: 1.06.01 Communication module: 1.04.00	Software update relevant only for production	50097089 / 10.03
10.2003	Amplifier: 1.06.00 Communication module: 1.03.00	Software expASMEon: ▪ Language groups ▪ Flow direction pulse output selectable New functionalities: ▪ Second Totalizer ▪ Adjustable backlight (display) ▪ Operation hours counter ▪ Simulation function for pulse output ▪ Counter for access code ▪ Reset function (fault history) ▪ Up-/download with FieldTool	50097089 / 10.03
08.2003	Communication module: 1.02.01	Software expASMEon: ▪ New / revised functionalities New functionalities: ▪ Current span NAMUR NE 43 ▪ Failsafe mode function ▪ Troubleshooting function ▪ System and process error messages ▪ Response of status output	50097089 / 08.03
08.2002	Amplifier: 1.04.00	Software expASMEon: ▪ New / revised functionalities New functionalities: ▪ Current span NAMUR NE 43 ▪ EPD (new mode) ▪ Failsafe mode function ▪ Acknowledge fault function ▪ Troubleshooting function ▪ System and process error messages ▪ Response of status output	50097089 / 08.02

Date	Software version	Changes to software	Operating Instructions
03.2002	Amplifier: 1.03.00	Software expASMEon: ▪ Suitability for custody transfer measurement Promag 50/51	none
06.2001	Amplifier: 1.02.00 Communication module: 1.02.00	Software expASMEon: ▪ New functionalities: New functionalities: ▪ General device functions ▪ "OED" software function ▪ "Pulse width" software function	50097089 / 06.01
09.2000	Amplifier: 1.01.01 Communication module: 1.01.00	Software expASMEon: ▪ Functional adaptations	none
08.2000	Amplifier: 1.01.00	Software expASMEon: ▪ Functional adaptations	none
04.2000	Amplifier: 1.00.00 Communication module: 1.00.00	Original software Compatible with: ▪ FieldTool ▪ Commuwin II (version 2.05.03 and higher) ▪ HART Communicator DXR 275 (from OS 4.6) with Rev. 1, DD1	50097089 / 04.00

Note!
Uploads or downloads between the individual software versions are only possible with a special service software.

10 Technical data

10.1 Application

→ 🖹 4

10.2 Function and system design

Measuring principle

Electromagnetic flow measurement on the basis of Faraday's Law.

Measuring system

→ 🖹 6

10.3 Input

Measured variable

Flow velocity (proportional to induced voltage)

Measuring range

Typically v = 0.01 to 10 m/s (0.033 to 33 ft/s) with the specified accuracy

Operable flow range

Over 1000 : 1

Input signal

Status input (auxiliary input)

- Galvanically isolated
- U = 3 to 30 V DC
- Ri = 5 kΩ
- Can be configured for: totalizer reset, positive zero return, error message reset.

10.4 Output

Output signal

Current output

- Galvanically isolated
- Active/passive can be selected:
  - Active: 0/4 to 20 mA, R_L < 700 Ω (HART: R_L ≥ 250 Ω)
  - Passive: 4 to 20 mA, supply voltage V_S 18 to 30 V DC, R_i ≥ 150 Ω)
- Time constant can be selected (0.01 to 100s)
- Full scale value adjustable
- Temperature coefficient: typ. 0.005% o.f.s./°C, resolution: 0.5 µA

o.f.s. = of full scale value

Pulse/frequency output

- Galvanically isolated
- Passive: 30 V DC / 250 mA
- Open collector
- Can be configured as:
  - Pulse output
    Pulse value and pulse polarity can be selected, max. pulse width adjustable (0.5 to 2000 ms)
  - Frequency output

Full scale frequency 2 to 1000 Hz (f_{max} = 1.25 Hz), on/off ratio 1:1, pulse width max. 10 s

Signal on alarm

Current output

Failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43)

Pulse/frequency output

Failsafe mode can be selected

Status output

"Not conductive" in the event of fault or power supply failure

Load

See "Output signal"

Low flow cut off

Switch-on point can be selected as required

Galvanic isolation

All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

Switching output

Status output

- Galvanically isolated
- Max. 30 V DC/250 mA
- Open collector
- Can be configured for: error messages, empty pipe detection (EPD), flow direction, limit values

10.5 Power supply

Terminal assignment

→ 📄 51

Supply voltage

- 20 to 55 V AC, 45 to 65 Hz
- 85 to 260 V AC, 45 to 65 Hz
- 16 to 62 V DC

Power consumption

Power consumption

- AC: <15 VA (incl. sensor)
- DC: <15 W (incl. sensor)

Switch-on current

- Max. 8.5 A (< 50 ms) for 24 V DC
- Max. 3 A (< 5 ms) for 260 V AC

Power supply failure

- Lasting min. 1 cycle frequency:
- EEPROM saves measuring system data
- S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point etc.)

Potential equalization

→ 📄 60

Cable entries

Power supply and electrode cables (inputs/outputs):

- Cable entry M20 × 1.5 (8 to 12 mm/0.31 to 0.47 inch)
- Sensor cable entry for armored cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63 inch)
- Threads for cable entries ½" NPT, G ½"

Connecting cable for remote version:

- Cable entry M20 × 1.5 (8 to 12 mm/0.31 to 0.47 inch)
- Sensor cable entry for armored cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63 inch)
- Threads for cable entries ½" NPT, G ½"

Cable specifications

→ 🖹 56

10.6 Performance characteristics

Reference operating conditions

- Error limits following DIN EN 29104, future ISO 20456
- Water, typically +15 to +45°C (+59 to +113 °F); 0,5 to 7 bar (73 to 101 psi)
- Specification as per calibration protocol
- Data on the measured error based on accredited calibration rigs traced back to ISO 17025

Maximum measured error

- Current output: plus typically ± 5 µA
- Pulse output: ± 0.5% o.r. ± 1 mm/s
  Option: ± 0.2% o.r. ± 2 mm/s (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.

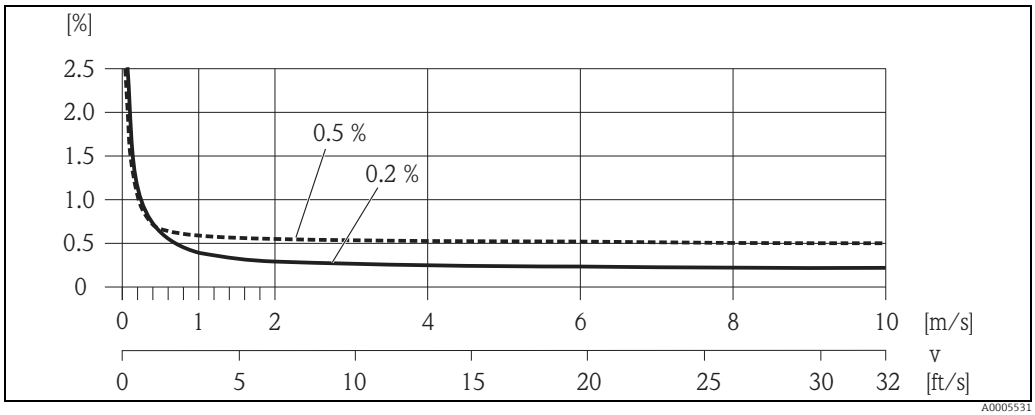


Fig. 66: Max. measured error in % of reading

Repeatability

Max. ± 0.1% o.r. ± 0.5 mm/s (o.r. = of reading)

10.7 Installation

Installation instructions

Any orientation (vertical, horizontal), restrictions and installation instructions → 📄 12

Inlet and outlet run

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc. The following inlet and outlet runs must be observed in order to meet accuracy specifications (→ 📄 15, → 🖼 12):
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

Adapters

→ 📄 16

Length of connecting cable

→ 📄 19

10.8 Environment

Ambient temperature range

- Transmitter: −20 to +60 °C (−4 to +140 °F)

  Note!
  At ambient temperatures below −20 (−4 °F) the readability of the display may be impaired.
- Sensor (Flange material carbon steel): −10 to +60 °C (+14 to +140 °F)

Caution!
- The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ "Operating conditions: Process" → "Medium temperature range").
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

Degree of protection

Transmitter
- As standard: IP 67, type 4X enclosure
- Promag L when housing is open: IP 20, type 1 enclosure

Sensor
- As standard: IP 67, type 4X enclosure
- Optionally available for remote version for Promag E/L/P/W:
  – IP 68, type 6P enclosure (Promag L only possible in conjunction with stainless steel flanges).

Shock and vibration resistance

Acceleration up to 2 g following IEC 60068-2-6
(high-temperature version: no data available)

Interior cleaning

Caution!
The maximum fluid temperature permitted for the device may not be exceeded.

CIP cleaning is possible:
Promag E (100 °C / 212 °F), Promag H/P

CIP cleaning is not possible:
Promag D/L/W

SIP cleaning is possible:
Promag H

SIP cleaning is not possible:
Promag D/E/L/P/W

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation NE 21
- Emission: to limit value for industry EN 55011

10.9 Process

Medium temperature range

The permissible temperature depends on the lining of the measuring tube

Promag D

0 to +60 °C (+32 to +140 °F) for polyamide

Promag E

−10 to +110 °C (+14 to +230 °F) for PTFE,
Restrictions → see the following diagram

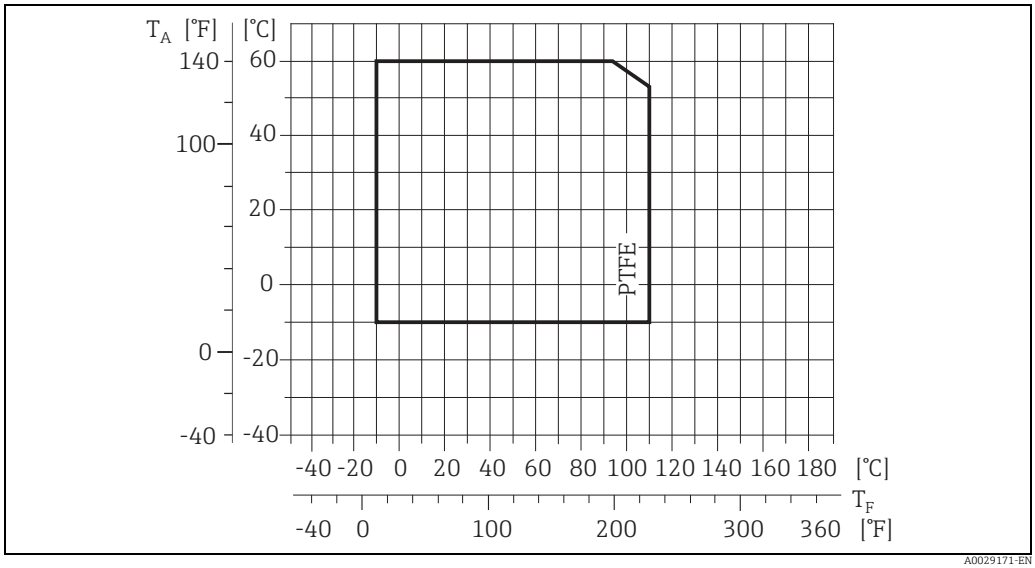


Fig. 67: Compact and remote version Promag E (T_A = ambient temperature; T_F = fluid temperature)

Promag H

Sensor:
- DN 2 to 25 (1/12 to 1"): −20 to +150 °C (−4 to +302 °F)
- DN 40 to 100 (1 ½ to 4"): −20 to +150 °C (−4 to +302 °F)

Seals:
- EPDM: −20 to +150 °C (−4 to +302 °F)
- Silicone (VMQ): −20 to +150 °C (−4 to +302 °F)
- Viton (FKM): −20 to +150 °C (−4 to +302 °F)
- Kalrez: −20 to +150 °C (−4 to +302 °F)

Promag L

- 0 to +80 °C (+32 to +176 °F) for hard rubber (DN 350 to 2400 / 14 to 90")
- −20 to +50 °C (−4 to +122 °F) for polyurethane (DN 25 to 1200 / 1 to 48")
- −20 to +90 °C (−4 to +194 °F) for PTFE (DN 25 to 300 / 1 to 12")

Promag P

Standard
- −40 to +130 °C (−40 to +266 °F) for PTFE (DN 15 to 600 / ½ to 24"), Restrictions → see the following diagrams
- −20 to +130 °C (−4 to +266 °F) for PFA/HE (DN 25 to 200 / 1 to 8"), Restrictions → see the following diagrams
- −20 to +150 °C (−4 to +302 °F) for PFA (DN 25 to 200 / 1 to 8"), Restrictions → see the following diagrams

Optional
High-temperature version (HT): −20 to +180 °C (−4 to +356 °F) for PFA (DN 25 to 200 / 1 to 8")

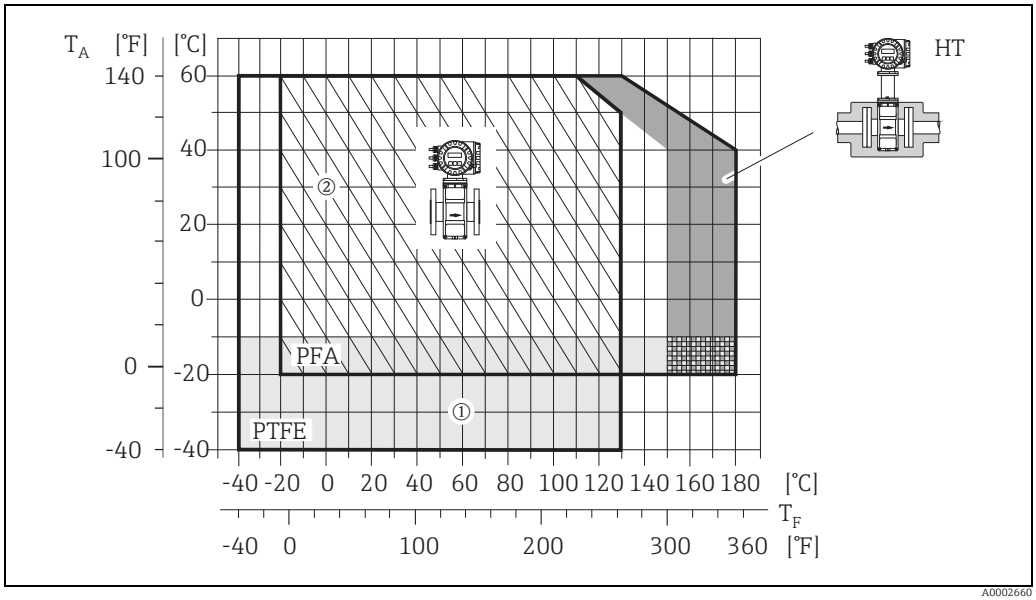


Fig. 68: Compact version Promag P (with PFA- or PTFE-lining)

T_A = ambient temperature; T_F = fluid temperature; HT = high-temperature version with insulation
1 = light gray area → temperature range from −10 to −40 °C (−14 to −40 °F) is valid for stainless steel version only
2 = diagonal hatched area → foam lining (HE) and degree of protection IP 68 = fluid temperature max. 130°C / 266 °F

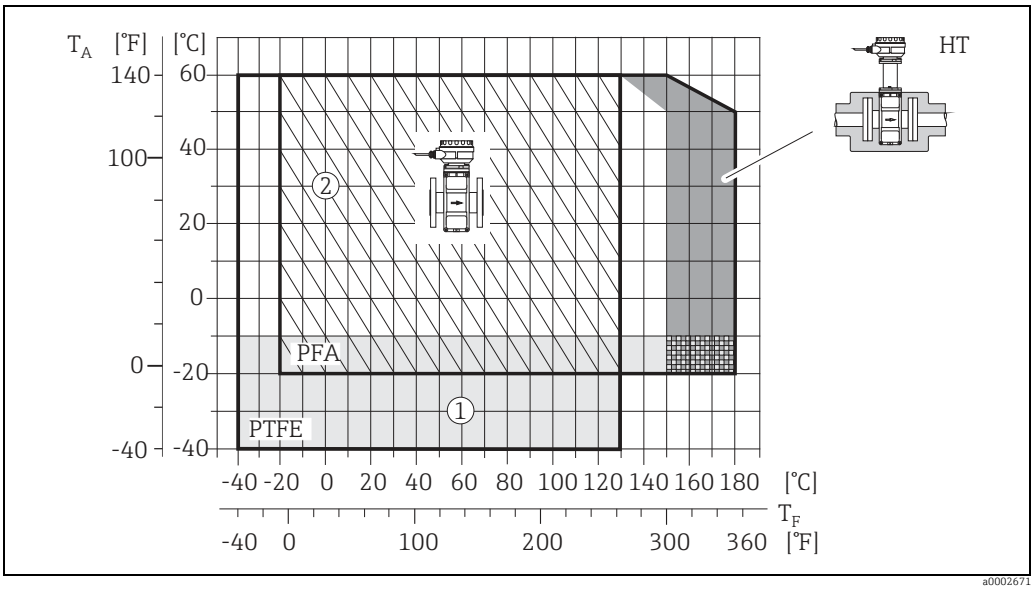


Fig. 69: Remote version Promag P (with PFA- or PTFE-lining)

T_A = ambient temperature; T_F = fluid temperature; HT = high-temperature version with insulation
1 = light gray area → temperature range from −10 to −40 °C (−14 to −40 °F) is valid for stainless steel version only
2 = diagonal hatched area → foam lining (HE) and degree of protection IP68 = fluid temperature max. 130°C / 266 °F

Promag W

- 0 to +80 °C (+32 to +176 °F) for hard rubber (DN 50 to 2000 / 2 to 78")
- −20 to +50 °C (−4 to +122 °F) for polyurethane (DN 25 to 1200 / 1 to 48")

Conductivity

The minimum conductivity is:
- ≥ 5 µS/cm for fluids generally
- ≥ 20 µS/cm for demineralized water

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length → 19.

Pressure-temperature ratings

An overview of the pressure-temperature ratings for the process connections are to be found in the "Technical Information" documents of the device in question.
List of supplementary documentation → 130.

Medium pressure range (nominal pressure)

Promag D

- EN 1092-1 (DIN 2501)
  - PN 16
- ASME B 16.5
  - Class 150
- JIS B2220
  - 10K

Promag E

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 600 / 14 to 24")
  - PN 10 (DN 200 to 600 / 8 to 24")
  - PN 16 (DN 65 to 600 / 3 to 24")
  - PN 40 (DN 15 to 150 / ½ to 2")
- ASME B 16.5
  - Class 150 (½ to 24")

- JIS B2220
  - 10K (DN 50 to 300 / 2 to 12")
  - 20K (DN 15 to 40 / ½ to 1½")

Promag H

The permissible nominal pressure depends on the process connection, the seal and the nominal diameter.
Details are provided in the separate documentation "Technical Information" → 130.

Promag L

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 2400 / 14 to 90")
  - PN 10 (DN 200 to 2400 / 8 to 90")
  - PN 16 (DN 25 to 2000 / 1 to 78")
- EN 1092-1, lap joint flange, stampel plate
  - PN 10 (DN 25 to 300 / 1 to 12")
- ASME B16.5
  - Class 150 (1 to 24")
- AWWA C207
  - Class D (28 to 90")
- AS2129
  - Table E (350 to 1200 / 14 to 48")
- AS4087
  - PN 16 (350 to 1200 / 14 to 48")

Promag P

- EN 1092-1 (DIN 2501)
  - PN 10 (DN 200 to 600 / 8 to 24")
  - PN 16 (DN 65 to 600 / 3 to 24")
  - PN 25 (DN 200 to 600 / 8 to 24")
  - PN 40 (DN 25 to 150 / 1 to 6")
- ASME B 16.5
  - Class 150 (1 to 24")
  - Class 300 (1 to 6")
- JIS B2220
  - 10K (DN 50 to 600 / 2 to 24")
  - 20K (DN 25 to 600 / 1 to 24")
- AS 2129
  - Table E (DN 25 / 1"), 50 / 2")
- AS 4087
  - PN 16 (DN 50 / 2")

Promag W

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 2000 / 14 to 84")
  - PN 10 (DN 200 to 2000 / 8 to 84")
  - PN 16 (DN 65 to 2000 / 3 to 84")
  - PN 25 (DN 200 to 1000 / 8 to 40")
  - PN 40 (DN 25 to 150 / 1 to 6")
- ASME B 16.5
  - Class 150 (1 to 24")
  - Class 300 (1 to 6")
- AWWA
  - Class D (28 to 78")
- JIS B2220
  - 10K (DN 50 to 750 / 2 to 30")

– 20K (DN 25 to 600 / 1 to 24")
- AS 2129
  – Table E (DN 80 / 3", 100 / 4", 150 to 1200 / 6 to 48")
- AS 4087
  – PN 16 (DN 80 / 3", 100 / 4", 150 to 1200 / 6 to 48")

Pressure tightness

Promag D

Measuring tube: 0 mbar abs (0 psi abs) with a fluid temperature of ≤ 60 °C (140 °F)

Promag E (Measuring tube lining: PTFE)

Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures							
		25 °C		80 °C		100 °C		110 °C	
		77 °F		176 °F		212 °F		230 °F	
[mm]	[inch]	[mbar]	[psi]			[mbar]	[psi]	[mbar]	[psi]
15	½"	0	0	0	0	0	0	100	1.45
25	1"	0	0	0	0	0	0	100	1.45
32	–	0	0	0	0	0	0	100	1.45
40	1 ½"	0	0	0	0	0	0	100	1.45
50	2"	0	0	0	0	0	0	100	1.45
65	–	0	0	*	*	40	0.58	130	1.89
80	3"	0	0	*	*	40	0.58	130	1.89
100	4"	0	0	*	*	135	1.96	170	2.47
125	–	135	1.96	*	*	240	3.48	385	5.58
150	6"	135	1.96	*	*	240	3.48	385	5.58
200	8"	200	2.90	*	*	290	4.21	410	5.95
250	10"	330	4.79	*	*	400	5.80	530	7.69
300	12"	400	5.80	*	*	500	7.25	630	9.14
350	14"	470	6.82	*	*	600	8.70	730	10.59
400	16"	540	7.83	*	*	670	9.72	800	11.60
450	18"	Partial vacuum is impermissible!							
500	20"								
600	24"								
* No value can be quoted.									

Promag H (Measuring tube lining: PFA)

Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures					
		25 °C	80 °C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]	77 °F	176 °F	212 °F	266 °F	302 °F	356 °F
2 to 150	1/12 to 6"	0	0	0	0	0	0

Promag L (Measuring tube lining: Polyurethane, Hard rubber)

Nominal diameter		Measuring tube lining	Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures		
			25 °C	50 °C	80 °C
[mm]	[inch]		77 °F	122 °F	176 °F
25 to 1200	1 to 48"	25 to 1200	1 to 48"	0	–
350 to 2400	14 to 90"	Hard rubber	0	0	0

Promag L (Measuring tube lining: PTFE)

Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures			
		25 °C		90 °C	
		77 °F		194 °F	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]
25	1"	0	0	0	0
32	–	0	0	0	0
40	1 ½"	0	0	0	0
50	2"	0	0	0	0
65	–	0	0	40	0.58
80	3"	0	0	40	0.58
100	4"	0	0	135	1.96
125	–	135	1.96	240	3.48
150	6"	135	1.96	240	3.48
200	8"	200	2.90	290	4.21
250	10"	330	4.79	400	5.80
300	12"	400	5.80	500	7.25

Promag P (Measuring tube lining: PFA)

Promag P Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures					
		25 °C	80° C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]	77 °F	176° F	212 °F	266 °F	302 °F	356 °F
25	1"	0	0	0	0	0	0
32	-	0	0	0	0	0	0
40	1 ½"	0	0	0	0	0	0
50	2"	0	0	0	0	0	0
65	-	0	*	0	0	0	0
80	3"	0	*	0	0	0	0
100	4"	0	*	0	0	0	0
125	-	0	*	0	0	0	0
150	6"	0	*	0	0	0	0
200	8"	0	*	0	0	0	0
* No value can be quoted.							

Promag P (Measuring tube lining: PTFE)

Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures									
		25 °C		80 °C		100 °C		130 °C		150 °C	180 °C
		77 °F		176 °F		212 °F		266 °F		302 °F	356 °F
[mm]	[inch]	[mbar]	[psi]			[mbar]	[psi]	[mbar]	[psi]		
25	1"	0	0	0	0	0	0	100	1.45	–	–
32	–	0	0	0	0	0	0	100	1.45	–	–
40	1 ½"	0	0	0	0	0	0	100	1.45	–	–
50	2"	0	0	0	0	0	0	100	1.45	–	–
65	–	0	0	*	*	40	0.58	130	1.89	–	–
80	3"	0	0	*	*	40	0.58	130	1.89	–	–
100	4"	0	0	*	*	135	1.96	170	2.47	–	–
125	–	135	1.96	*	*	240	3.48	385	5.58	–	–

Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures									
		25 °C		80 °C		100 °C		130 °C		150 °C	180 °C
		77 °F		176 °F		212 °F		266 °F		302 °F	356 °F
[mm]	[inch]	[mbar]	[psi]			[mbar]	[psi]	[mbar]	[psi]		
150	6"	135	1.96	*	*	240	3.48	385	5.58	–	–
200	8"	200	2.90	*	*	290	4.21	410	5.95	–	–
250	10"	330	4.79	*	*	400	5.80	530	7.69	–	–
300	12"	400	5.80	*	*	500	7.25	630	9.14	–	–
350	14"	470	6.82	*	*	600	8.70	730	10.59	–	–
400	16"	540	7.83	*	*	670	9.72	800	11.60	–	–
450	18"	Partial vacuum is impermissible!									
500	20"										
600	24"										
* No value can be quoted.											

Promag W

Nominal diameter		Measuring tube lining	Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures						
			25 °C	50 °C	80 °C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]		77 °F	122 °F	176 °F	212 °F	266 °F	302 °F	356 °F
25 to 1200	1 to 40"	Polyurethane	0	0	–	–	–	–	–
50 to 2000	2 to 78"	Hard rubber	0	0	0	–	–	–	–

Limiting flow

→ 🖹 17

Pressure loss

- No pressure loss if the sensor is installed in a pipe of the same nominal diameter (Promag H: only DN 8 and larger).
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (see "Adapters" → 🖹 16).

10.10 Mechanical construction

Design, dimensions

The dimensions and installation lengths of the sensor and transmitter can be found in the "Technical Information" for the device in question. This document can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section on → 🖹 130.

Weight (SI units)

Promag D

Weight data in kg				
Nominal diameter		Compact version	Remote version (without cable)	
[mm]	[inch]		Sensor	Transmitter
25	1"	4.5	2.5	6.0
40	1 ½"	5.1	3.1	6.0
50	2"	5.9	3.9	6.0
65	–	6.7	4.7	6.0
80	3"	7.7	5.7	6.0
100	4"	10.4	8.4	6.0
Transmitter Promag (compact version): 3.4 kg (Weight data valid without packaging material)				

Promag E

Weight data in kg							
Nominal diameter		Compact version					
		EN (DIN)				ASME	JIS
[mm]	[inch]	PN 6	PN 10	PN 16	PN 40	Class 150	10K
15	½"	–	–	–	6.5	6.5	6.5
25	1"	–	–	–	7.3	7.3	7.3
32	–	–	–	–	8.0	–	7.3
40	1½"	–	–	–	9.4	9.4	8.3
50	2"	–	–	–	10.6	10.6	9.3
65	–	–	–	12.0	–	–	11.1
80	3"	–	–	14.0	–	14.0	12.5
100	4"	–	–	16.0	–	16.0	14.7
125	–	–	–	21.5	–	–	21.0
150	6"	–	–	25.5	–	25.5	24.5
200	8"	–	45.0	46.0	–	45.0	41.9
250	10"	–	65.0	70.0	–	75.0	69.4
300	12"	–	70.0	81.0	–	110	72.3
350	14"	77.4	88.4	104	–	137	–
400	16"	89.4	104	125	–	168	–
450	18"	103	118	149	–	193	–
500	20"	115	132	190	–	228	–
600	24"	155.4	181	300	–	329	–

- Transmitter (compact version): 1.8 kg
- Weight data without packaging material

Weight data in kg								
Nominal diameter		Remote version (without cable)						
		Sensor						Transmitter
		EN (DIN)				ASME	JIS	
[mm]	[inch]	PN 6	PN 10	PN 16	PN 40	Class 150	10K	Wall-mount housing
15	½"	–	–	–	4.5	4.5	4.5	6.0
25	1"	–	–	–	5.3	5.3	5.3	
32	–	–	–	–	6.0	–	5.3	
40	1½"	–	–	–	7.4	7.4	6.3	
50	2"	–	–	–	8.6	8.6	7.3	
65	–	–	–	10.0	–	–	9.1	
80	3"	–	–	12.0	–	12.0	10.5	
100	4"	–	–	14.0	–	14.0	12.7	
125	–	–	–	19.5	–	–	19.0	
150	6"	–	–	23.5	–	23.5	22.5	
200	8"	–	43.0	44.0	–	43.0	39.9	
250	10"	–	63.0	68.0	–	73.0	67.4	
300	12"	–	68.0	79.0	–	108	70.3	
350	14"	73.1	84.1	100	–	133	–	
400	16"	85.1	100	121	–	164	–	
450	18"	99	114	145	–	189	–	
500	20"	111	128	186	–	224	–	
600	24"	158	177	296	–	325	–	

- Transmitter (remote version): 3.1 kg
- Weight data without packaging material

Promag H

Nominal diameter	Compact version (DIN)		Remote version (without cable; DIN)	
DIN	Aluminum field housing	Stainless steel field housing	Sensor	Transmitter (wall-mount housing)
[mm]	[kg]	[kg]	[kg]	[kg]
2	5.2	5.7	2.0	6.0
4	5.2	5.7	2.0	6.0
8	5.3	5.8	2.0	6.0
15	5.4	5.9	1.9	6.0
25	5.5	6.0	2.8	6.0
40	7.1	7.6	4.1	6.0
50	7.6	8.1	4.6	6.0
65	8.4	8.9	5.4	6.0
80	9.0	9.5	6.0	6.0
100	10.3	10.8	7.3	6.0
125	15.7	16.2	12.7	6.0
150	18.1	18.6	15.1	6.0

Transmitter (compact version): 3.4 kg
Weight data valid for standard pressure ratings and without packaging material.

Promag L

Weight data in kg												
Nominal diameter		Compact version (including transmitter)[1]										
[mm]	[inch]	EN (DIN)						ASME/ AWWA		AS		
25	1"	PN 6	–	PN 10	–	PN 16	7.3	ASME / Class 150	7.9	PN 16	–	Table E	–
32	1 ¼"		–		–		8.0		–		–		–
40	–		–		–		9.0		7.5		–		–
50	2"		–		–		9.4		7.6		–		–
65	–		–		–		10.4		–		–		–
80	3"		–		–		12.4		12.8		–		–
100	4"		–		–		14.4		16.1		–		–
125	–		–		–		15.9		–		–		–
150	6"		–		–		23.9		24.4		–		–
200	8"		–		43.4		44.9		49.6		–		–
250	10"		–		63.4		70.7		75.1		–		–
300	12"		–		68.4		85.8		100		–		–
350	14"		77.4		88.4		107		137		99.4		99.4
375	15"		–		–		–		–		105		–
400	16"		89.4		104		125		168		124		120
450	18"		104		119		150		191		142		152
500	20"		114		132		191		228		191		182
600	24"		155		182		301		327		283		281
700	28"		215		274		335	AWWA / Class D	278		386		350
750	30"		–		–		–		338		470		458
800	32"		289		374		462		402		569		518
900	36"		384		476		582		498		739		739
1000	40"		493		615		795		666		854		856
–	42"		–		–		–		771		–		–
1200	48"		707		916		1314		1035		1368		1368
–	54"		–		–		–		1438		–		–
1400	–		1126		1482		1906		–		–		–
–	60"		–		–		–		1785		–		–
1600	–		1521		2197		2698		–		–		–
–	66"		–		–		–		2463		–		–
1800	72"		2001		2838		3687		2857		–		–
-	78"		2777		3508		4646		3532		–		–
2000	–		2777		3508		4646		3532		–		–
–	84"		–		–		–		3883		–		–
2200	–		3065		4172		–		–		–		–
–	90"		–		–		–		4847		–		–
2400	–		3940		5035		–		–		–		–
Transmitter Promag (compact version): 3.4 kg (Weight data valid without packaging material)													

1) Lap joint flanges / welded flanges DN > 300 (12")

Weight data in kg

Nominal diameter		Remote version (sensor plus sensor housing without cable)[1]											
[mm]	[inch]	EN (DIN)						ASME/ AWWA		AS			
25	1"	PN 6	–	PN 10	–	PN 16	5.3	ASME / Class 150	5.9	PN 16	–	Table E	–
32	–		–		–		6.0		–		–		–
40	1 ½"		–		–		7.0		5.5		–		–
50	2"		–		–		7.4		5.6		–		–
65	–		–		–		8.4		–		–		–
80	3"		–		–		10.4		10.8		–		–
100	4"		–		–		12.4		14.1		–		–
125	–		–		–		13.9		–		–		–
150	6"		–		–		21.9		22.4		–		–
200	8"		–		41.4		42.9		47.6		–		–
250	10"		–		61.4		68.7		73.1		–		–
300	12"		–		66.4		83.8		98		–		–
350	14"		75.4		86.4		103		139		97.4		97.4
375	15"		–		102		–		–		103		–
400	16"		87.4		102		121		170		123		118
450	18"		103		118		149		193		141		151
500	20"		112		130		190		230		190		180
600	24"		156		181		300		329		282		280
700	28"		214		273		334	AWWA / Class D	278		385		349
750	30"		–		–		–		339		471		457
800	32"		288		373		461		402		568		517
900	36"		383		475		581		498		738		738
1000	40"		492		614		794		666		853		855
–	42"		–		–		–		771		-		–
1200	48"		706		915		1313		1035		1367		1367
–	54"		–		–		–		1438		–		–
1400	–		1125		1381		1905		–		–		–
–	60"		–		–		–		1785		–		–
1600	–		1520		2196		2697		–		–		–
–	66"		–		–		–		2463		–		–
1800	72"		2000		2837		3686		2857		–		–
–	78"		2776		2837		4645		3532		–		–
2000	–		2776		3507		4645		3532		–		–
–	84"		–		–		–		3883		–		–
2200	–		3064		4171		–		–		–		–
–	90"		–		–		–		4847		–		–
2400	–		3939		5034		–		–		–		–

Transmitter Promag (remote version): 3.4 kg
(Weight data valid without packaging material)

1) Lap joint flanges / welded flanges DN > 300 (12")

Weight data in kg						
Nominal diameter		Compact version[1)]		Remote version (without cable)1)		
[mm]	[inch]	EN (DIN)		Sensor EN (DIN)		Transmitter
25	1"	PN 10	5.8	PN 10	3.8	4.2
32	–		5.4		3.4	4.2
40	1 ½"		6.3		4.7	4.2
50	2"		5.4		3.4	4.2
65	–		6.2		4.2	4.2
80	3"		7.2		5.2	4.2
100	4"		9.7		7.7	4.2
125	–		13.2		11.2	4.2
150	6"		17.2		15.2	4.2
200	8"		35.7		33.7	4.2
250	10"		54.2		52.2	4.2
300	12"		55.2		53.2	4.2
Transmitter Promag (compact version): 3.4 kg (Weight data valid for standard pressure ratings and without packaging material)						

1) Lap joint flanges, stamped plate

Promag P

Weight data in kg														
Nominal diameter		Compact version						Remote version (without cable)						
								Sensor						Trans-mitter
[mm]	[inch]	EN (DIN) / AS*		JIS		ASME/ AWWA		EN (DIN) / AS*		JIS		ASME/ AWWA		
15	½"	PN 40	6.5	10K	6.5	Class 150	6.5	PN 40	4.5	10K	4.5	Class 150	4.5	6.0
25	1"		7.3		7.3		7.3		5.3		5.3		5.3	6.0
32	–		8.0		7.3		–		6.0		5.3		–	6.0
40	1 ½"		9.4		8.3		9.4		7.4		6.3		7.4	6.0
50	2"		10.6		9.3		10.6		8.6		7.3		8.6	6.0
65	–	PN 16	12.0		11.1		–	PN 16	10.0		9.1		–	6.0
80	3"		14.0		12.5		14.0		12.0		10.5		12.0	6.0
100	4"		14.4		14.7		16.0		14.0		12.7		14.0	6.0
125	–		16.0		21.0		–		19.5		19.0		–	6.0
150	6"		21.5		24.5		25.5		23.5		22.5		23.5	6.0
200	8"	PN 10	45		41.9		45	PN 10	43		39.9		43	6.0
250	10"		65		69.4		75		63		67.4		73	6.0
300	12"		70		72.3		110		68		70.3		108	6.0
350	14"		115		81.0		175		113		79.0		173	6.0
400	16"		135		102		205		133		100		203	6.0
450	18"		175		130		255		173		128		253	6.0
500	20"		175		144		285		173		142		283	6.0
600	24"		235		190		405		233		188		403	6.0
Transmitter Promag (compact version): 3.4 kg High-temperature version: + 1.5 kg (Weight data valid for standard pressure ratings and without packaging material) * Flanges according to AS are only available for DN 25 and 50.														

Promag W

Weight data in kg

Nominal diameter		Compact version						Remote version (without cable)						
								Sensor						Trans-mitter
[mm]	[inch]	EN (DIN) / AS*		JIS		ASME/ AWWA		EN (DIN) / AS*		JIS		ASME/ AWWA		
25	1"	PN 40	7.3	10K	7.3	Class 150	7.3	PN 40	5.3	10K	5.3	Class 150	5.3	6.0
32	–		8.0		7.3		–		6.0		5.3		–	6.0
40	1 ½"		9.4		8.3		9.4		7.4		6.3		7.4	6.0
50	2"		10.6		9.3		10.6		8.6		7.3		8.6	6.0
65	–	PN 16	12.0		11.1		–	PN 16	10.0		9.1		–	6.0
80	3"		14.0		12.5		14.0		12.0		10.5		12.0	6.0
100	4"		16.0		14.7		16.0		14.0		12.7		14.0	6.0
125	–		21.5		21.0		–		19.5		19.0		–	6.0
150	6"		25.5		24.5		25.5		23.5		22.5		23.5	6.0
200	8"	PN 10	45		41.9		45	PN 10	43		39.9		43	6.0
250	10"		65		69.4		65		63		67.4		73	6.0
300	12"		70		72.3		110		68		70.3		108	6.0
350	14"		115		81.1		175		113		79.1		173	6.0
400	16"		135		102		205		133		100		203	6.0
450	18"		175		130		255		173		128		253	6.0
500	20"		175		144		285		173		142		283	6.0
600	24"		235		190		405		233		188		403	6.0
700	28"		355		282	Class D	400		353		280	Class D	398	6.0
750	30"		–		333		460		–		331		458	6.0
800	32"		435		-		550		433		-		548	6.0
900	36"		575		-		800		573		-		798	6.0
1000	40"		700		-		900		698		-		898	6.0
–	42"	PN 6	–		-		1100	PN 6	–		-		1098	6.0
1200	48"		850		-		1400		848		-		1398	6.0
–	54"		–		-		2200		–		-		2198	6.0
1400	–		1300		-		–		1298		-		–	6.0
–	60"		–		-		2700		–		-		2698	6.0
1600	–		1700		-		–		1698		-		–	6.0
–	66"		–		-		3700		–		-		3698	6.0
1800	72"		2200		-		4100		2198		-		4098	6.0
–	78"		–		-		4600		–		-		4598	6.0
2000	–		2800		-		–		2798		-		–	6.0

Transmitter Promag (compact version): 3.4 kg
(Weight data valid for standard pressure ratings and without packaging material)
*Flanges according to AS are only available for DN 80, 100, 150 to 400, 500 and 600

Weight (US units)

Promag D

Weight data in lbs				
Nominal diameter		Compact version	Remote version (without cable)	
[mm]	[inch]		Sensor	Transmitter
25	1"	10	6	13
40	1 ½"	11	7	13
50	2"	13	9	13
80	3"	17	13	13
100	4"	23	19	13
Transmitter Promag (compact version): 7.5 lbs (Weight data valid without packaging material)				

Promag E (ASME)

Weight data in lbs				
Nominal diameter		Compact version	Remote version (without cable)	
			Sensor	Transmitter
		ASME	ASME	
[mm]	[inch]	Class 150	Class 150	Wall-mount housing
15	½"	14.3	9.92	13.2
25	1"	16.1	11.7	
40	1½"	20.7	16.3	
50	2"	23.4	19.0	
80	3"	30.9	26.5	
100	4"	35.3	30.9	
150	6"	56.2	51.8	
200	8"	99.2	94.8	
250	10"	165	161	
300	12"	243	238	
350	14"	303	294	
400	16"	371	362	
450	18"	424	417	
500	20"	504	494	
600	24"	725	717	

- Transmitter: 4.0 lbs (compact version); 6.8 lbs (remote version)
- Weight data without packaging material

Promag H

Nominal diameter	Compact version (DIN)		Remote version (without cable; DIN)	
DIN	Aluminum field housing	Stainless steel field housing	Sensor	Transmitter (wall-mount housing)
[in]	[lbs]	[lbs]	[lbs]	[lbs]
1/12"	11.5	12.6	4.0	13.0
1/8"	11.5	12.6	4.0	13.0
3/8"	11.7	12.8	4.0	13.0
½"	11.9	13.0	4.0	13.0
1"	12.1	13.2	6.0	13.0
1 ½"	15.7	16.8	4.1	13.0
2"	16.8	17.9	4.6	13.0
3"	19.8	20.9	6.0	13.0
4"	22.7	23.8	7.3	13.0
6"	39.9	41.0	15.1	13.0
Transmitter (compact version): 7.5 lbs (Weight data valid for standard pressure ratings and without packaging material)				

Promag L (ASME/AWWA)

Weight data in lbs					
Nominal diameter		Compact version[1]		Remote version1)	
[mm]	[inch]	ASME/AWWA		ASME/AWWA	
25	1"	ASME / Class 150	17.4	ASME / Class 150	13
32	–		–		–
40	1 ½"		16.5		12.1
50	2"		16.8		12.3
65	–		–		–
80	3"		28.2		23.8
100	4"		35.5		31.1
125	–		–		–
150	6"		53.8		49.4
200	8"		109		105
250	10"		166		161
300	12"		221		216
350	14"		302		306
375	15"		–		–
400	16"		370		274
450	18"		421		425
500	20"		503		507
600	24"		726		725
700	28"	AWWA / Class D	613	AWWA / Class D	612
750	30"		745		746
800	32"		886		885
900	36"		1098		1097
1000	40"		1468		1467
–	42"		1701		1700
1200	48"		2283		2282
–	54"		3171		3170
1400	–		–		–
–	60"		3935		3934
1600	–		–		–
–	66"		5430		5429
1800	72"		6300		6299
–	78"		7787		7786
2000	–		7787		-
–	84"		8561		8560
2200	–		–		–
–	90"		10686		10685
2400	–		–		–
Transmitter Promag (compact version): 7.5 lbs Transmitter Promag (remote version): 13.2 lbs (Weight data valid without packaging material)					

1) Lap joint flanges / welded flanges DN > 300 (12")

Promag P (ASME)

Weight data in lbs						
Nominal diameter		Compact version		Remote version (without cable)		
[mm]	[inch]			Sensor		Transmitter
15	½"	Class 150	14	Class 150	10	13
25	1"		16		12	13
40	1 ½"		21		16	13
50	2"		23		19	13
80	3"		31		26	13
100	4"		35		31	13
150	6"		56		52	13
200	8"		99		95	13
250	10"		165		161	13
300	12"		243		238	13
350	14"		386		381	13
400	16"		452		448	13
450	18"		562		558	13
500	20"		628		624	13
600	24"		893		889	13
Transmitter Promag (compact version): 7.5 lbs High-temperature version: 3.3 lbs (Weight data valid for standard pressure ratings and without packaging material)						

Promag W (ASME/AWWA)

Weight data in lbs						
Nominal diameter		Compact version		Remote version (without cable)		
[mm]	[inch]			Sensor		Transmitter
25	1"	Class 150	16	Class 150	12	13
40	1 ½"		21		16	13
50	2"		23		19	13
80	3"		31		26	13
100	4"		35		31	13
150	6"		56		52	13
200	8"		99		95	13
250	10"		143		161	13
300	12"		243		238	13
350	14"		386		381	13
400	16"		452		448	13
450	18"		562		558	13
500	20"		628		624	13
600	24"		893		889	13

Weight data in lbs						
Nominal diameter		Compact version		Remote version (without cable)		
[mm]	[inch]			Sensor		Transmitter
700	28"	Class D	882	Class D	878	13
750	30"		1014		1010	13
800	32"		1213		1208	13
900	36"		1764		1760	13
1000	40"		1985		1980	13
–	42"		2426		2421	13
1200	48"		3087		3083	13
–	54"		4851		4847	13
–	60"		5954		5949	13
–	66"		8159		8154	13
1800	72"		9041		9036	13
–	78"		10143		10139	13
Transmitter Promag (compact version): 7.5 lbs (Weight data valid for standard pressure ratings and without packaging material)						

Materials

Promag D

- Transmitter housing: powder-coated die-cast aluminum
- Sensor housing: powder-coated die-cast aluminum
- Measuring tube: polyamide, O-rings EPDM
  (Drinking water approvals: WRAS BS 6920, ACS, NSF 61, KTW/W270)
- Electrodes: 1.4435 (316, 316L)
- Ground disks: 1.4301 (304)

Promag E

- Transmitter housing
  – Compact housing: powder-coated die-cast aluminum
  – Wall-mount housing: powder-coated die-cast aluminum
- Sensor housing
  – DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  – DN 350 to 600 (14 to 24"): with protective lacquering
- Measuring tube
  – DN ≤ 300 (12"): stainless steel 1.4301 (304) or 1.4306 (304L) (with Al/Zn protective coating)
  – DN ≥ 350 (14"): stainless steel 1.4301 (304) or 1.4306 (304L) (with protective lacquering)
- Electrodes: 1.4435 (316, 316L), Alloy C22, Tantalum
- Flanges (with protective lacquering)
  – EN 1092-1 (DIN2501): carbon steel, S235JRG2, S235JR+N, P245GH, E250C1, A105
  – ASME B16.5: carbon steel, A105
  – JIS B2220: carbon steel, A105, A350 LF2
  1 DN DN ≤ 300 (12") with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering
- Seals: to DIN EN 1514-1, IBC form
- Ground disks: 1.4435 (316, 316L), Alloy C22, Titanium, Tantalum

Promag H

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum or stainless steel field housing (1.4301 (316L))
  - Wall-mounted housing: powder-coated die-cast aluminum
  - Window material: glass or polycarbonate
- Sensor housing: stainless steel 1.4301 (304)
- Wall mounting kit: stainless steel 1.4301 (304)
- Measuring tube: stainless steel 1.4301 (304)
- Liner: PFA (USP class VI; FDA 21 CFR 177.1550: 3A)
- Electrodes:
  - Standard: 1.4435 (316, 316L)
  - Option: Alloy C22, Tantalum, Platinum
- Flange:
  - All connections stainless-steel 1.4404 (F316L)
  - EN (DIN), ASME, JIS made of PVDF
  - Adhesive fitting made of PVC
- Seals
  - DN 2 to 25 (1/12 to 1"): O-ring (EPDM, Viton, Kalrez), gasket seal (EPDM*, Viton, Silicone*)
  - DN 40 to 150 (1½ to 6"): gasket seal (EPDM*, Silicone*)
    * = USP class VI; FDA 21 CFR 177.2600: 3A
- Ground rings: 1.4435 (316, 316L) (optional: Tantalum, Alloy C22)

Promag L

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mounted housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  - DN 350 to 2400 (14 to 90"): with protective lacquering
- Measuring tube:
  - DN 25 to 300 (1 to 12"): Stainless-steel, 1.4301/1.4306 (304L)
  - DN 350 to 1200 (14 to 48"): Stainless-steel, 1.4301/1.4307 (304)
  - DN 1350 to 2400 (54 to 90"): Stainless-steel, 1.4301/1.4307
- Electrodes: 1.4435 (316L), Alloy C22, 2.4602 (UNS N06022)
- Flange
  - EN 1092-1 (DIN 2501)
    - DN 25 to 300
      Lap joint flange:
      - Stainless-steel, 1.4306/1.4307
      - Carbon steel, 235JR
      Lap joint flange, stampel plate:
      - Stainless-steel, 1.4301 (304)
      - Carbon steel, RSt37-2
    - DN 350 to 2400: carbon steel, S235JRG2, S235JR+N, P250GH, P245GH, E250C, A105
    - DN 350 to 600: Stainless-steel, 1.4571
    - DN 700 to 1000: Stainless-steel, 1.4404
  - ASME B16.5
    - DN ≤ 300 (12"), lap joint flange:
      - Stainless-steel, F316L
      - Carbon steel, A105

  - DN ≥ 350 (14"):
    - Carbon steel, A105
    - Stainless-steel, F316L
  - AWWA C207: A105, A181 Cl.70, E250C, S235JRG2, P265GH, S275JR
  - AS 2129: Carbon steel, A105, P235GH, P265GH, S235JRG2, E250C
  - AS 4087: Carbon steel, A105, P265GH, S275JR, E250C
- Seals: to DIN EN 1514-1 IBC form
- Ground disks: 1.4435 (316L) or Alloy C22

Promag P

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mounted housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 15 to 300 (½ to 12"): powder-coated die-cast aluminum
  - DN 350 to 600 (14 to 24"): with protective lacquering
- Measuring tube
  - DN ≤ 300 (12"): stainless steel 1.4301 (304) or 1.4306 (304L); for flanges made of carbon steel with Al/Zn protective coating
  - DN ≥ 350 (14"): stainless steel 1.4301 (304) or 1.4306 (304L); for flanges made of carbon steel with Al/Zn protective coating
- Electrodes: 1.4435 (316, 316L), Platinum, Alloy C22, Tantalum, Titanium
- Flange
  - EN 1092-1 (DIN2501):
    - Stainless-steel, 1.4571, F316L
    - Carbon steel, S235JRG2, S235JR+N, P245GH, P250GH, A105, E250C1
    (1 DN ≤ 300 (12") with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - ASME B16.5:
    - Stainless-steel, F316L
    - Carbon steel, A105
    (DN ≤ 300 mit Al/Zn-Schutzbeschichtung; DN ≥ 350 mit Schutzlackierung)
  - AWWA: 1.0425 (316L)
  - JIS B2220:
    - Stainless-steel, 1.0425 F316L1
    - Carbon steel, A105, A350 LF2
    (1 DN ≤ 300 (12") with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AS 2129: Carbon steel, A105, P235GH, P265GH, S235JRG2, E250C
  - AS 4087: Carbon steel, A105, P265GH, S275JR, E250C
- Seals: to DIN EN 1514-1 IBC form
- Ground disks: 1.4435 (316, 316L) or Alloy C22

Promag W

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mounted housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  - DN 350 to 2000 (14 to 84"): with protective lacquering
- Measuring tube
  - DN ≤ 300 (12"): stainless steel 1.4301 (304) or 1.4306 (304L)
  (for flanges made of carbon steel with Al/Zn protective coating)

  - DN ≥ 350 (14"): stainless steel 1.4301 (304) or 1.4306 (304)
    (for flanges made of carbon steel with protective lacquering)
- Electrodes: 1.4435 (316, 316L) or Alloy C22, Tantalum
- Flange
  - EN 1092-1 (DIN2501)
    - DN 25 to 3001:
      - Stainless-steel, 1.4571, F316L
      - Carbon steel, S235JRG2, S235JR+N, P250GH, E250C, A105
    - DN 350 to 6001:
      - Stainless-steel, 1.4571, F316L
      - Carbon steel, P245GH, S235JRG2, S235JR+N, P250GH, E250C
    - DN > 600:
      - Stainless-steel, 1.4404/F316L
      - Carbon steel, P245GH
  - ASME B16.5: Carbon steel, A105
  - AWWA: Carbon steel, A105, Cl.70 A181, P265GH, S275JR, E250C
  - JIS B2220:
    - Carbon steel, A105, A350 LF2
    - Stainless-steel, F316L
    (DN ≤ 300 (12") mit Al/Zn-Schutzbeschichtung; DN ≥ 350 (14") mit Schutzlackierung)
  - AS 2129: Carbon steel, A105, P235GH, P265GH, S235JRG2
  - AS 4087: Carbon steel, A105, P265GH, S275JR
- Seals: to DIN EN 1514-1 IBC form
- Ground disks: 1.4435 (316, 316L), Alloy C22, Titanium, Tantalum

1 For flange material carbon steel with Al/Zn protective coating (DN 25 to 300 (1 to 12")), protective varnish (IP68) (DN 50 to 300 (2 to 12")) or protective varnish ≥ DN 350 (14")

Fitted electrodes

Promag D

- 2 measuring electrodes for signal detection

Promag E/L/P/W

- 2 measuring electrodes for signal detection
- 1 EPD electrode for empty pipe detection
- 1 reference electrode for potential equalization

Promag H

- 2 measuring electrodes for signal detection
- 1 EPD electrode for empty pipe detection, not for (DN 2 to 8 (1/12 to 5/16")

Process connections

Promag D

Wafer version → without process connections

Promag E

Flange connections:
- EN 1092-1 (DIN 2501)
  - DN ≤300 (12") = form A
  - DN ≥ 350 (14") = flat face
  - DN 65 PN 16 and DN 600 PN 16 only as per EN 1092-1
- ASME B16.5
- JIS B2220

Promag H

With O-ring:
- Weld nipple DIN (EN), ISO 1127, ODT/SMS
- Flange EN (DIN), ASME, JIS
- Flange made of PVDF EN (DIN), ASME, JIS
- External thread
- Internal thread
- Hose connection
- PVC adhesive fitting

With gasket seal:
- Weld nipple EN 10357 (DIN 11850), ODT/SMS
- Clamp ISO 2852, DIN 32676, L14 AM7
- Threaded joint DIN 11851, DIN 11864-1, ISO 2853, SMS 1145
- Flange DIN 11864-2

Promag L

Flange connection:
- EN 1092-1 (DIN 2501)
  - DN ≤ 300 (12") = form A
  - DN ≥ 350 (14") = form B
- ASME B16.5
- AWWA C207
- AS 2129
- AS 4087

Promag P/W

Flange connections:
- EN 1092-1 (DIN 2501)
  - DN ≤ 300 = form A
  - DN ≥ 350 = flat face
  - DN 65 PN 16 and DN 600 PN 16 only as per EN 1092-1
- ASME B16.5
- AWWA C207 (only Promag W)
- JIS 10K, 20K
- AS 2129
- AS 4087

Surface roughness

All data relate to parts in contact with fluid.

- Liner → PFA: ≤ 0.4 µm (15 µin)
- Electrodes: 0.3 to 0.5 µm (12 to 20 µin)
- Process connection made of stainless-steel (Promag H):
  - with O-ring seal: ≤ 1.6 µm (63 µin)
  - with aseptic gasket seal: ≤ 0.8 µm (31.5 µin)
  - optional: ≤ 0.38 µm (15 µin)

10.11 Operability

Display elements

- Liquid crystal display: illuminated, two-line, 16 characters per line
- Custom configurations for presenting different measured-value and status variables
- 2 totalizers

Note!
At ambient temperatures below −20 (−4 °F) the readability of the display may be impaired.

Operating elements

- Local operation with three keys (⊟⊞Ⓔ)
- "Quick Setup" menus for straightforward commissioning

Language packages

Language packages available for operation in different countries:
- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe/Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish and Czech
- Southeast Asia (SEA):
  English, Japanese, Indonesian

Note!
You can change the language group via the operating program "FieldCare".

Remote operation

Operation via HART protocol and Fieldtool

10.12 Certificates and approvals

CE approval

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-tick symbol

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Sanitary compatibility

Promag D/E/L/P/W

No applicable approvals or certification

Promag H

- 3A authorization and EHEDG-certified
- Seals: in conformity with FDA (except Kalrez seals)

Drinking water approval

Promag D/L/W

- WRAS BS 6920
- ACS
- NSF 61
- KTW/W270

Promag E/H/P

No drinking water approval

Pressure equipment directive

Promag D/L

No pressure measuring device approval

Promag E/H/P/W

The devices can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.

- With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 2014/68/EU.
- Devices bearing this marking (PED) are suitable for the following types of medium: Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to 0.5 bar (7.3 psi)
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.4 Section 3 of the Pressure Equipment Directive 2014/68/EU. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU.

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code).
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC/EN 61326
  Electromagnetic compatibility (EMC requirements)
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 (No. 1010.1-92)
  Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category I.
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

10.13 Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

Note!
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

10.14 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor → 83.
Your Endress+Hauser service organization can provide detailed information on the specific order codes on request.

10.15 Documentation

- Flow measuring technology (FA00005D/06)
- Technical Information Promag 50D (TI00082D/06)
- Technical Information Promag 50E (TI01161D/06)
- Technical Information Promag 50L (TI00097D/06)
- Technical Information Promag 50/53H (TI00048D/06)
- Technical Information Promag 50/53P (TI00047D/06)
- Technical Information Promag 50/53W (TI00046D/06)
- Description of Device Functions Promag 50 HART (BA00049D/06)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, etc.

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