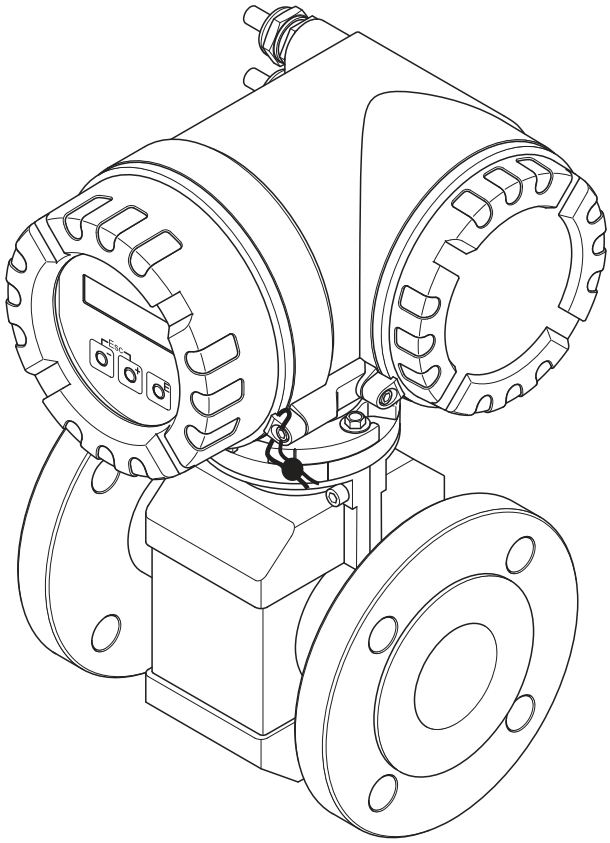
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Promag 51 HART

Electromagnetic flow measuring system

HART® FIELD COMMUNICATION PROTOCOL



BA00137D/06/EN/03.10
71111278

Valid as of version
V 2.03.XX (device software)

Endress+Hauser

People for Process Automation

Table of contents

1 Safety instructions 5

1.1 Designated use 5
1.2 Installation, commissioning and operation 5
1.3 Operational safety 6
1.4 Return 6
1.5 Notes on safety conventions and icons 6

2 Identification 7

2.1 Device designation 7
2.1.1 Nameplate of the transmitter 7
2.1.2 Nameplate of the sensor 8
2.1.3 Nameplate for connections 9
2.2 Certificates and approvals 9
2.3 Registered trademarks 10

3 Installation 11

3.1 Incoming acceptance, transport and storage 11
3.1.1 Incoming acceptance 11
3.1.2 Transport 11
3.1.3 Storage 12
3.2 Installation conditions 13
3.2.1 Dimensions 13
3.2.2 Mounting location 13
3.2.3 Orientation 15
3.2.4 Vibrations 16
3.2.5 Foundations, supports 17
3.2.6 Adapters 17
3.2.7 Flow characteristics 18
3.2.8 Length of connecting cable 19
3.3 Installation instructions 20
3.3.1 Installing the Promag W sensor 20
3.3.2 Installing the Promag P sensor 22
3.3.3 Turning the transmitter housing 24
3.3.4 Turning the local display 25
3.3.5 Installing the wall-mount transmitter housing 26
3.4 Post-installation check 28

4 Wiring 29

4.1 Connecting the remote version 29
4.1.1 Connecting Promag W, P 29
4.1.2 Cable specifications 32
4.2 Connecting the measuring unit 33
4.2.1 Connecting the transmitter 33
4.2.2 Terminal assignment 34
4.2.3 Connecting a "reset key" 35
4.2.4 HART connection 36
4.3 Potential equalization 37
4.3.1 Potential equalization for Promag W, P . . . 37
4.3.2 Exampels for potential equalization connections for Promag W, P 37
4.4 Degree of protection 39
4.5 Post-connection check 40

5 Operation 41

5.1 Display and operating elements 41
5.2 Brief guide to the function matrix 42
5.3 Displaying error messages 44
5.3.1 Type of error 44
5.3.2 Error message types 44
5.4 Communication 45
5.4.1 Operating options 45
5.4.2 Current device description files 46
5.4.3 Device variables 46
5.4.4 Switching HART write protection on and off 46
5.4.5 Universal and common practice HART commands 47
5.4.6 Device status and error messages 51

6 Commissioning 53

6.1 Operation subject to legal metrological control/"custody transfer measurement" 53
6.1.1 Subsequent verification 53
6.1.2 Setting-up custody transfer mode 53
6.1.3 Deactivating custody transfer mode 54
6.1.4 Special features of operation subject to metrological control/custody transfer measurement 55
6.1.5 Definitions 55
6.2 Function check 56
6.3 Switching on the measuring device 56
6.4 Quick setup 57
6.4.1 "Commissioning" Quick Setup menu 57
6.5 Configuration 58
6.5.1 Current output: active/passive 58
6.6 Adjustment 59
6.6.1 Empty-pipe/full-pipe adjustment 59
6.7 Data storage device (HistoROM) 60
6.7.1 HistoROM/S-DAT (sensor-DAT) 60

7 Maintenance 61

7.1 Exterior cleaning 61

8 Accessories 62

8.1 Measuring principle-specific accessories 62
8.2 Communication-specific accessories 63
8.3 Service-specific accessories 63

9 Troubleshooting 64

9.1 Troubleshooting instructions 64
9.2 System error messages 66
9.3 Process error messages 69
9.4 Process errors without messages 70
9.5 Response of outputs to errors 71
9.6 Spare parts 73

9.6.1 Removing and installing printed circuit boards 74
9.6.2 Replacing the device fuse 78
9.7 Return 79
9.8 Disposal 79
9.9 Software history 79

10 Technical data 80

10.1 Technical data at a glance 80
10.1.1 Application 80
10.1.2 Function and system design 80
10.1.3 Input 80
10.1.4 Output 81
10.1.5 Power supply 82
10.1.6 Operating conditions: rated operating conditions 83
10.1.7 Operating conditions: other operating conditions 84
10.1.8 Operating conditions: process 85
10.1.9 Mechanical construction 86
10.1.10 Human interface 89
10.1.11 Certificates and approvals 89
10.1.12 Ordering information 91
10.1.13 Accessories 91
10.1.14 Documentation 91

Index 92

1 Safety instructions

1.1 Designated use

The Promag 51 measuring device described in these Operating Instructions is approved to OIML R49 and has an EC type-examination certificate according to Measuring Instruments Directive 2004/22/EC (MID) for use in legal metrological control ("custody transfer") for cold water (MI-001).
A minimum conductivity of 20 µS/cm is required for measuring demineralized water. Fresh water can be measured as of a minimum conductivity of 5 µS/cm.

The Promag 51 is operated with a totalizer display for legal metrological control and, optionally, with a pulse output for legal metrological control.

The measuring system operates within a temperature range of 0 to +30 °C and can be deployed, for example, in the supply of drinking water:
- Internal monitoring of delivery pipe network (local water network)
- Calculation of the bill from the main supply pipe (junctions)
- Monitoring of the water source. For example, the amount of ground water (tank inlet points, incl. pump stations).
- Certification for the amount supplied to the delivery network (tank outlet points).
- Monitoring of the withdrawal and supply of different water works in a supply pipe (overland supply pipe of a water network).

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

Note the following points:
- A Promag 51 measuring system for legal metrological control is protected by seals on the transmitter or the sensor connection housing from manipulation of parameters relevant to measuring technology (see Page 72). As a rule, these seals may only be broken by a representative of the appropriate approval authorities.
- 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 according to the Measuring Instruments Directive 2004/22/EC (MID). The specialist must have read and understood these Operating Instructions 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.
- Endress+Hauser is willing to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning. However, small changes in temperature, concentration or the degree of contamination in the process can result in changes of the chemical resistance properties. Therefore, Endress+Hauser can not guarantee or accept liability for the chemical resistance properties of the fluid wetted materials in a specific application.
  The user is responsible for the choice of fluid wetted materials in regards to their in-process resistance to corrosion.
- If welding work is performed on the piping system, do not ground the welding appliance through the flowmeter.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, unless special protective measures have been taken (e.g. galvanically isolated power supply SELV or PELV).
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Note the following points:

- Measuring systems for use in hazardous environments are accompanied by separate Ex documentation, which is an integral part of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this documentation indicates the approval and the inspection authority (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 recommendation NE 21 and NE 43.
- Due to the performance rate in the electronic components, the maximum heating of the outer housing surfaces is 10 K. When hot fluids are passed through the measuring tube, the surface temperature of the housing increases. With regard to the sensor, in particular, you should expect temperatures that can be close to the fluid temperature.
  If the temperature of the fluid is high, ensure staff are protected against burns and scalds.
- 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

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.
- Please note the measures on → 79

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 other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions 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 51 transmitter
- Promag W or Promag P sensor

In the *compact version*, transmitter and sensor form a single mechanical unit; in the *remote version* they are installed separately.

2.1.1 Nameplate of the transmitter

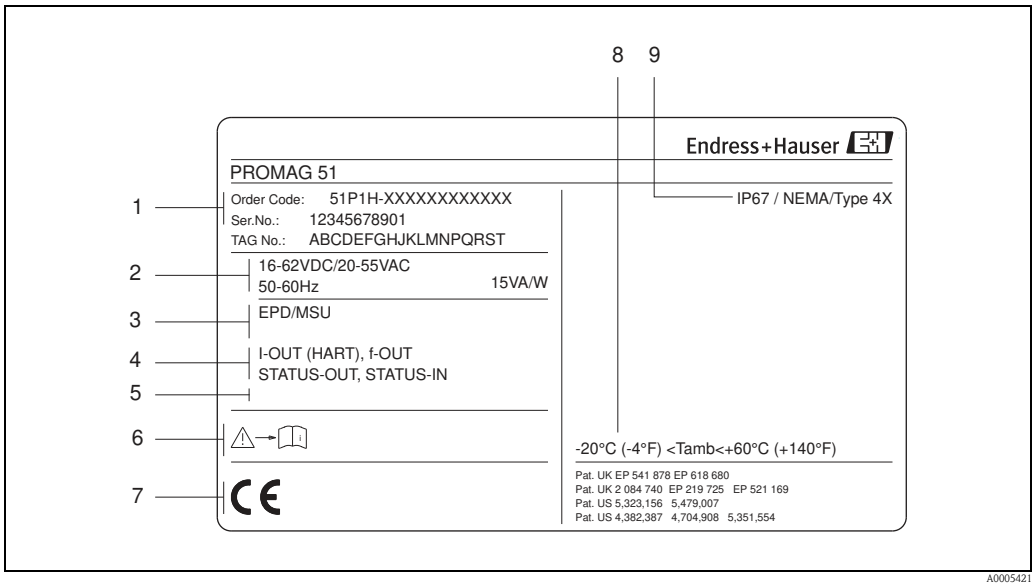


Fig. 1: Nameplate specifications for the "Promag 51" transmitter (example)

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: 16 to 62 V DC / 20 to 55 V AC, 50 to 60 Hz
Power consumption: 15 VA / 15 W
3 Additional information:
EPD/MSU: with Empty Pipe Detection
4 Outputs available:
I-OUT (HART): with current output (HART)
PULSE-OUT: with pulse/status output
STATUS-IN: with status input (power supply)
STATUS-OUT: with status output (switch output)
5 Reserved for information on special products
6 Reference to Operating Instructions
7 Reserved for additional information on device version (approvals, certificates)
8 Ambient temperature range
9 Degree of protection

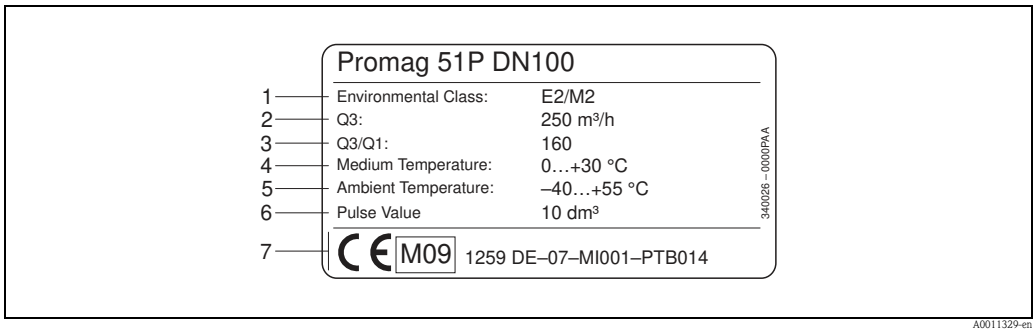


Fig. 2: Additional nameplate for Promag 51 measuring devices subject to legal metrological control (example)

1 Electromagnetic / mechanical ambient class
2 Permanent flowrate Q3
3 Permanent flowrate ratio Q3/Q1
4 Permitted fluid temperature range
5 Permitted operating temperature range
6 Information on pulse value
7 Conformity identification with CE-M mark, year number, notified body and number of EC type-examination certificate

2.1.2 Nameplate of the sensor

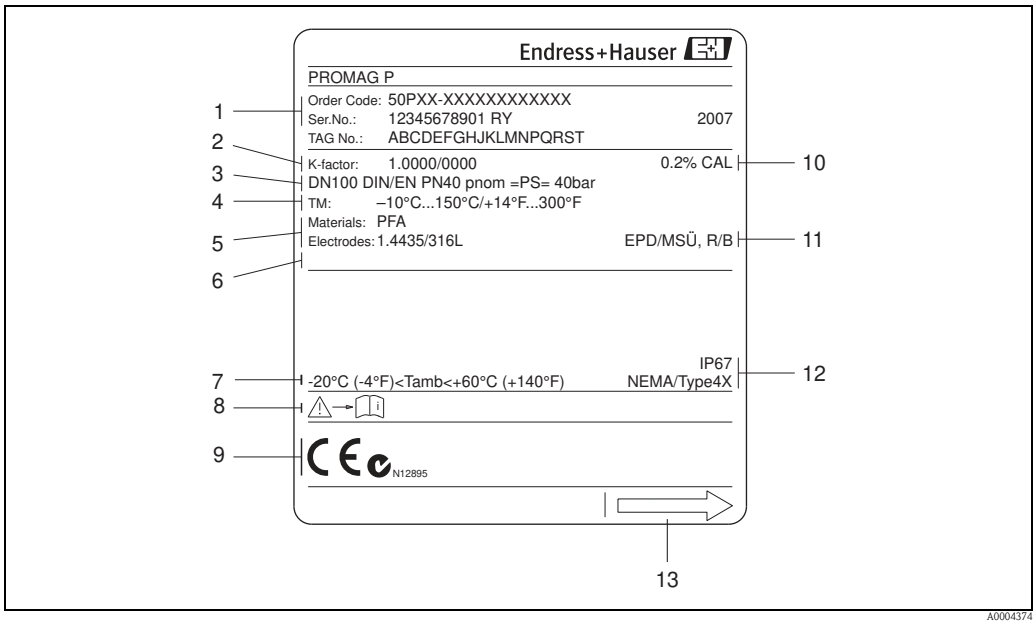


Fig. 3: Nameplate specifications for the "Promag" sensor (example)

1 Ordering code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Calibration factor: 0.5328 / zero point: -5
3 Nominal diameter: DN 100 / pressure rating: EN (DIN) 16 bar
4 Fluid temperature range
5 Lining material: PTFE, measuring electrodes: stainless steel 1.4435/316L
6 Reserved for information on special products
7 Ambient temperature range
8 Reference to Operating Instructions
9 Reserved for additional information on device version (approvals, certificates)
10 See "Maximum measured error" → 84
11 Additional information (examples):
– EPD/MSU: with Empty Pipe Detection electrode
– R/B: with reference electrode
12 Degree of protection
13 Flow direction

2.1.3 Nameplate for connections

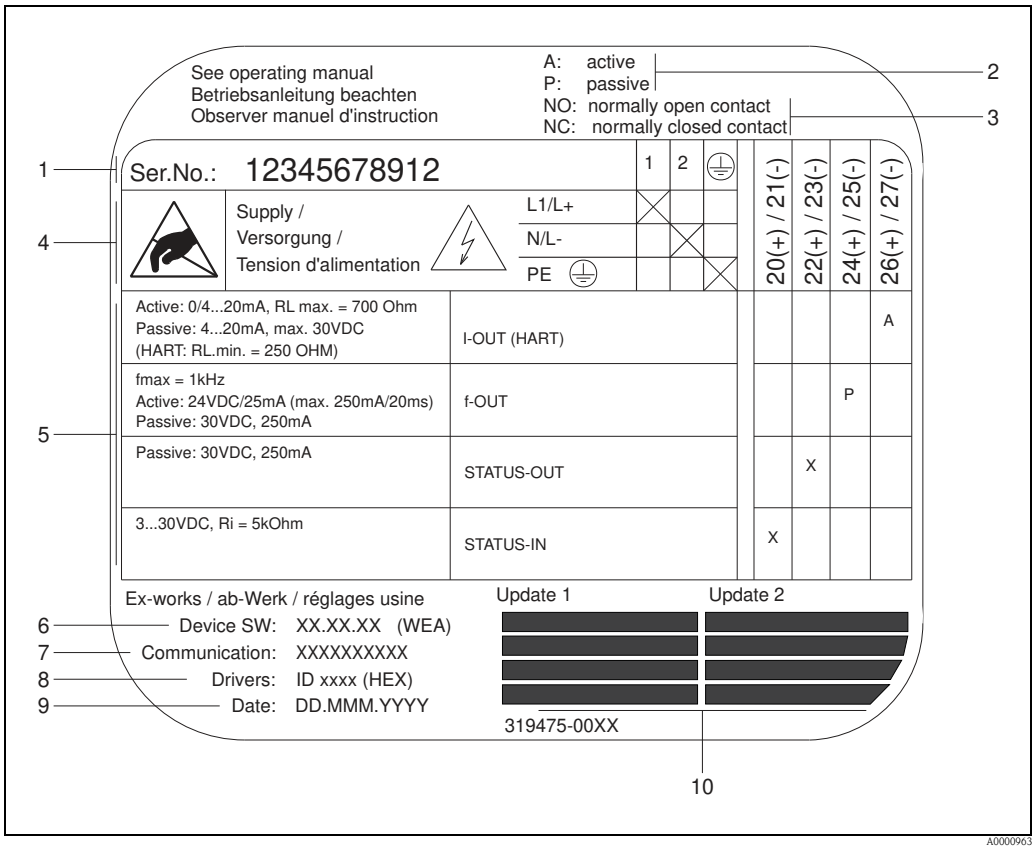


Fig. 4: Nameplate specifications for transmitter (example)

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 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.

The measuring system described in these Operating Instructions 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 HART Communication Foundation, Austin, USA

HistoROM™, S-DAT®, Field Xpert™, FieldCare®, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

On receipt of the goods, check the following points:
- 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 before the device leaves the factory protect the linings on the flanges during storage and transportation. Do not remove these covers until **immediately before** the device is installed 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):

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.

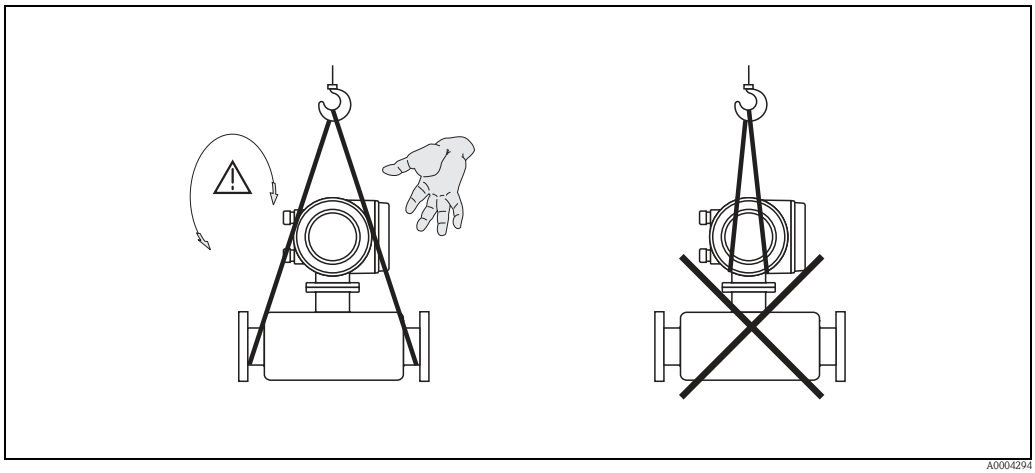


Fig. 5: Transporting transmitters with DN ≤ 300

Transporting flanged devices (DN ≥ 350)

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.

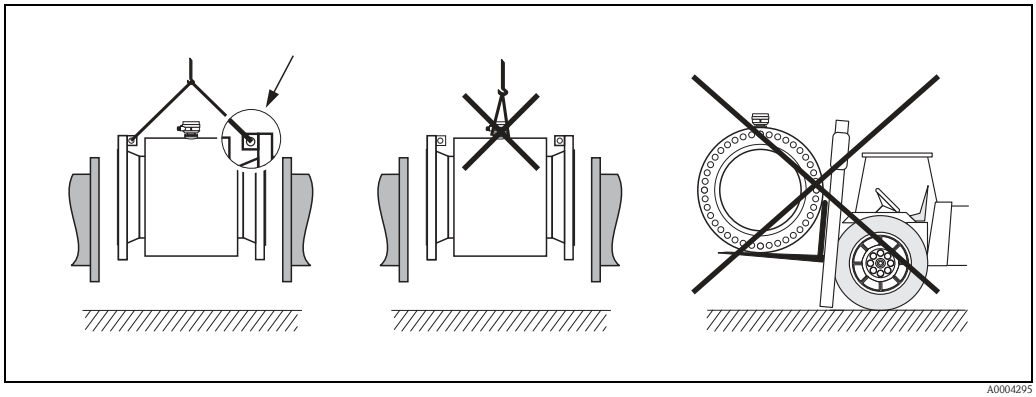


Fig. 6: Transporting sensors with DN ≥ 350

3.1.3 Storage

Note the following points:
- 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. → 84
- 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 lengths of the sensor and transmitter are provided in the "Technical Information" document for the device in question. This 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 → 91.

3.2.2 Mounting location

Entrained air or gas bubbles 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 a free pipe outlet in a vertical pipeline.

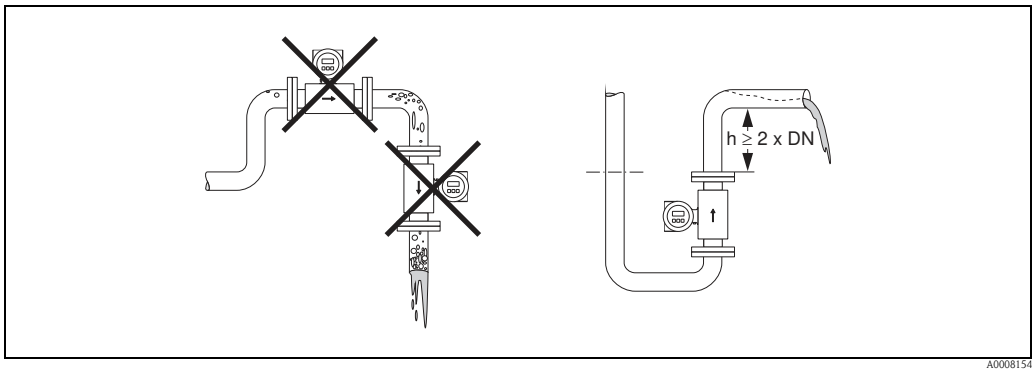


Fig. 7: Location

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 → 85.

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 → 84.

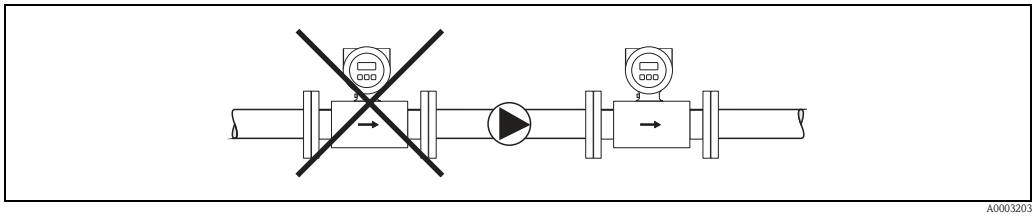


Fig. 8: Installation of pumps

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The Empty Pipe Detection function (EPD → 59) 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.

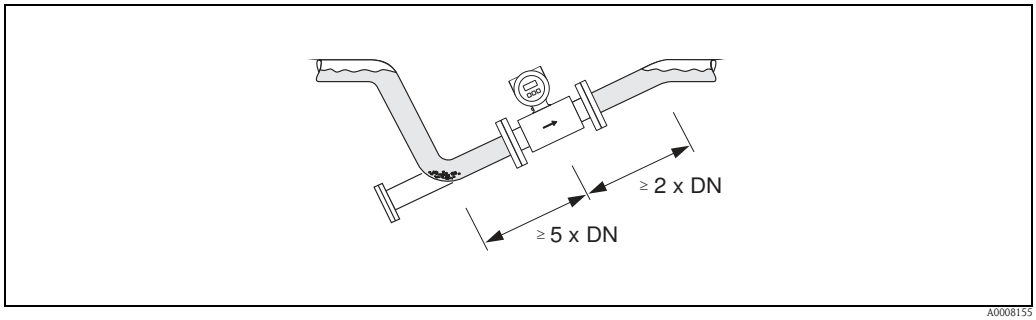


Fig. 9: Installation in partially filled pipe

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length h is ≥ 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 inclusions. Information on the lining's resistance to partial vacuum can be found on → 85.

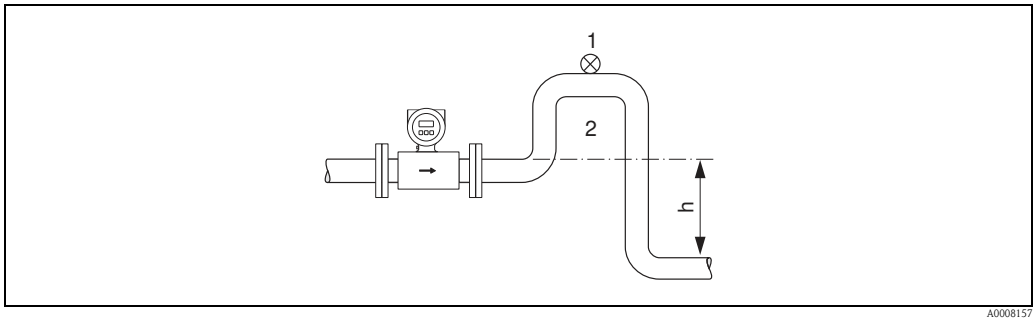


Fig. 10: Measures for installation in a down pipe

1 Vent valve
2 Pipe siphon
h Length of down pipe

3.2.3 Orientation

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, Promag also offers the additional empty pipe detection function for detecting partially filled measuring tubes, e.g. in the case of degassing fluids or varying process pressure:

- Electrode Cleaning function (ECC) to prevent electrically conductive buildup in the measuring tube, e.g. in the case of fluids that cake (→ "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 or varying process pressure (→ 59)

Vertical orientation

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

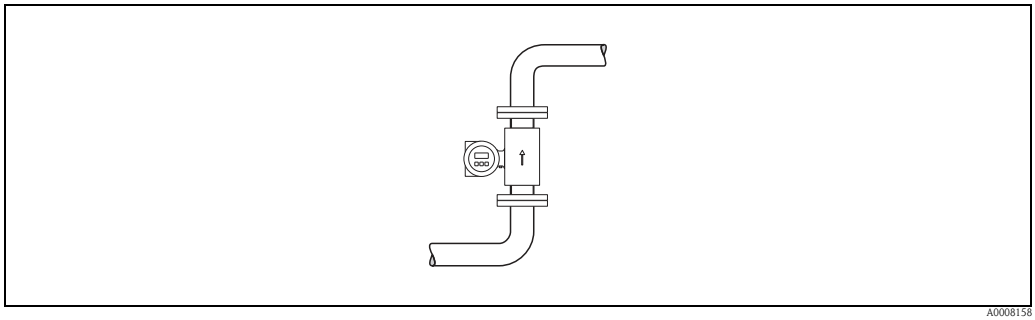


Fig. 11: Vertical orientation

Horizontal orientation

The measuring electrode plane should be horizontal. This prevents brief insulation of the two 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 (→ 11). Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled or empty.

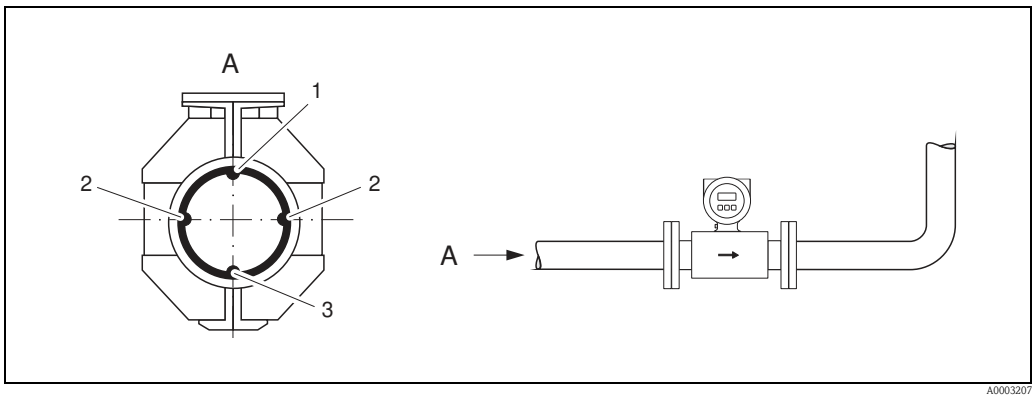


Fig. 12: Horizontal orientation

1 EPD electrode for the detection of empty pipes
2 Measurement electrodes for the signal acquisition
3 Reference electrode for the potential equalization

Inlet and outlet runs

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc. Compliance with the following requirements for the inlet and outlet runs is necessary in order to ensure measuring accuracy:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

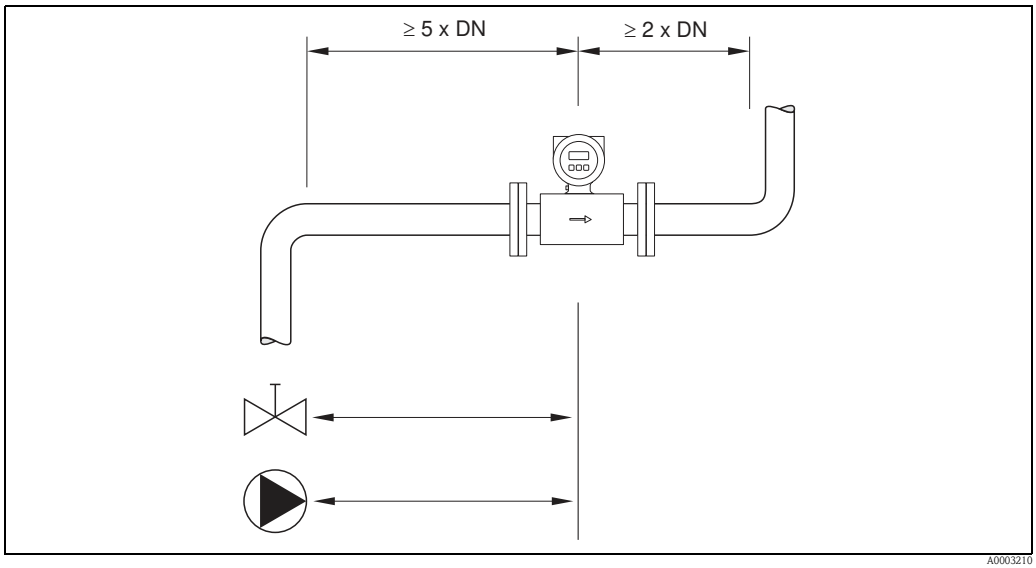


Fig. 13: Inlet and outlet runs

3.2.4 Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!
It is advisable to install sensor and transmitter separately if vibration is excessively severe.
Information on resistance to vibration and shock → 84.

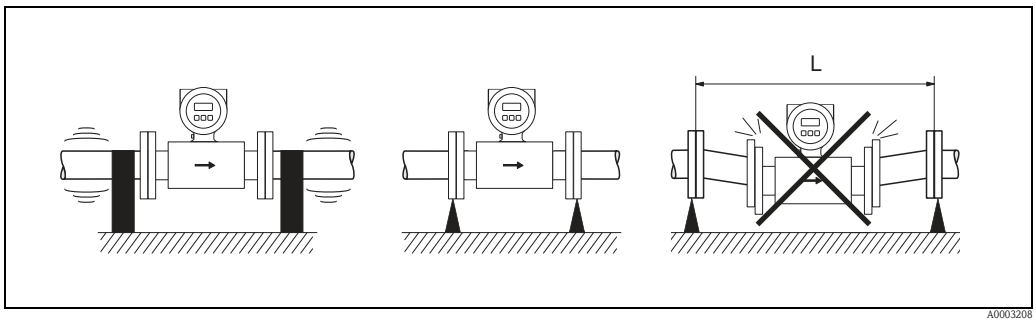


Fig. 14: Measures to prevent device vibrations (L > 10 m (32.8 ft))

3.2.5 Foundations, supports

If the nominal diameter is DN ≥ 350, mount the transmitter 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.

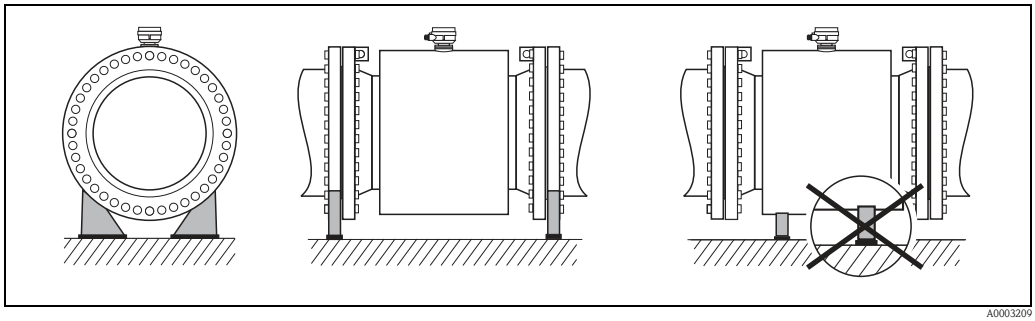


Fig. 15: Correct support for large nominal diameters (DN ≥ 350)

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 cross section reduction.

Note!
The nomogram applies to fluids of viscosity similar to water.

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.

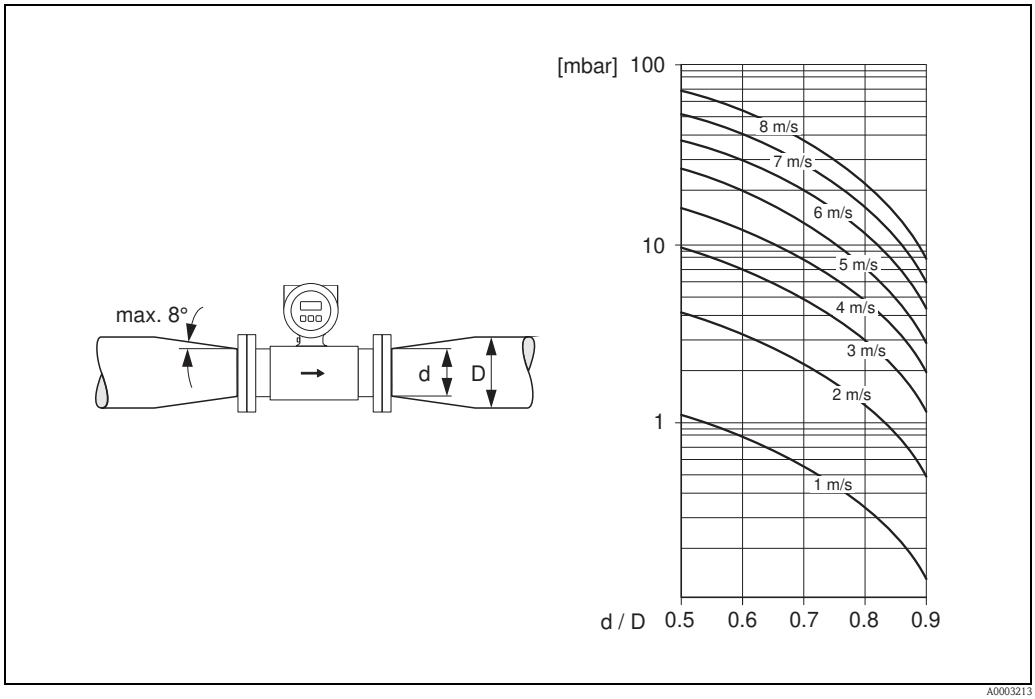


Fig. 16: Pressure loss due to adapters

3.2.7 Flow characteristics

Please indicate the following data in all requests and orders for devices subject to metrological controls:

Nominal values DN or permanent flowrate Q3
This information is shown on the nameplate and must be given in the order text.

Current output / pulse output
The permanent flowrate Q3 (~10 m/s), which is set at the factory, is decisive for scaling the current output; if required, also provide the pulse output values.

Permanent flowrate characteristics

Nominal Diameter DN	Q1	Q2	Q3	Q4	Q3/Q1
[mm]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]
15	0.04	0.06	6.3	7.9	160
25	0.10	0.16	16	20	160
32	0.16	0.25	25	31	160
40	0.25	0.40	40	50	160
50	0.39	0.63	63	79	160
65	0.63	1.0	100	125	160
80	1.0	1.6	160	200	160
100	1.6	2.5	250	313	160
125	2.5	4.0	400	500	160
150	3.9	6.3	630	788	160
200	6.3	10	1000	1250	160
250	10	16	1600	2000	160
300	16	25	2500	3125	160
350	16	25	2500	3125	160
400	25	40	4000	5000	160
500	39	63	6300	7875	160
600	63	100	6300	7875	100
700	63	100	6300	7875	100
800	63	100	6300	7875	100

3.2.8 Length of connecting cable

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

- Secure the cable run or route the cable in a conduit. Movement of the cable can falsify the measuring signal, particularly if the fluid conductivity is low.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permissible length of the connecting cable L_{max} depends on the fluid conductivity (→ 17). 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.
- The maximum length of the connecting cable is 10 m (32.8 ft) when Empty Pipe Detection (EPD → 59) is switched on.

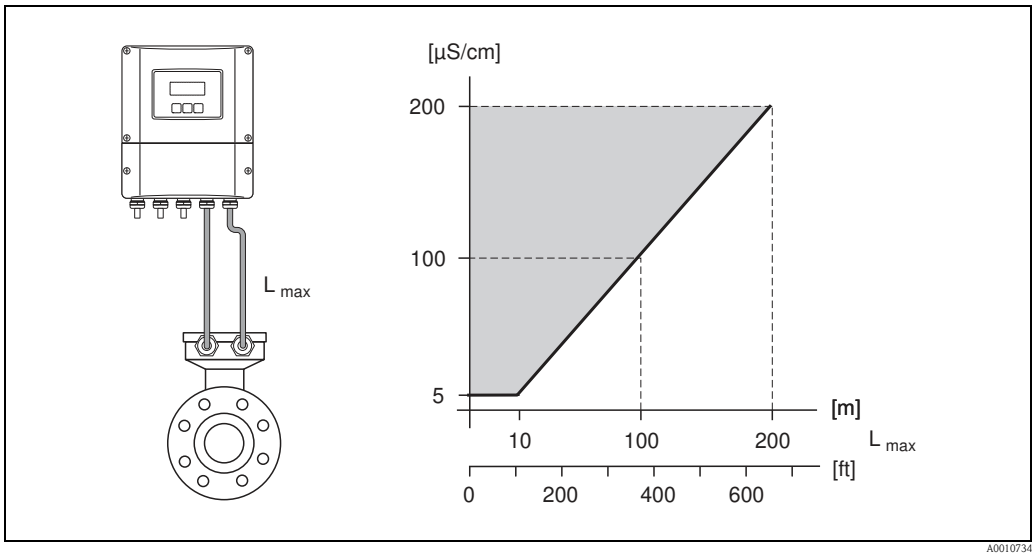


Fig. 17: Permissible cable length for the remote version

Gray shaded area = permissible range
L_{max} = length of connecting cable in [m]
Fluid conductivity in [µS/cm]

3.3 Installation instructions

3.3.1 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 → 📄 21.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment

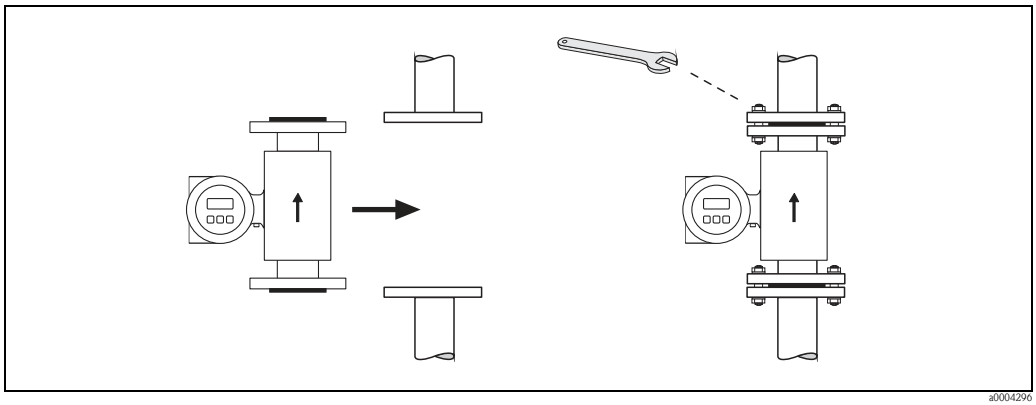


Fig. 18: Installing the Promag W sensor

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 compound 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, a special ground cable for potential equalization can be ordered as an accessory (→ 📄 62).
- Information on potential equalization and detailed installation instructions for using ground cables can be found on → 📄 37.

Screw tightening torques (Promag W)

Note the following points:
- The tightening torques listed below are for lubricated threads only.
- Always tighten threaded fasteners uniformly and in diagonally opposite sequence.
- Overtightening the fasteners will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Promag W tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
25	PN 40	4 × M 12	-	15
32	PN 40	4 × M 16	-	24
40	PN 40	4 × M 16	-	31
50	PN 40	4 × M 16	48	40
65*	PN 16	8 × M 16	32	27
65	PN 40	8 × M 16	32	27
80	PN 16	8 × M 16	40	34
80	PN 40	8 × M 16	40	34
100	PN 16	8 × M 16	43	36
100	PN 40	8 × M 20	59	50
125	PN 16	8 × M 16	56	48
125	PN 40	8 × M 24	83	71
150	PN 16	8 × M 20	74	63
150	PN 40	8 × M 24	104	88
200	PN 10	8 × M 20	106	91
200	PN 16	12 × M 20	70	61
200	PN 25	12 × M 24	104	92
250	PN 10	12 × M 20	82	71
250	PN 16	12 × M 24	98	85
250	PN 25	12 × M 27	150	134
300	PN 10	12 × M 20	94	81
300	PN 16	12 × M 24	134	118
300	PN 25	16 × M 27	153	138
350	PN 6	12 × M 20	111	120
350	PN 10	16 × M 20	112	118
350	PN 16	16 × M 24	152	165
350	PN 25	16 × M 30	227	252
400	PN 6	16 × M 20	90	98
400	PN 10	16 × M 24	151	167
400	PN 16	16 × M 27	193	215
400	PN 25	16 × M 33	289	326
450	PN 10	20 × M 24	153	133
450	PN 16	20 × M 27	198	196
450	PN 25	20 × M 33	256	253
500	PN 6	20 × M 20	119	123
500	PN 10	20 × M 24	155	171
500	PN 16	20 × M 30	275	300
500	PN 25	20 × M 33	317	360
600	PN 6	20 × M 24	139	147
600	PN 10	20 × M 27	206	219
600 *	PN 16	20 × M 33	415	443
600	PN 25	20 × M 36	431	516
700	PN 6	24 × M 24	148	139
700	PN 10	24 × M 27	246	246
700	PN 16	24 × M 33	278	318
700	PN 25	24 × M 39	449	507
800	PN 6	24 × M 27	206	182

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
800	PN 10	24 × M 30	331	316
800	PN 16	24 × M 36	369	385
800	PN 25	24 × M 45	664	721
* Designed acc. to EN 1092-1 (not to DIN 2501)				

3.3.2 Installing the Promag P sensor

Caution!
- The protective covers mounted on the two sensor flanges guard the PTFE lining, 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 → 📄 23.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment

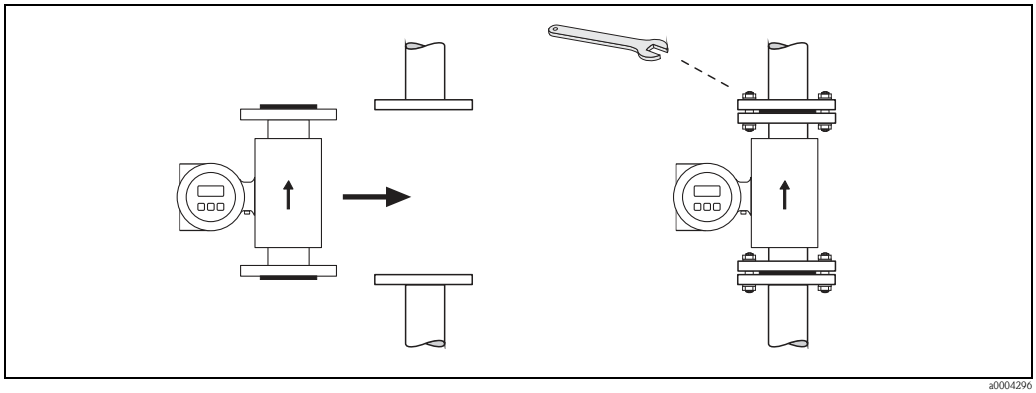


Fig. 19: Installing the Promag P sensor

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 compound 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 (→ 📄 62).
- Information on potential equalization and detailed installation instructions for using ground cables can be found on → 📄 37.

Tightening torques for threaded fasteners (Promag P)

Note the following points:
- The tightening torques listed below are for lubricated threads only.
- Always tighten threaded fasteners uniformly and in diagonally opposite sequence.
- Overtightening the fasteners will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Promag P tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			PTFE	PFA
15	PN 40	4 × M 12	11	–
25	PN 40	4 × M 12	26	20
32	PN 40	4 × M 16	41	35
40	PN 40	4 × M 16	52	47
50	PN 40	4 × M 16	65	59
65 *	PN 16	8 × M 16	43	40
65	PN 40	8 × M 16	43	40
80	PN 16	8 × M 16	53	48
80	PN 40	8 × M 16	53	48
100	PN 16	8 × M 16	57	51
100	PN 40	8 × M 20	78	70
125	PN 16	8 × M 16	75	67
125	PN 40	8 × M 24	111	99
150	PN 16	8 × M 20	99	85
150	PN 40	8 × M 24	136	120
200	PN 10	8 × M 20	141	101
200	PN 16	12 × M 20	94	67
200	PN 25	12 × M 24	138	105
250	PN 10	12 × M 20	110	–
250	PN 16	12 × M 24	131	–
250	PN 25	12 × M 27	200	–
300	PN 10	12 × M 20	125	–
300	PN 16	12 × M 24	179	–
300	PN 25	16 × M 27	204	–
350	PN 10	16 × M 20	188	–
350	PN 16	16 × M 24	254	–
350	PN 25	16 × M 30	380	–
400	PN 10	16 × M 24	260	–
400	PN 16	16 × M 27	330	–
400	PN 25	16 × M 33	488	–
450	PN 10	20 × M 24	235	–
450	PN 16	20 × M 27	300	–
450	PN 25	20 × M 33	385	–
500	PN 10	20 × M 24	265	–
500	PN 16	20 × M 30	448	–
500	PN 25	20 × M 33	533	–
600	PN 10	20 × M 27	345	–
600 *	PN 16	20 × M 33	658	–
600	PN 25	20 × M 36	731	–

* Designed acc. to EN 1092-1 (not to DIN 2501)

3.3.3 Turning the transmitter housing

Turning the aluminum field housing



Warning!
The turning mechanism in devices with Ex d/de 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 as far as it will go.
4. Turn the transmitter housing to the desired position:
   Max. 280° clockwise and max. 20° counterclockwise
5. Lower the housing into position and re-engage the bayonet catch.
6. Retighten the two securing screws.

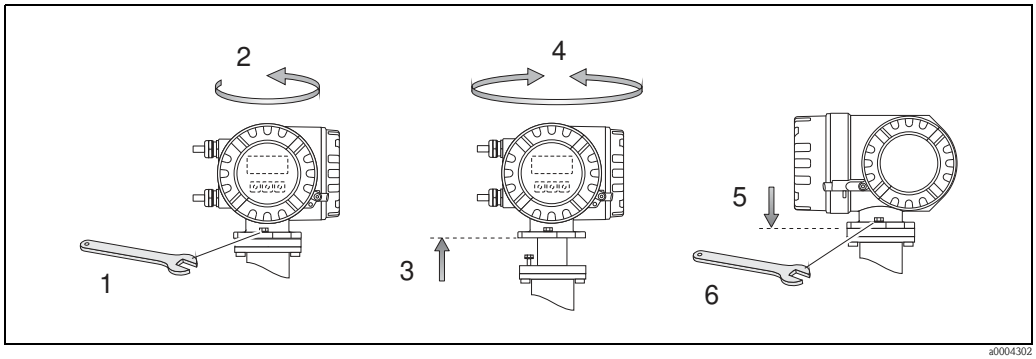


Fig. 20: Turning the transmitter housing (aluminum field housing)

Turning the stainless steel field housing

1. Loosen the two securing screws.
2. Carefully lift the transmitter housing as far as it will go.
3. Turn the transmitter housing to the desired position (max. 2 × 90° in either direction).
4. Put the housing back on.
5. Retighten the two securing screws.

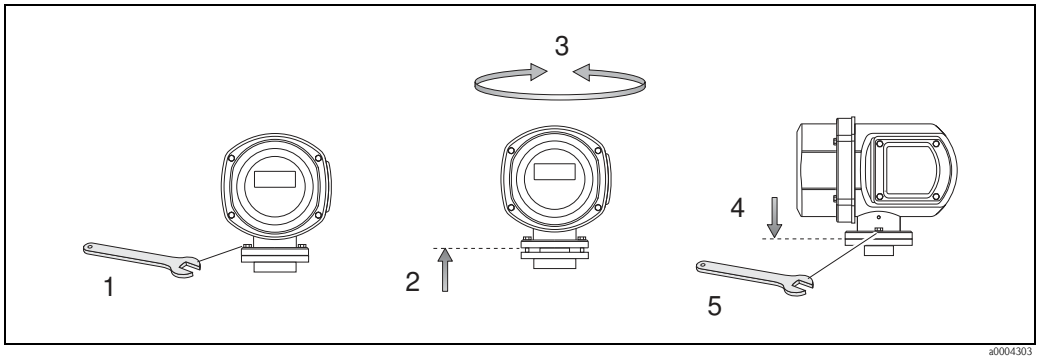


Fig. 21: Turning the transmitter housing (stainless steel field housing)

3.3.4 Turning the local 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. Rotate the display to the desired position (max. 4 × 45° in each direction), and place it back onto the electronics compartment cover plate.
4. Screw the cover of the electronics compartment firmly onto the transmitter housing.

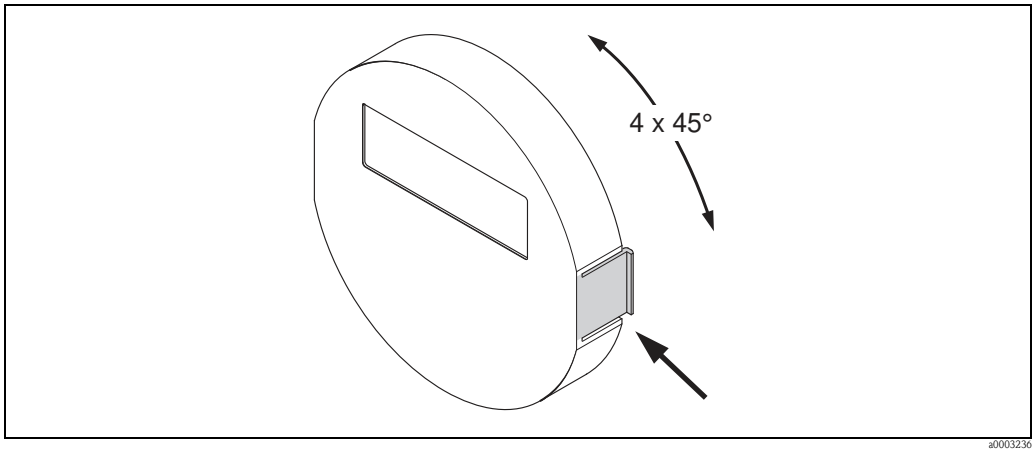


Fig. 22: Turning the local display (field housing)

3.3.5 Installing the wall-mount transmitter housing

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

- Mounted directly on the wall
- Installation in control panel (with separate mounting kit, accessories) → 📄 27
- Pipe mounting (with separate mounting kit, accessories) → 📄 27

Caution!

- Make sure that ambient temperature does not exceed the permissible range –40 to +55 °C (–40 to +131 °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.

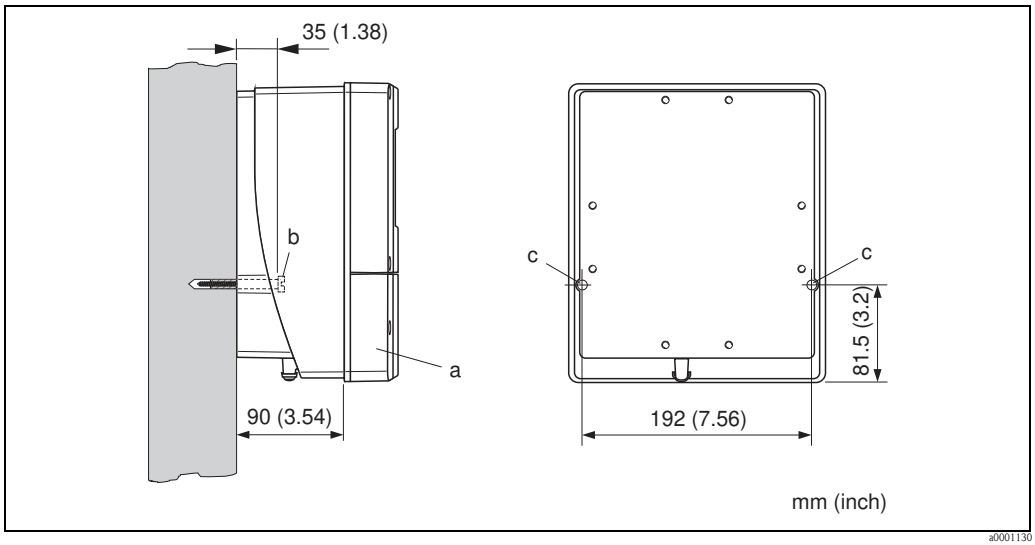


Fig. 23: Mounted directly on the wall

Panel 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.

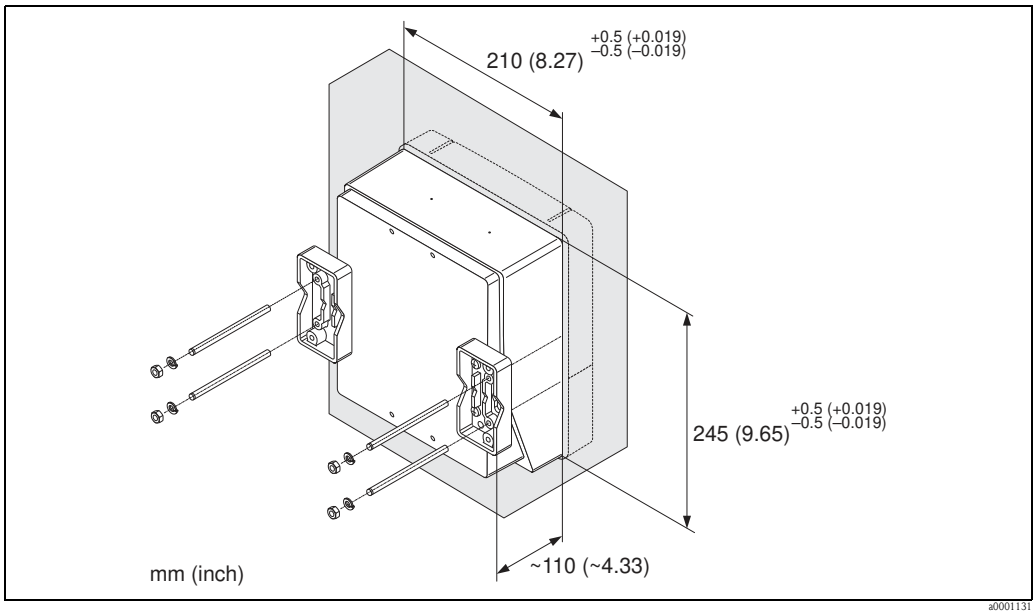


Fig. 24: Panel Installation (wall-mount housing)

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 +55 °C (+131 °F), which is the maximum permissible temperature.

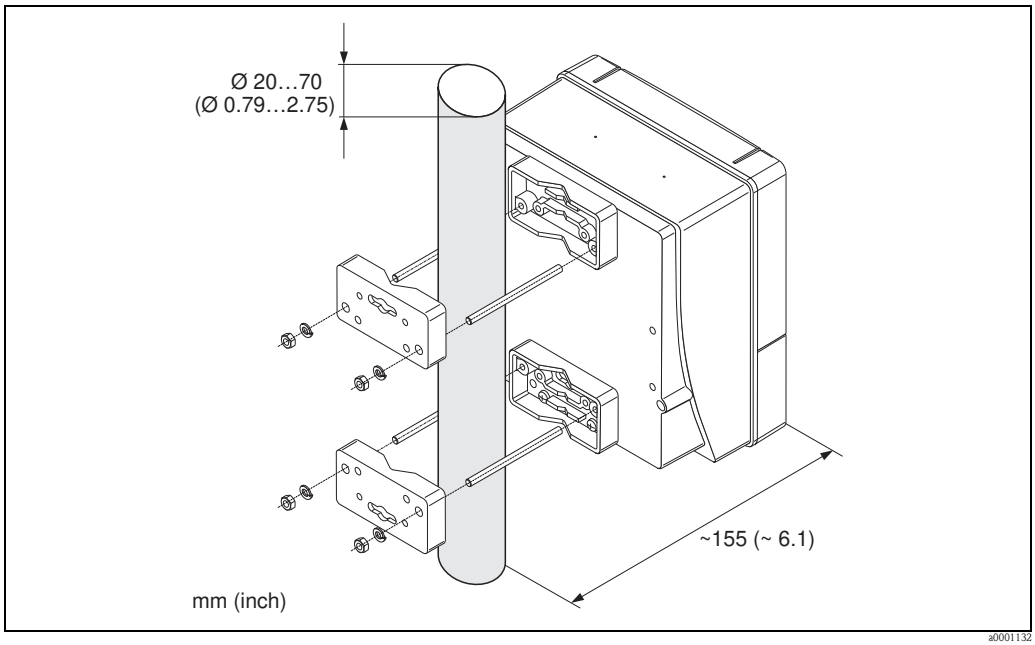


Fig. 25: Pipe mounting (wall-mount housing)

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.?	→ 🖹 85
Installation	**Notes**
Does the arrow on the sensor nameplate match the direction of flow through the pipe?	-
Is the plane of the measuring electrode axis correct?	Horizontal?
Is the position of the Empty Pipe Detection (EPD) electrode correct?	→ 🖹 15
Were all threaded fasteners tightened to the specified torques when the sensor was installed?	Promag W → 🖹 21 Promag P → 🖹 23
Were the correct seals installed (type, material, installation)?	Promag W → 🖹 20 Promag P → 🖹 22
Are the measuring point number and labeling correct (visual inspection)?	-
Have all the lead seals (lead seal diagram) and protection stickers been fitted?	→ 🖹 53
Process environment / process conditions	**Notes**
Are the inlet and outlet runs to 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 measuring device does not have an internal circuit breaker. For this reason, assign the measuring device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

4.1 Connecting the remote version

4.1.1 Connecting Promag W, P

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 errors 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 cable.

Procedure

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

   Caution!
   Install the connecting cables securely (see "Length of connecting cable" → 19).
4. Terminate the signal and coil current cable as specified in the table → 31.
5. Establish the wiring between the sensor and transmitter.
   You can find the electrical wiring diagram that is valid for your device in:
   - The specific graphic: → 26
   - The cover of the sensor and transmitter

   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 onto the connection compartment (a).
7. Sensor: Secure the cover on the connection housing (b).

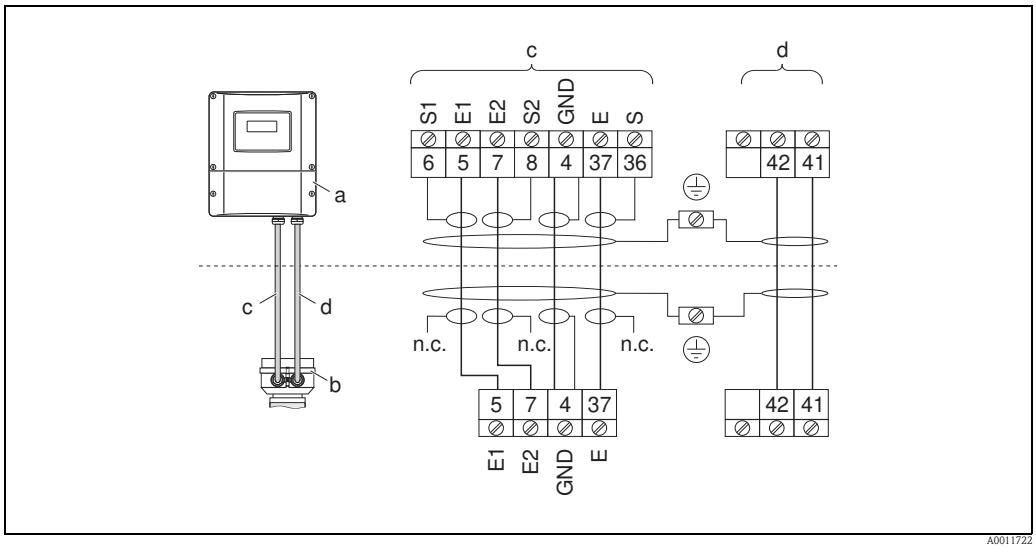


Fig. 26: Connecting the remote version of Promag W, P

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Signal 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, 41 = 1, 42 = 2

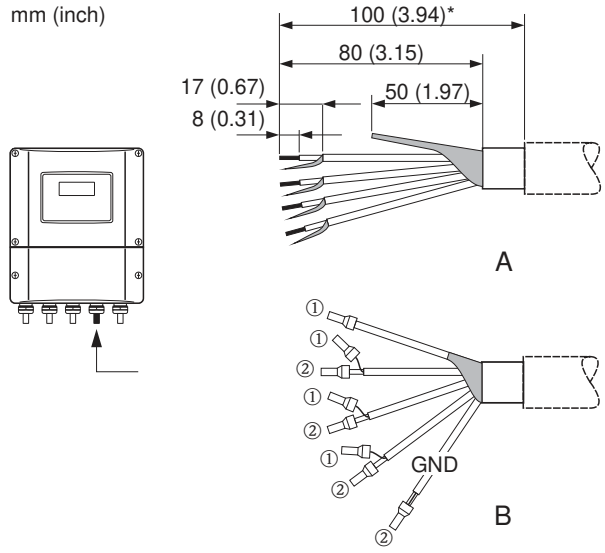
Cable termination for the remote version
Promag W / Promag P

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with wire end ferrules (Detail B: ① = red wire end ferrules, Ø 1.0 mm; ② = white wire end ferrules, Ø 0.5 mm).
* Stripping only for reinforced cables

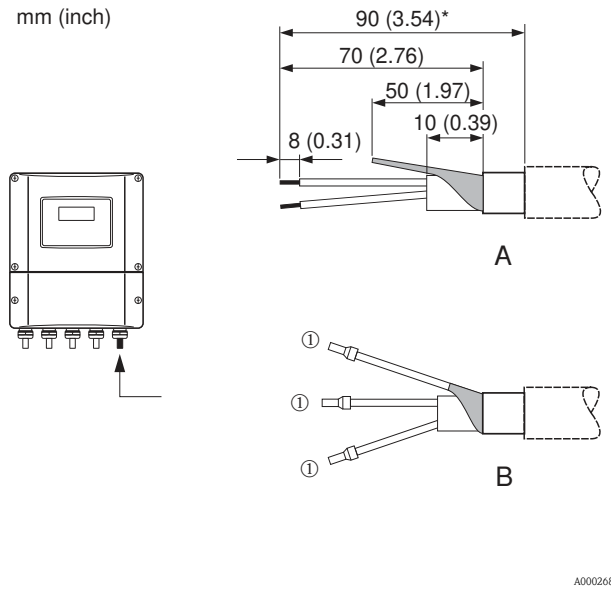
Caution!
When fitting the connectors, pay attention to the following points:
- *Signal cable* → Make sure that the wire end sleeves do not touch the wire shields on the sensor side!
  Minimum distance = 1 mm (exception "GND" = green cable)
- *Coil current cable* → Insulate one core of the three-core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

TRANSMITTER

Signal cable

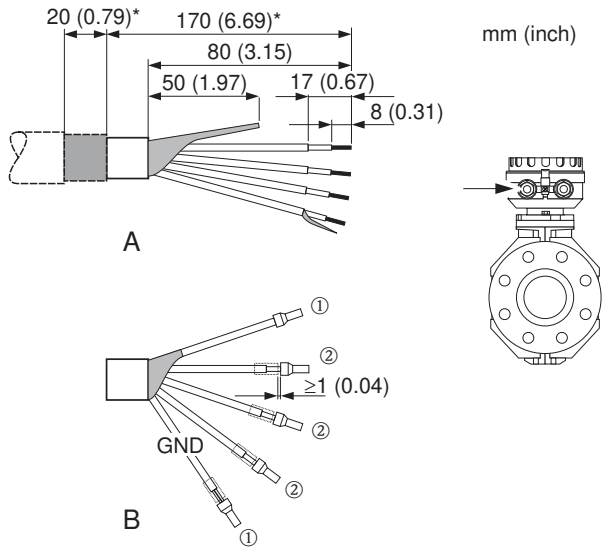


Coil current cable

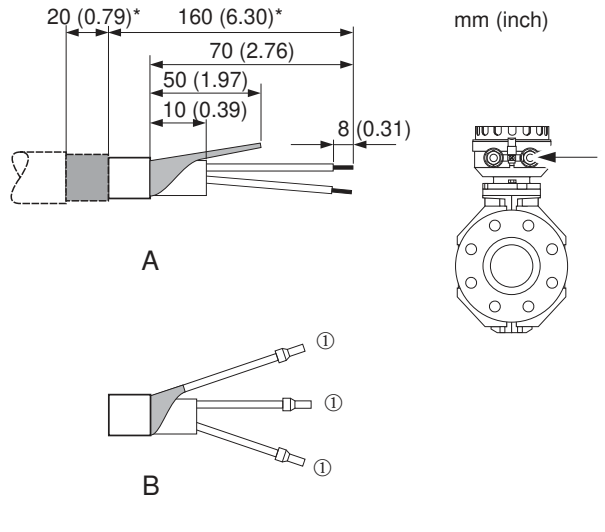


SENSOR

Signal cable



Coil current cable



4.1.2 Cable specifications

Signal cable

- 3 × 0.38 mm² PVC cable with common, braided copper shield (∅ ~ 7 mm) and individually shielded cores
- With Empty Pipe Detection (EPD): 4 × 0.38 mm² PVC cable with common, braided copper shield (∅ ~ 7 mm) 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 cable

- 2 × 0.75 mm² PVC cable with common, braided copper shield (Ø ~ 7 mm)
- Conductor resistance: ≤ 37 Ω/km
- Capacitance: core/core, shield grounded: ≤120 pF/m
- Permanent 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

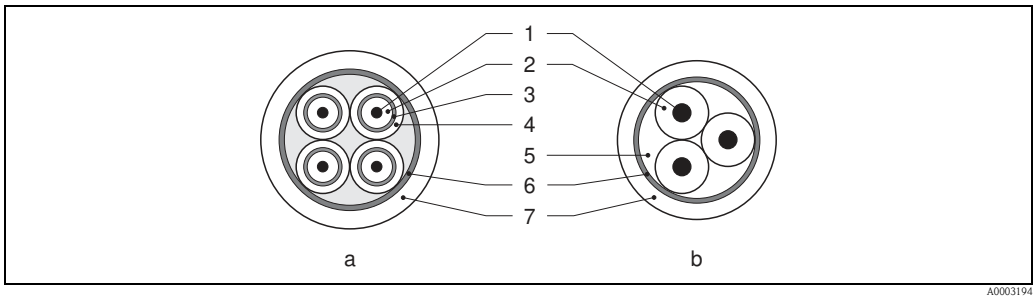


Fig. 27: Cable cross-section

a Signal 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 cables under ground, in situations where there is the danger of cable destruction by rodents and if using a measuring device with 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. Keep the stripped and twisted lengths of cable shield to the terminals 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 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 (not required for galvanically isolated power supply).
- Compare the specifications on the nameplate with the local voltage supply and frequency. Also observe the 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 signal cable (b) through the appropriate cable entries.
3. Connect the cables in accordance with the wiring diagram:
   – Wiring diagram (aluminum housing) → 28
   – Wiring diagram (wall-mount housing) → 29
   – Terminal assignment → 34
4. Screw the cover of the connection compartment (f) back onto the transmitter housing.

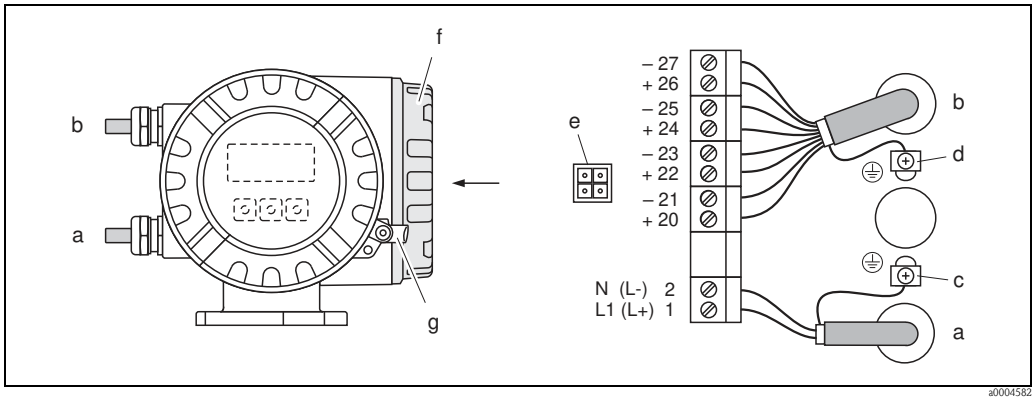


Fig. 28: Connecting the transmitter (aluminum field housing). Cable cross-section: max. 2.5 mm²

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 Signal cable: Terminals **Nos. 20–27** → 34*
c Ground terminal for protective conductor
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment
g Securing clamp

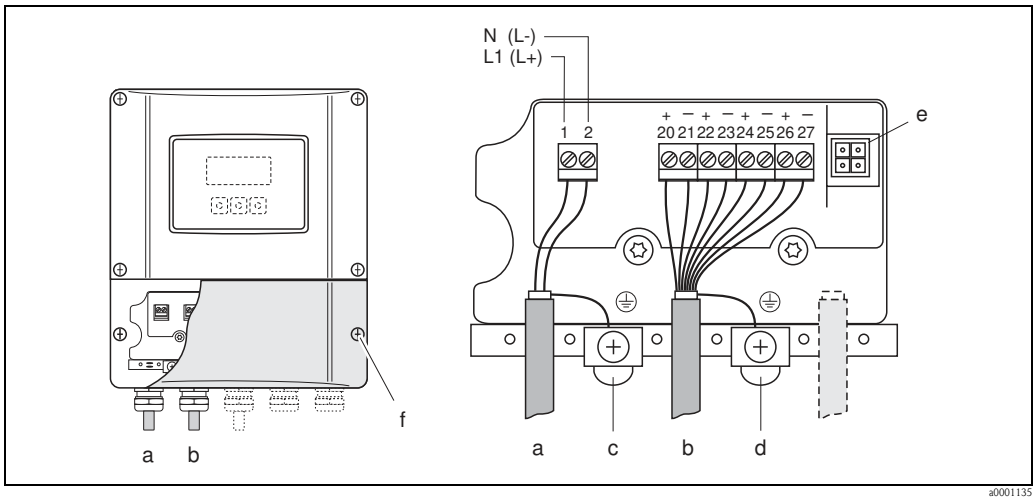


Fig. 29: Connecting the transmitter (wall-mount housing); cable cross-section: max. 2.5 mm²

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 Signal cable: Terminals **Nos. 20–27** → 📄 34*
c Ground terminal for protective conductor
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment

4.2.2 Terminal assignment

Order variant	Terminal No. (inputs / outputs)			
	20 (+) / 21 (–)	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 (+) / 27 (–)**
51***_**********D	Status input	Status output	Frequency output	Current output HART
51***_**********P	Status input	Status output	Pulse input custody transfer	Current output HART

Note!
Functional values of the inputs and outputs → 📄 80

4.2.3 Connecting a "reset key" (for error messages)

In custody transfer mode, error messages occurring during operation must be reset or confirmed manually via the status input (auxiliary input) using a voltage pulse, e.g. via external switches or reset buttons provided for this purpose. The power is supplied either by means of an external power source or the current output (Fig. 31).

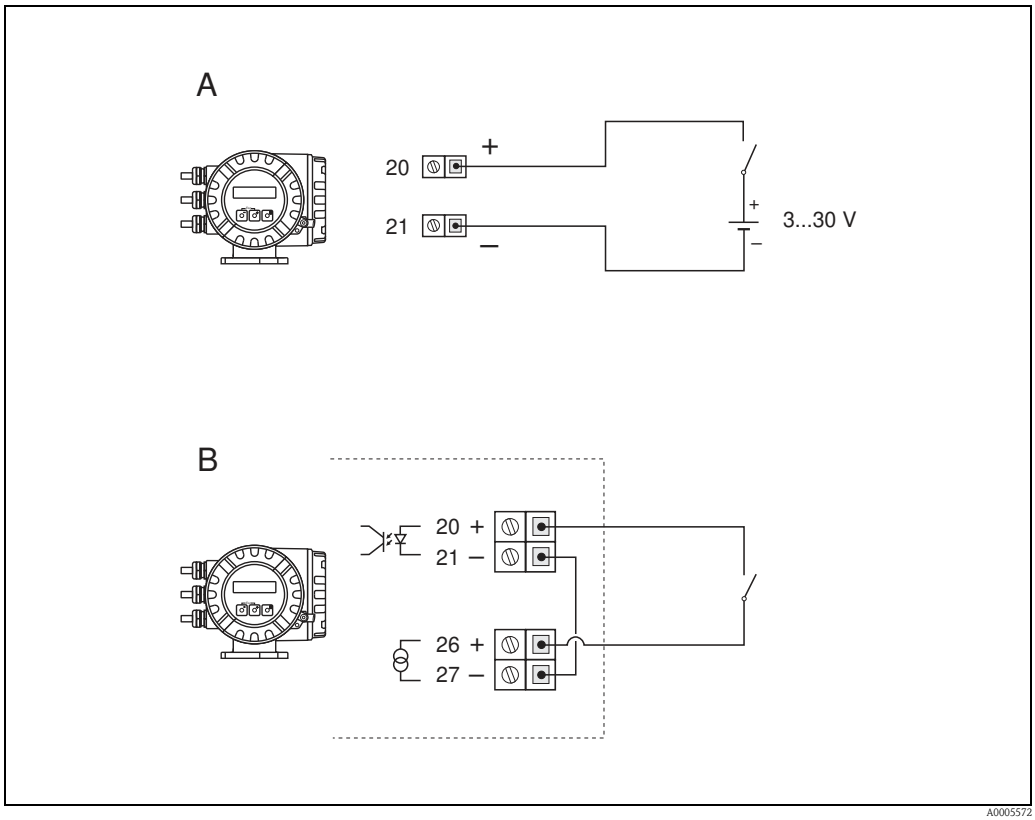


Fig. 30: Wiring versions for connecting a "reset" key (for resetting errors)

A = Wiring version with external voltage supply (3 to 30 V)

B = Wiring version with the current output as voltage supply (4 to 20 mA)

Terminal No. 20 / 21 = Status input
Terminal No. 26 / 27 = Current output

4.2.4 HART connection

The following connection options are available:
- Direct connection to transmitter by means of terminals 26(+) / 27(–)
- Connection by means of the 4 to 20 mA circuit

Note!
- The measuring loop's minimum load must be at least 250 Ω.
- CURRENT SPAN function → "4-20 mA".

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".

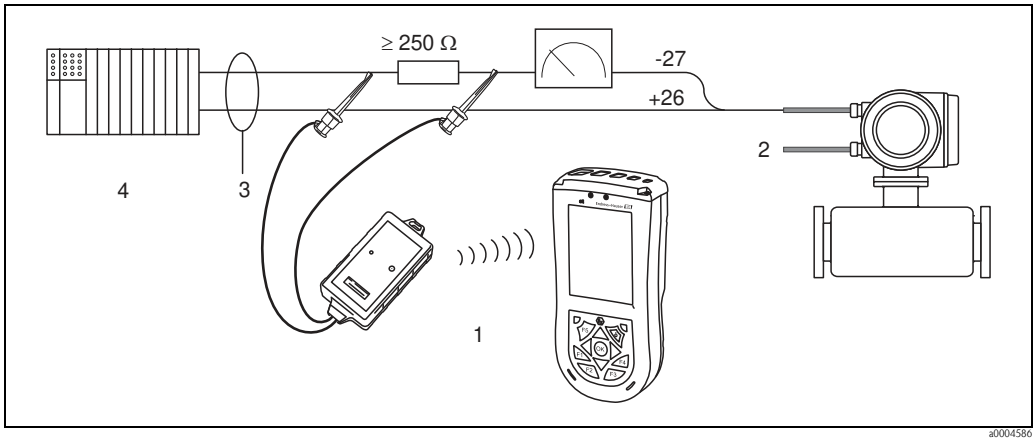


Fig. 31: Electrical connection of the HART handheld terminal Field Xpert SFX100

1 HART handheld terminal Field Xpert SFX100
2 Power supply
3 Shield
4 Other evaluation 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.

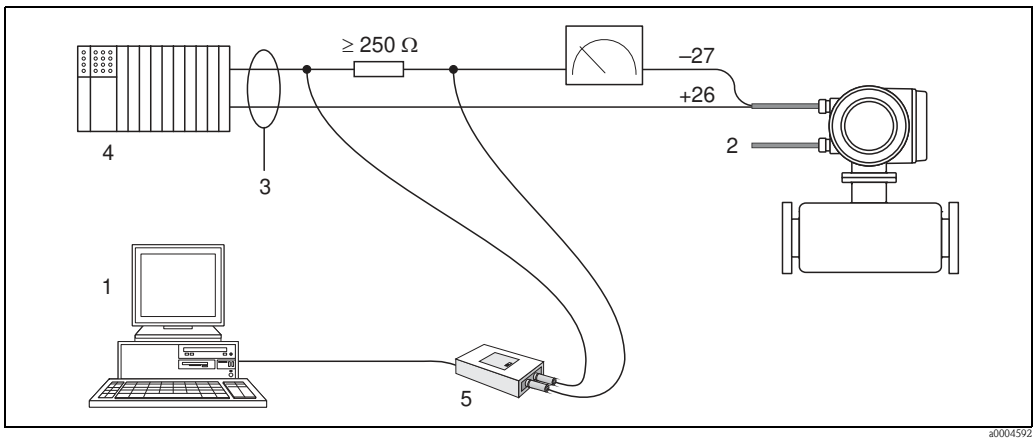


Fig. 32: Electrical connection of a PC with operating software

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.

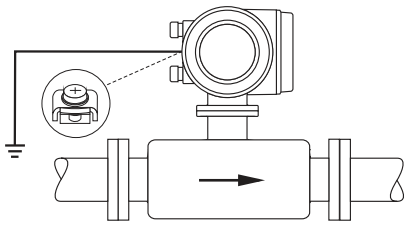
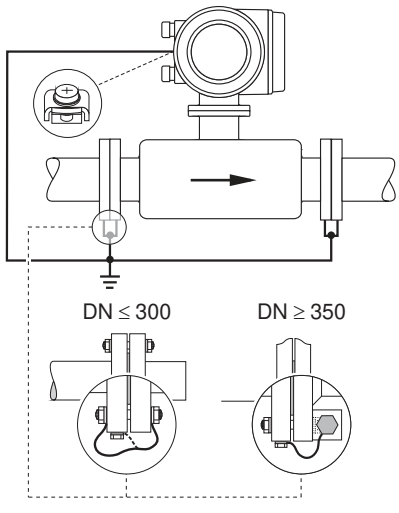
Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

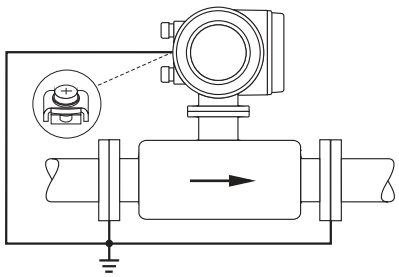
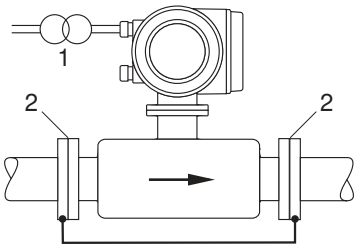
The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes (see Table)

4.3.1 Potential equalization for Promag W, P

- Reference electrode integrated in the sensor as standard
- Exampels for connections → 37

4.3.2 Exampels for potential equalization connections for Promag W, P

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. 33: Via the ground terminal of the transmitter*
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) 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: The ground cable is mounted directly on the conductive flange coating with the flange screws. ■ DN ≥ 350: 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. 34: Via the ground terminal of the transmitter and the flanges of the pipe (ground cable: copper wire at least 6 mm²/0.0093 in²).*

Operating conditions	Potential equalization
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 by means of the additional ground disks. Accessories ground discs → 62	 A0011895 *Fig. 35: Via the ground terminal of the transmitter (ground cable: copper wire at least 6 mm²/0.0093 in²).*
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). 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. 36: Potential equalization and cathodic protection (ground cable: copper wire at least 6 mm²/0.0093 in²)* *1 Power supply isolation transformer* *2 Electrically isolated*

4.4 Degree of protection

The devices fulfill all the requirements for IP 67.

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 → 32.
- 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.

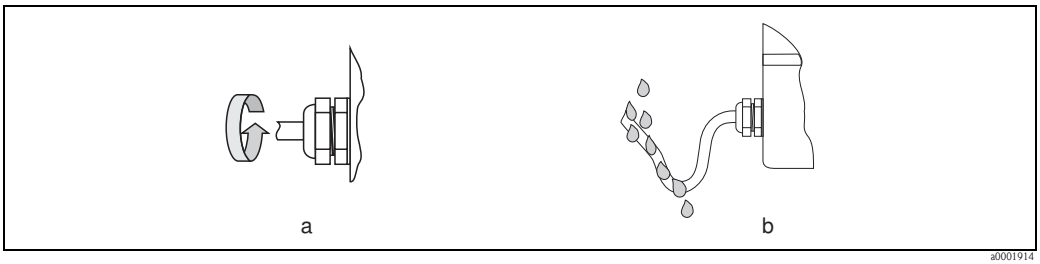


Fig. 37: Installation instructions, cable entries

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 W and Promag P sensors can be supplied with IP 68 rating (permanent immersion in water to a depth of 3 meters (10ft)). In this case the transmitter must be installed remote from the sensor.

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 comply with the specifications?	→ 📄 32
Do the cables have adequate strain relief?	-
Cables correctly segregated by type? Without loops and crossovers?	-
Are the power supply and signal 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?	→ 📄 29
Are all screw terminals firmly tightened?	-
Have the measures for grounding/potential equalization been correctly implemented?	→ 📄 37
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as "water traps"?	→ 📄 39
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).

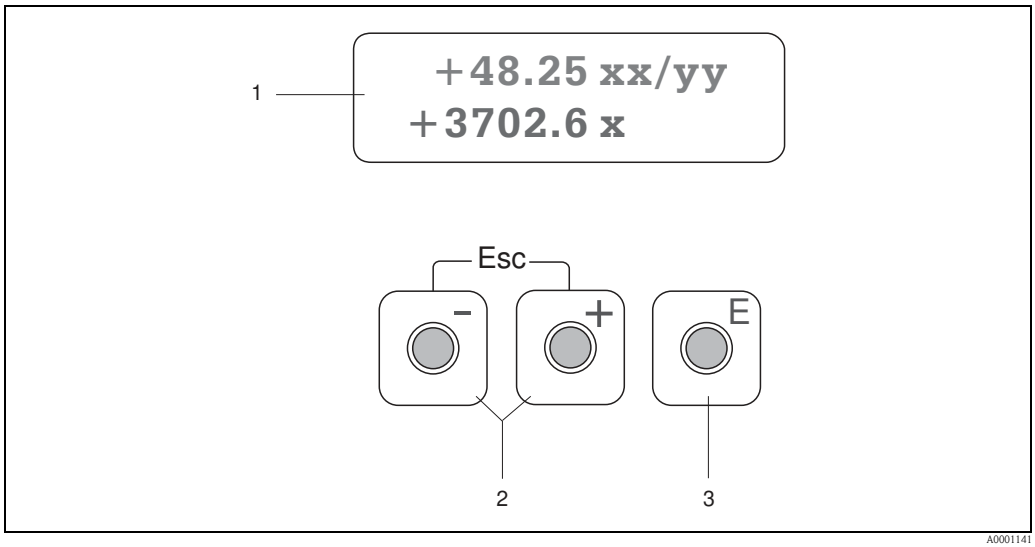


Fig. 38: Display and operating elements

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 guide to the function matrix

Note!
- See the general notes on → 43.
- Detailed descriptions of all the functions → "Description of Device Functions" manual

The function matrix consists of two levels: the function groups and their associated functions. The groups are the highest-level grouping of the control options for the measuring 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 measuring 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

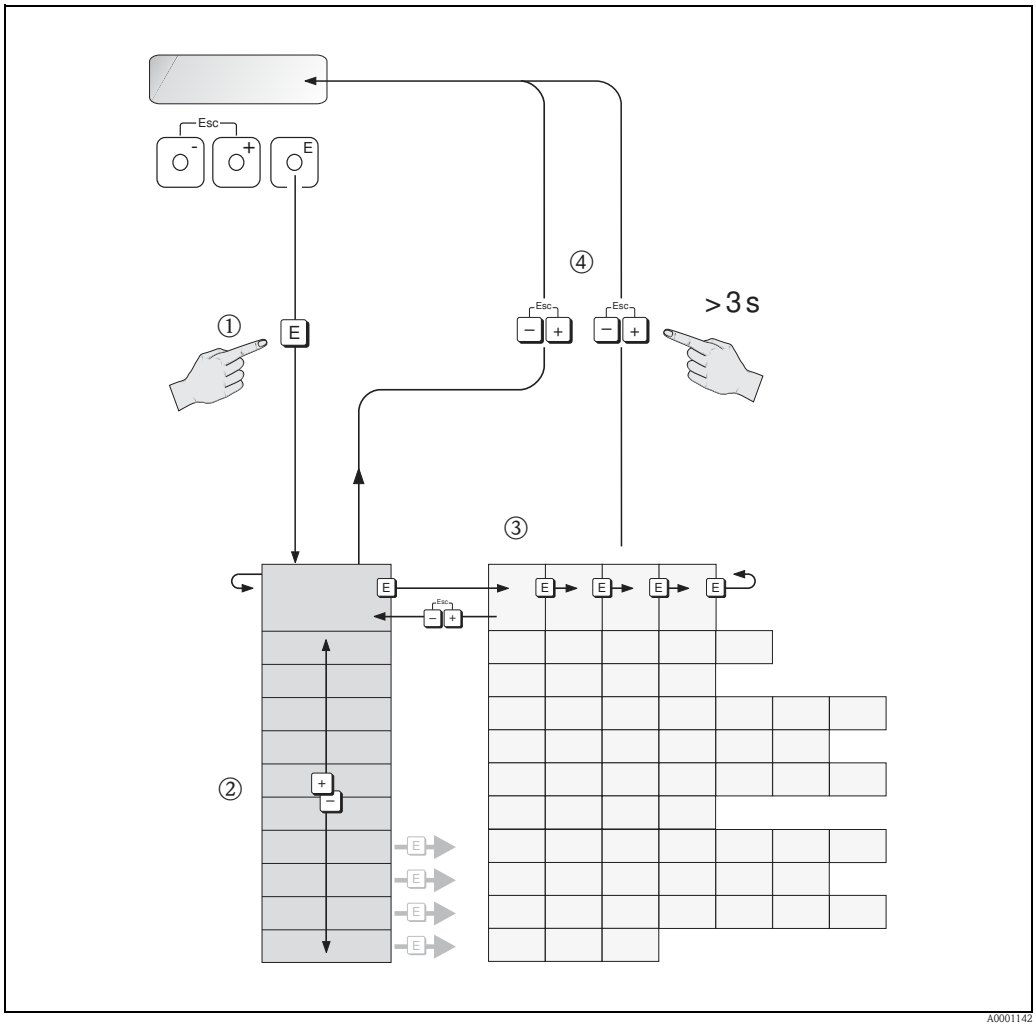


Fig. 39: Selecting functions and configuring parameters (function matrix)

General notes

The Quick Setup menu (→ 53) 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 → 53.
- 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 parameterized 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.

5.3 Displaying error messages

5.3.1 Type of error

Errors that occur during commissioning or measuring 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* → 66*:*
  This group comprises all device errors, e.g. communication errors, hardware faults, etc.
- *Process errors* → 69:
  This group comprises all application errors, e.g. empty pipe, etc.

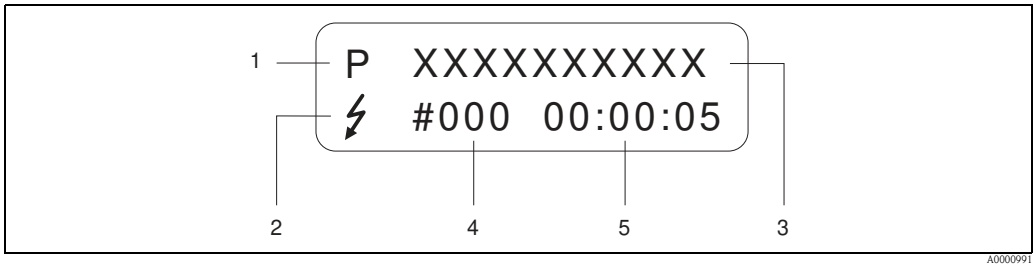


Fig. 40: Error messages on the display (example)

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 by means of the "FAILSAFE MODE" function in the function matrix (→ "Description of Device Functions" manual).

Note!
For safety 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 (→ 📄 36).

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 groups:

- *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 adjustment values, low flow cutoff settings, etc.

Note!
The device has access to all three command classes. List of all the "Universal Commands" and "Common Practice Commands": → 📄 47.

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 it can be obtained.

HART protocol:

Valid for device software:	2.03.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:	07.2010	

Operating program:	**Sources for obtaining device descriptions:**
Handheld terminal Field Xpert	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 via 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 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 and off

HART write protection can be switched on and off by means of the HART WRITE PROTECTION 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 51 – 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: % 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 51 – 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.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
16	Read the device production number Access type = read	none	Bytes 0-2: Production number
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 "volume flow" primary process variable 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! This HART command can be executed even if 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 unit 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: Code: see → 51.
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 1 ■ 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 set 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 on → 46 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)	As a response, the current number of the preambles is displayed in the response message: 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!
- For a detailed explanation of the device status and error messages and their elimination, see → 📄 51
- Nothing is assigned to bits and bytes that are not listed.

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 the amplifier board are not compatible
4	3	251	Internal communication error 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	Current buffer: The buffering of the flow components (measuring mode with pulsating flow) could not be calculated and output within 60 seconds.
6	0	340	
	1	341	
	2	342	
	3	343	Frequency buffer: The buffering of the flow components (measuring mode with pulsating flow) could not be calculated and output within 60 seconds.
	4	344	
	5	345	
	6	346	
	7	347	Pulse buffer: The buffering of the flow components (measuring mode with pulsating flow) could not be calculated and 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 adjustment not possible because the fluid's conductivity is either too low or too high.
	4	463	The EPD adjustment values for empty pipe and full pipe are identical, therefore incorrect.
12	1	474	The maximum flow value entered has been exceeded.
	7	501	Loading amplifier SW version. Currently no other commands are possible.
13	0	502	Uploading/downloading 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 Operation subject to legal metrological control/ "custody transfer measurement"

Promag 51 is a flowmeter for operation subject to legal metrological control with cold water in Europe – in accordance with Measuring Instruments Directive 2004/22/EC, Annex MI-001.
The measuring system operates within a temperature range of +0.1 to +30 °C and can be deployed, for example, in the supply of drinking water: Examples are given on → 5.
The Promag 51 "custody transfer mode" is implemented with a totalizer display for metrological control and, optionally, with the measurement-specific transmission of volume pulses via the pulse output.
To ensure correct measurement in custody transfer procedures, the piping and the measuring tube must always be filled with liquid.
Also comply with country-specific regulations when constructing a measuring system.

6.1.1 Subsequent verification

The Measuring Instruments Directive regulates the placing on the market and putting into use of measuring devices subject to legal metrological control.
The measuring equipment user/operator of an Promag 51 measuring system for legal metrological control is required to apply for subsequent verification in accordance with national regulations.
The date for subsequent verification (year number) can be given on a special sticker.

6.1.2 Setting-up custody transfer mode

The devices are locked and lead-sealed when delivered to the customer.
In the case of the remote device version, the connection between the transmitter and sensor might have to be subsequently lead-sealed on site by an authorized Endress and Hauser service technician or by the measuring equipment owner/operator.

Proceed as follows if the device is operational and not in custody transfer mode:

1. Break the lead seal and loosen the sealing screws (→ 41, A).
2. Open the electronics compartment cover of the transmitter.
3. Configure the functions important for custody transfer measurement (e.g. "PULSE CT APPROV").

   Note!
   A detailed description of the functions is provided in the separate "Description of Device Functions" manual BA081D/06/…
4. The device is locked by entering the custody transfer code "5100" in the function OPERATION → ACCESS CODE (see also "Description of Device Functions" manual BA081D/06/…). Once the device is locked, all the functions for recording, processing and displaying measuring values are protected against change. These functions are indicated by a keyhole symbol (🔒) in the separate device functions manual.
5. Screw on the cover of the electronics compartment.
6. Lead-seal the device → 41.
7. The device is in custody transfer mode. The flow measurement values can now be used in commercial transactions.

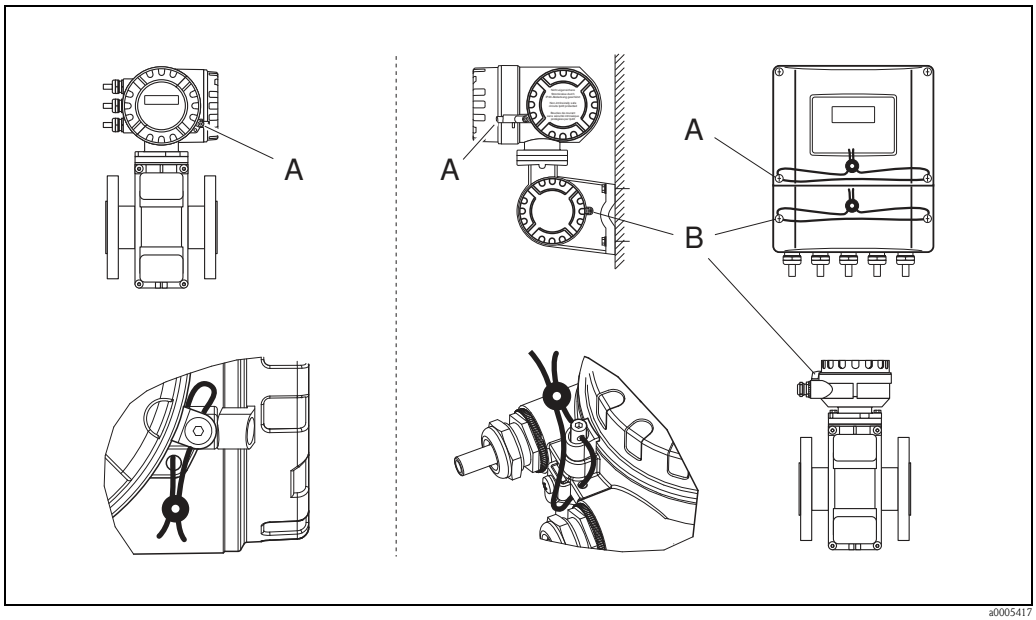


Fig. 41: Examples of how to lead-seal the various device versions.

6.1.3 Deactivating custody transfer mode

Precondition: The device is operational and is already set to custody transfer mode.

1. Switch off the power supply (disconnect from the operating voltage).
2. Break the lead seal and loosen the sealing screws (→ 41, A).

Warning!
In the case of explosion-protected equipment, observe a cooling or discharge time of 10 minutes before opening the device.

3. Open the electronics compartment cover of the transmitter.
   For a detailed description of the procedure for compact/wall-mount version, see → 74.
4. Remove the S-DAT.
5. Reconnect the device to the power supply.
6. The device runs through the startup cycle.
   After startup, the error message "#031 SENSOR HW-DAT" is displayed.

   Note!
   This error message appears because the S-DAT has been removed.
   This does not have any effect on the subsequent steps.
7. Disconnect the device from the power supply again.
8. Reinsert the S-DAT.
9. Screw the electronics compartment cover back on tightly.
10. Reconnect the device to the power supply.
11. The device runs through the startup cycle.
    During startup, the message "CUSTODY TRANSFER NO" appears on the display.
12. The device is now operational and is not in custody transfer mode.

Note!
To set the device back to the custody transfer mode: → 53, Setting-up custody transfer mode.

6.1.4 Special features of operation subject to metrological control/ custody transfer measurement

Measuring devices subject to legal metrological control differ from standard devices as follows:
- Once the device has been placed on the market/put into operation or lead-sealed, it can no longer be operated using the local display.
- Flowmeters for legal metrological control totalize bidirectional flow, i.e. all outputs consider flow shares in positive (forward) and negative (backward) flow direction.

6.1.5 Definitions

Cold water

Fluid temperature between +0.1 °C and +30 °C

Flow ranges

Overload flowrate Q_4:
Highest flowrate at which a water is required to operate, for a short period of time, within its maximum permissible error, without deteriorating.

Permanent flowrate Q_3:
Highest flowrate within the rated operating conditions, at which the water meter is required to operate in satisfactory manner within the maximum permissible error.

Transitional flowrate Q_2:
Flowrate which occurs between the permanent flowrate Q_3, and the minimum flowrate Q1, that divides the flowrate range into two zones, the upper flowrate zone and lower flowrate zone, each characterized by its own maximum permissible error (→ 42).

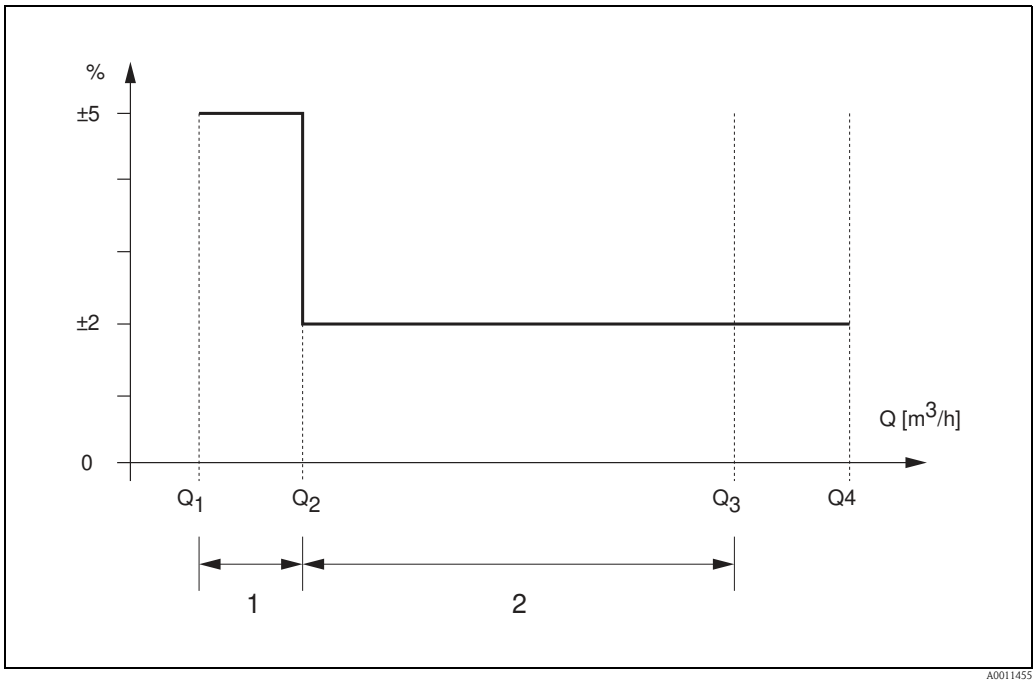


Fig. 42: Flow ranges and error limits for cold water

1 = Lower range (error limit: ±5%)

2 = Upper range (error limit: ±2%)

Minimum flowrate Q_1:
Lowest flowrate at which the water meter is required to operate within the maximum permissible error.

6.2 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist for "Post-installation check" → 28
- Checklist for "Post-connection check" → 40

6.3 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:

PROMAG 51 **START UP . .**	Start-up message
▼	
DEVICE SOFTWARE **V XX.XX.XX**	Current software version (example)
▼	
CUSTODY TRANSFER **NO / YES**	Status display of the custody transfer mode YES = in custody transfer mode, NO = not in custody transfer mode
▼	
SYSTEM OK → OPERATION	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.
- If a device is in the custody transfer mode, the error message "POWER BRK. DWN" appears on the display each time the power supply is applied. This error message has to be reset and acknowledged via the status input. Each time an error is reset, a display test is triggered.

6.4 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 device parameters and additional function which are important for standard operation can be configured quickly and easily by means of the following Quick Setup menu.

6.4.1 "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.

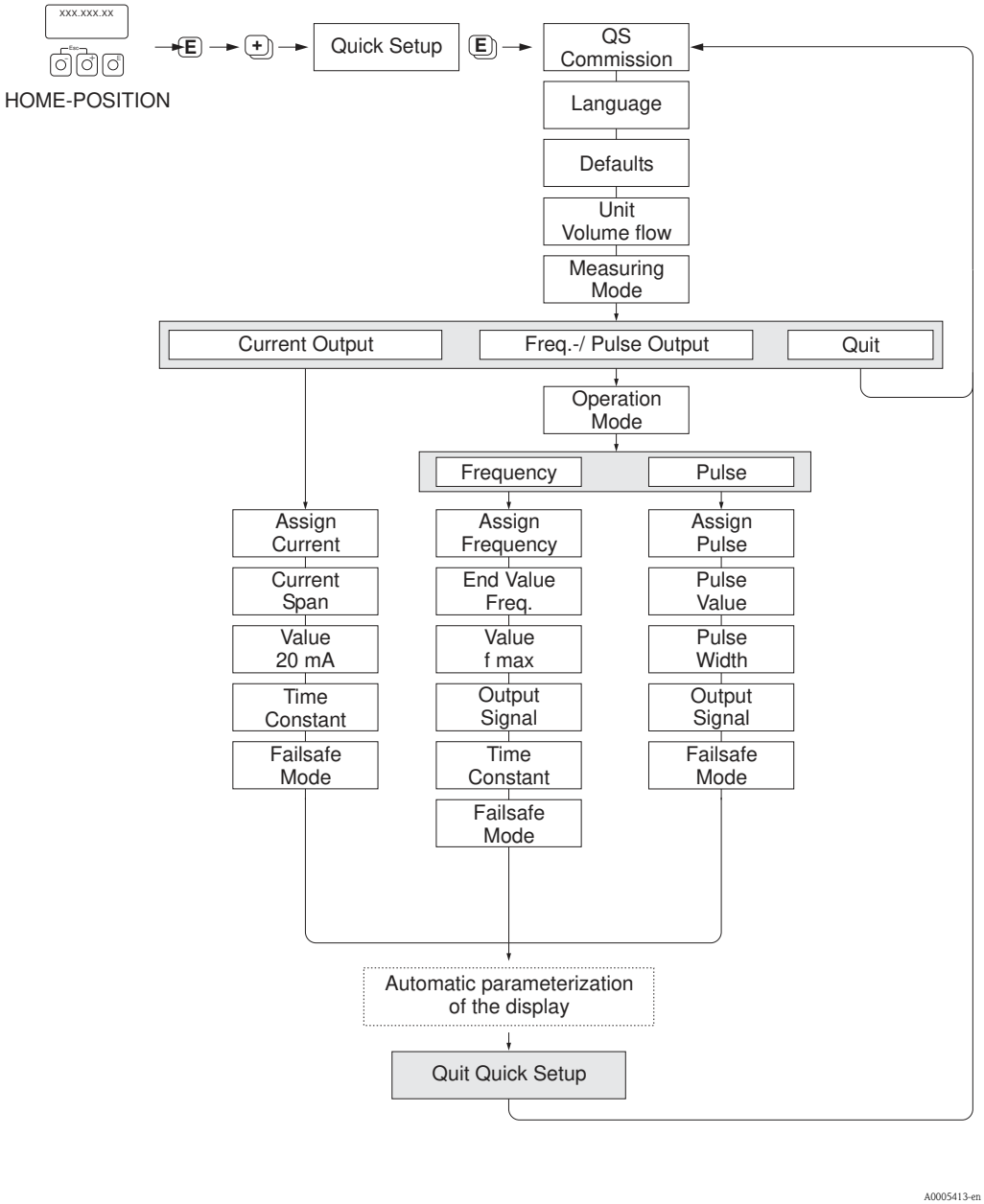


Fig. 43: "QUICK SETUP COMMISSIONING" menu for the rapid configuration of important device functions

6.5 Configuration

6.5.1 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 → 74.
3. Position the jumpers → 44.

   ☝ Caution!
   Risk of destroying the measuring device. Set the jumpers exactly as shown in the graphic. Incorrectly set jumpers can cause overcurrents that would destroy either the measuring device or external devices connected to it.
4. Installation of the I/O board is the reverse of the removal procedure.

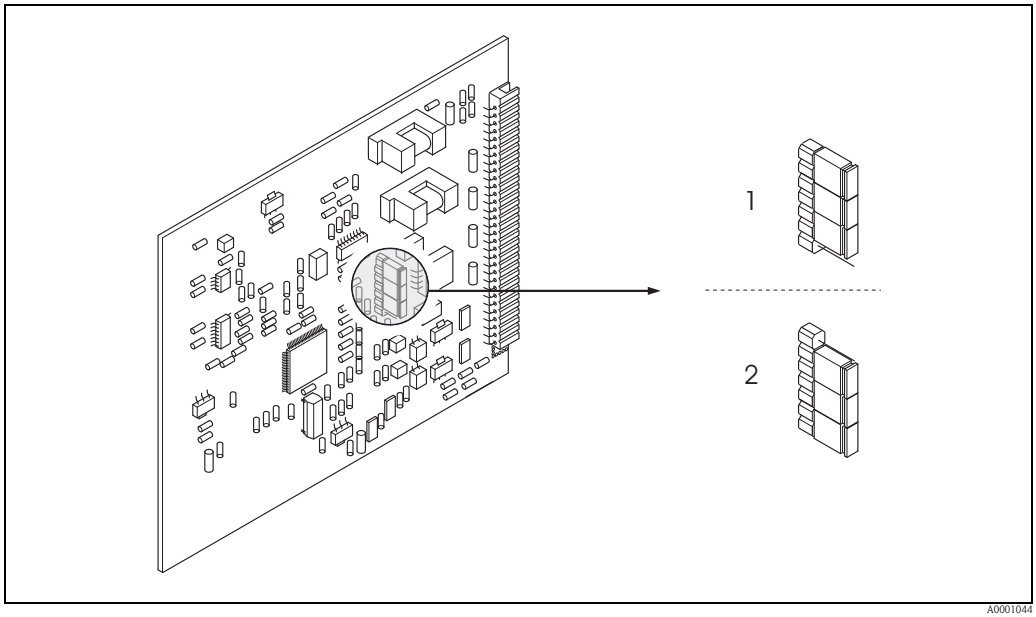


Fig. 44: Configuring the current outputs with the jumpers (I/O board)

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

6.6 Adjustment

6.6.1 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!
Other helpful hints for the empty-pipe/full-pipe adjustment procedure can be found in the separate "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:
   – In the case of EPD empty pipe adjustment, the wall of the measuring tube should still be wetted with fluid for the adjustment procedure
   – In the case of OED empty pipe adjustment, the wall of the measuring tube/measuring electrodes should **no** longer be wetted with fluid
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.

6.7 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. By plugging these modules into other slots, device configurations can be duplicated onto other measuring devices to cite just one example.

6.7.1 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.

8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. The Endress+Hauser service organization can provide detailed information on the order codes of your choice.

8.1 Measuring principle-specific accessories

Accessory	Description	Ordering 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 - *
Cable for remote version	Coil and signal cables, various lengths.	DK5CA - **
Ground cable for Promag W/P	Ground cable for potential equalization.	DK5GC - ***
Ground disk for Promag W, P	Ground disk for potential equalization.	DK5GD – * * ***
Process display RIA250	Multifunctional 1-channel display unit: ■ Universal input ■ Transmitter power supply ■ Limit relay ■ Analog output	RIA250 - ******
Process display RIA251	Digital display unit for looping into 4 to 20 mA current loop.	RIA251 - **
Field display unit RIA261	Digital field display unit for looping into 4 to 20 mA current loop.	RIA261 - ***
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 - **********
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 - **********

8.2 Communication-specific accessories

Accessory	Description	Order code
Field Xpert HART handheld terminal	Handheld terminal for remote parameterization and for fetching measured values via the current output HART (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 the Web browser and/or WAP cellular phone ■ Limit value monitoring with alarm signaling via 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 the Web browser and/or WAP cellular phone ■ Limit value monitoring with alarm signaling via 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 – *

8.3 Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and configuring flowmeters. Applicator 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 and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all the intelligent field devices in your plant and helps you manage them. By using the 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
FXA193	Service interface from the measuring device to the PC for operation via FieldCare.	FXA193 – *

9 Troubleshooting

Caution!
- In custody transfer mode, error messages must be reset or confirmed manually. Error messages are reset via the status input by applying a pulse.
- For certified devices subject to legal metrological control, faults can only be corrected by breaking the seal. After repair by an Endress+Hauser service technician (provisional seal), the device must be resealed by the appropriate standards authority.
- In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. The procedures on Page 8 must be carried out before you return a flowmeter to Endress+Hauser. Always enclose a duly completed "Declaration of Contamination" form → 📄 96. You will find a preprinted blank of the form at the back of this manual.

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.

Check the display	
No display visible and no output signals present.	1. Check the power supply → terminals 1, 2 2. Check the device fuse → 📄 78 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→ 📄 62 **Custody transfer mode**: To eliminate fault, lead seal must be broken!
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 → 📄 74 2. Display module defective → order spare parts → 📄 62 3. Measuring electronics defective → order spare parts→ 📄 62 **Custody transfer mode**: To eliminate fault, lead seal must be broken!
Display texts are in a foreign language.	**Custody transfer mode / Non-custody transfer mode:** You can alter the language settings via the HART interface or the FieldCare operating software, regardless of the custody transfer setting. **Non-custody transfer mode:** Switch off power supply. Press and hold down both the ⊞ buttons and switch one 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 → 📄 62 **Custody transfer mode**: To eliminate fault, lead seal must be broken!

↓

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** = Error designation (e.g. measuring tube is only partly filled) – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – **# 401** = error number ☝ Caution! ■ Also observe the information on → 📄 44! ■ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.

↓

Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → 📄 70

9.2 System error messages

Serious system errors are **always** recognized by the device as "Fault messages", and are indicated by a lightning symbol (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 procedures on → 📄 6 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 preprinted blank of the form at the back of this manual.

Note!
Also observe the information on → 📄 44.

No.	Error message / Type	Cause	Remedy (spare parts → 📄 73ff)
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 ϟ: # 001	Serious device error	Replace the amplifier board. **Custody transfer mode** To eliminate fault, lead seal must be broken!
011	S: AMP HW EEPROM ϟ: # 011	Amplifier: Defective EEPROM	Replace the amplifier board. **Custody transfer mode** To eliminate fault, lead seal must be broken!
012	S: AMP SW EEPROM ϟ: # 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. **Custody transfer mode** To eliminate fault, lead seal must be broken! Note! The device has to be restarted if an error occurs in the totalizer block (see also error no. 111 / CHECKSUM TOTAL.).
031	S: SENSOR HW DAT ϟ: # 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. **Custody transfer mode** To eliminate fault, lead seal must be broken!
032	S: SENSOR SW DAT ϟ: # 032		

No.	Error message / Type	Cause	Remedy (spare parts → 🖹 73ff)
No. # 1xx → Software error			
101	S: GAIN ERROR AMP. ϟ: # 101	Gain deviation compared to reference gain > 25%.	Replace the amplifier board. **Custody transfer mode** To eliminate fault, lead seal must be broken!
111	S: CHECKSUM TOTAL ϟ: # 111	Totalizer checksum error.	1. Restart the measuring device. 2. Replace the amplifier board if necessary. **Custody transfer mode** To eliminate fault (point 2), lead seal must be broken!
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 appears 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. **Custody transfer mode** To eliminate fault, lead seal must be broken!
No. # 2xx → Error in DAT / no communication			
251	S: COMMUNICATION I/O ϟ: # 251	Internal communication error on the amplifier board.	Replace the amplifier board. **Custody transfer mode** To eliminate fault, lead seal must be broken!
261	S: COMMUNICATION I/O ϟ: # 261	No data reception between amplifier and I/O board or faulty internal data transfer.	Check the BUS contacts. **Custody transfer mode** To eliminate fault, lead seal must be broken!
271	S: POWER BRK. DWN ϟ: # 271	Amplifier: Power supply is interrupted. ✎ Note! This error message is only displayed or output in custody transfer mode.	**Custody transfer mode** Reset error message via the status input (auxiliary input).
No. # 3xx → System limits exceeded			
321	S: TOL. COIL CURR. ϟ: # 321	Sensor: Coil current is out of tolerance.	Check the following electrical connections before you contact your E+H service organization: 1. Remote version: ☝ Caution! Switch off the power supply before connecting or disconnecting the cable of the coil current (terminals 41/42). Check the wiring of the terminals 41 and 42 → 🖹 33 2. Switch off the power supply and check the connectors of the coil current cable. **Custody transfer mode** To eliminate fault, lead seal must be broken!
351 … 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. **Custody transfer mode** Change the upper or lower limit setting via the HART interface or by means of the FieldCare operating software.
355 … 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. **Custody transfer mode** Change the upper or lower limit setting via the HART interface or by means of the FieldCare operating software.

No.	Error message / Type	Cause	Remedy (spare parts → 🖹 73ff)
359 … 362	S: PULSE RANGE !: # 359 to 362	Pulse output: 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. **Custody transfer mode** If the pulse output is not suitable for custody transfer mode, the pulse value can be altered via the HART interface or the FieldCare operating software. The pulse width can be altered independently of the operation.
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. **Custody transfer mode** During operation, no software version can be loaded.
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. **Custody transfer mode** Checking via a test device is not possible.
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. **Custody transfer mode** In custody transfer mode, positive zero return cannot be activated.
611 … 614	S: SIM. CURR. OUT n !: # 611 to 614	Simulation current output active	Switch off simulation. **Custody transfer mode** Simulation not possible
621 … 624	S: SIM. FREQ. OUT n !: # 621 to 624	Simulation frequency output active	Switch off simulation. **Custody transfer mode** Simulation not possible
631 … 634	S: SIM. PULSE n !: # 631 to 634	Simulation pulse output active	Switch off simulation. **Custody transfer mode** Simulation not possible
641 … 644	S: SIM. STAT. OUT n !: # 641 to 644	Simulation status output active	Switch off simulation. **Custody transfer mode** Simulation not possible
671 … 674	S: SIM. STATUS IN n !: # 671 to 674	Simulation status input active	Switch off simulation. **Custody transfer mode** Simulation not possible
691	S: SIM. FAILSAFE !: # 691	Simulation of response to error (outputs) active	Switch off simulation. **Custody transfer mode** Simulation not possible

No.	Error message / Type	Cause	Remedy (spare parts → 🖹 73ff)
692	S: SIM. MEASURAND !: # 692	Simulation of a measured variable active (e.g. mass flow).	Switch off simulation. **Custody transfer mode** Simulation not possible
698	S: DEV. TEST ACT. !: # 698	The measuring device is being tested on site via the test and simulation device.	**Custody transfer mode** Checking via a test device is not possible.

9.3 Process error messages



Note!
Also observe the information on → 🖹 44.

No.	Error message / Type	Cause	Remedy (spare parts → 🖹 73ff)
P = Process error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
401	P: EMPTY PIPE ϟ: # 401	Measuring tube partially filled or empty	1. Check the process conditions of the plant. 2. Fill the measuring tube. **Custody transfer mode** Reset error message via the status input or via the "reset key".
461	P: ADJ. NOT OK !: # 461	EPD adjustment 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 ϟ: # 463	The EPD adjustment values for empty pipe and full pipe are identical, therefore incorrect.	Repeat adjustment, making sure procedure is correct → 🖹 59. **Custody transfer mode** In custody transfer mode, an EPD/OED adjustment is not possible.

9.4 Process errors without messages

Symptoms	Rectification
Remarks: You may have to change or correct certain settings in functions in the function matrix in order to rectify the fault. ✎ Note! For certified devices subject to legal metrological control, faults can only be corrected by breaking the lead seal or protection sticker. Contact your Endress+Hauser representative to repair the device.	
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 → 🖹 29 – 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 → 🖹 37. 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 → 🖹 37. 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. (Not possible in **custody transfer mode**)
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 → 🖹 59. 2. Remote version: Check the terminals of the EPD cable → 🖹 29. 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. (Not possible in **custody transfer mode**)
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 (→ 🖹 7): order code, serial number **Returning devices to Endress+Hauser** The necessary procedures must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser (→ 🖹 6). Always enclose a duly completed "Declaration of Conformity" form with the flowmeter. You will find a preprinted form at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective → order spare parts → 🖹 62.

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 activated
Caution! System or process errors that have been defined as "notice messages" have no effect on the inputs and outputs. Please refer to the information on → 📄 44.		
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 *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* [1)] Signal output → no pulses *ACTUAL VALUE* Fault is ignored, i.e. normal measured value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"
Frequency output	*FALLBACK VALUE* Signal output → 0 Hz *FAILSAFE LEVEL* Output of the frequency specified in the FAILSAFE 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"

Failsafe mode of outputs and totalizers		
	Process/system error is current	Positive zero return activated
Totalizer	*STOP* [1] The totalizers are paused until the error is rectified. *ACTUAL VALUE* The fault is ignored. The totalizers continue to count in accordance with the current flow value. *HOLD VALUE* The totalizers continue 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

[1] fixed setting in **custody transfer mode**

9.6 Spare parts

A detailed troubleshooting guide is provided in the previous sections → 64ff.
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 (→ 7).

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

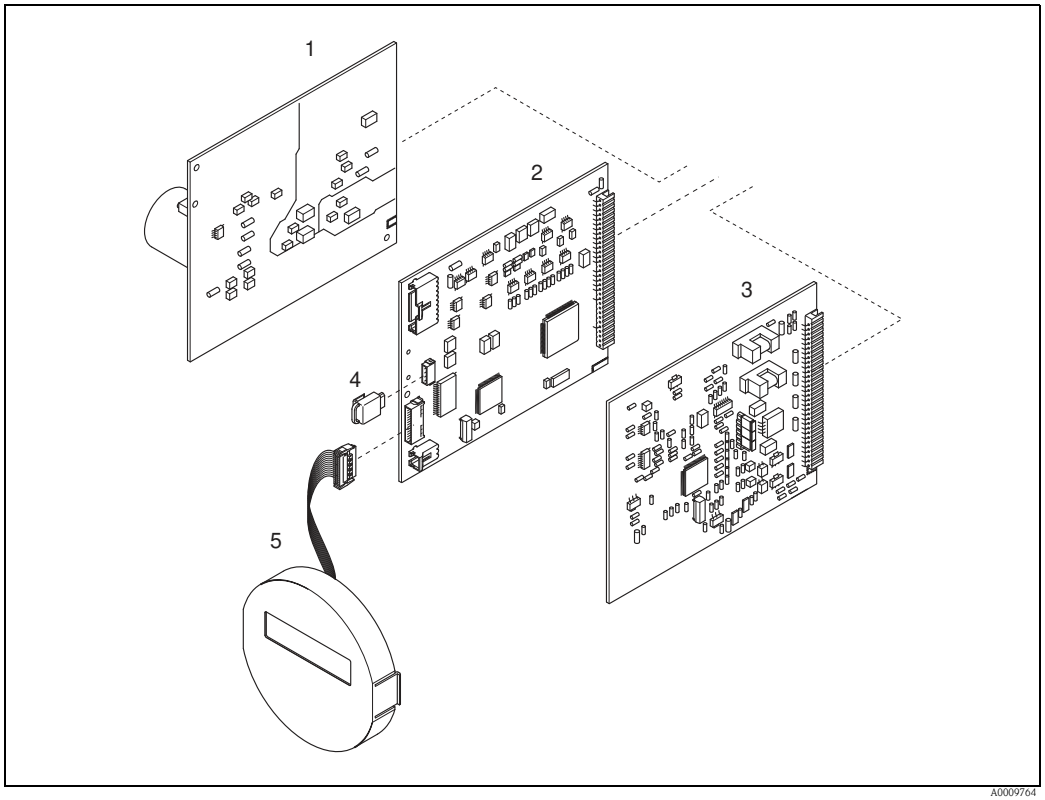


Fig. 45: Spare parts for Promag 51 transmitter (field and wall-mounted housings)

1 Power supply 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 → 46

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 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 signal 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 holes (3) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.

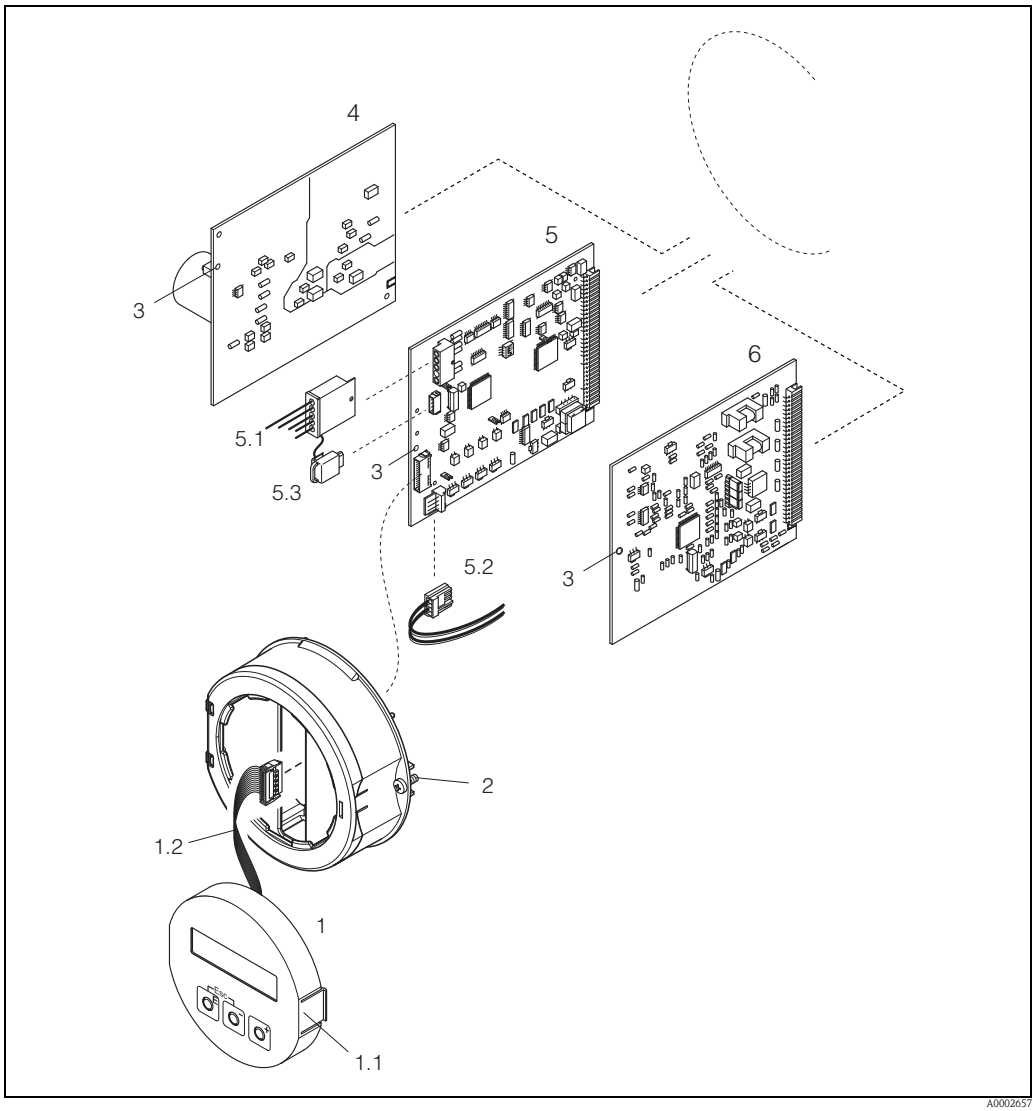


Fig. 46: Field housing: removing and installing printed circuit boards

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

Wall-mounted housing: removing and installing printed circuit boards → 47

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 signal 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.

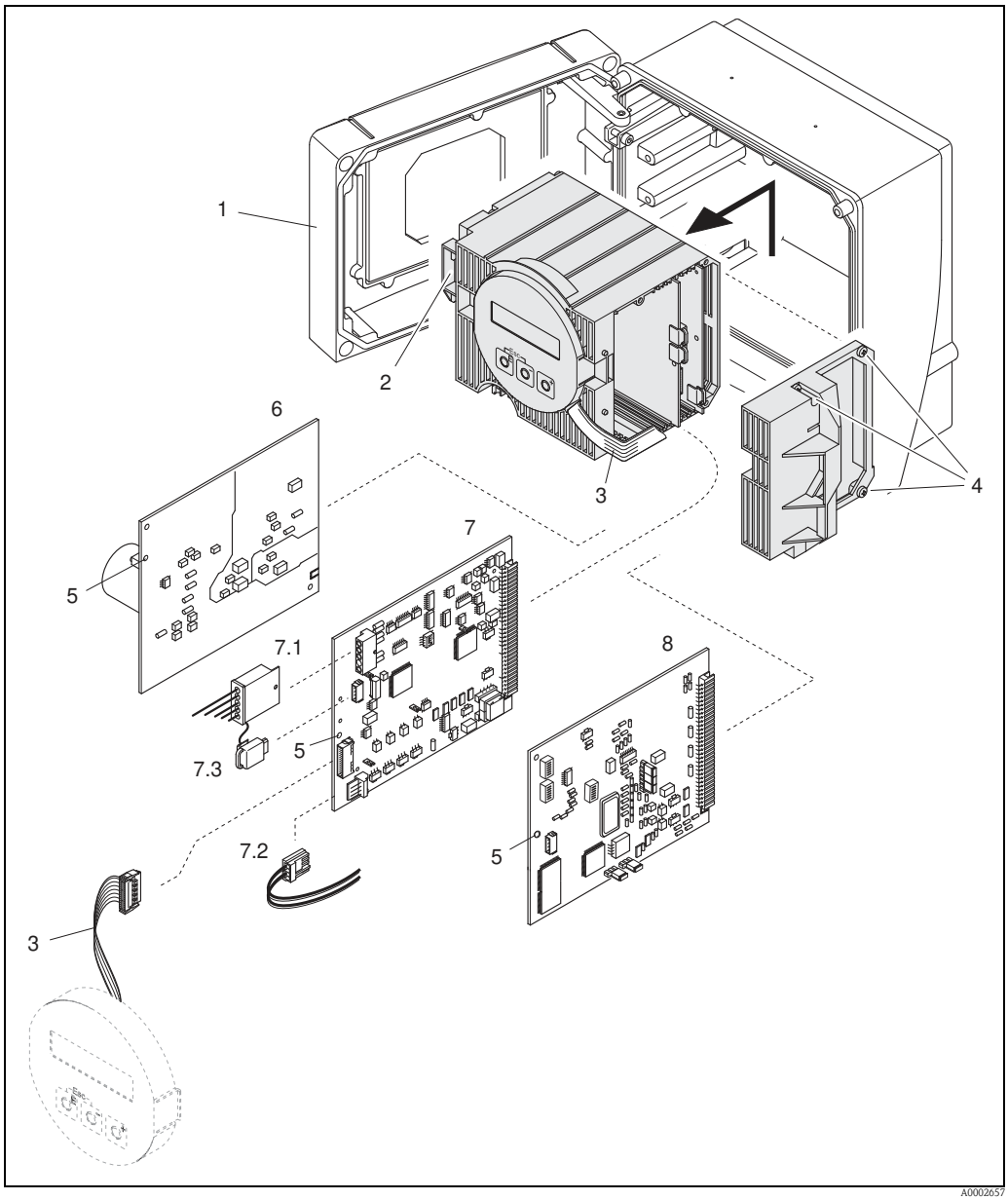


Fig. 47: Wall-mounted housing: removing and installing printed circuit boards

1 Housing cover
2 Electronics module
3 Ribbon cable (display module)
4 Cover of electronics compartment (3 screws)
5 Aperture for tool, removal/installation
6 Power supply board
7 Amplifier board
7.1 Electrode signal 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 → 48.
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power supply board: field housing → 74, wall-mount housing → 76.
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.

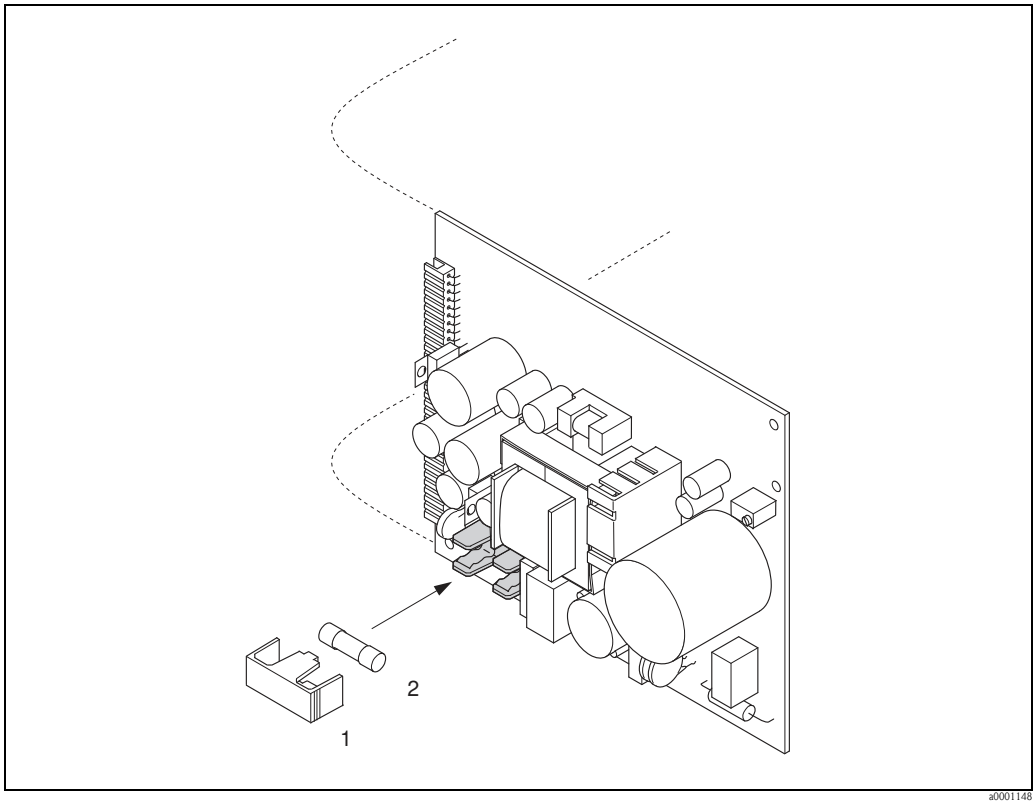


Fig. 48: Replacing the device fuse on the power supply board

1 Protective cap
2 Device fuse

9.7 Return

Caution!
Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

The following steps must be taken before returning a flow measuring device to Endress+Hauser, e.g. for repair or calibration:
- Always enclose a duly completed "Declaration of contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EC REACH Regulation No. 1907/2006.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

Note!
You will find a preprinted "Declaration of contamination" form at the back of these Operating Instructions.

9.8 Disposal

Comply with the regulations that apply in your country.

9.9 Software history

Date	Software version	Changes to software	Operating Instructions
07.2010	Amplifier: V 2.03.XX	Introduction of Promag W Pressure rating PN6	71111278 / 03.10
06.2009	Amplifier: V 2.02.XX	…	71095352 /06.09

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

10 Technical data

10.1 Technical data at a glance

10.1.1 Application

→ 📄 5

10.1.2 Function and system design

Measuring principle	Electromagnetic flow measurement on the basis of Faraday's Law.
Measuring system	→ 📄 7

10.1.3 Input

Measured variable	Flow rate (proportional to induced voltage)
Measuring range	Typically v = 0.01 to 10 m/s (0.033 to 33 ft/s) with the specified measuring accuracy
Operable flow range	Not in custody transfer mode: 1000 : 1 In custody transfer mode up to 160 : 1 (corresponding to 0.04 to 10 m/s)
Input signal	*Status input (auxiliary input)* ■ Galvanically isolated ■ U = 3 to 30 V DC ■ Ri = 5 kΩ ■ Configurable for: totalizer reset, positive zero return, error message reset In the custody transfer mode, error messages can only be reset and a display test function activated via the status input!

10.1.4 Output

Output signal

Current output

- Galvanically isolated
- Active/passive selectable:
  - Active: 0/4 to 20 mA, R_L <700 Ω (for 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 selectable (0.01 to 100 s)
- Full scale value adjustable
- Temperature coefficient: typically 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 selectable, max. pulse width configurable (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 selectable (for example, according to NAMUR Recommendation NE 43) → 📄 71.

Pulse/frequency output

Fallback value (only with certified pulse output)

Status output

"Non-conductive" in the event of a fault or power supply failure; switching response selectable → 📄 71

Note!
In custody transfer mode, error messages can be reset via the status input once the fault has been cleared.
Resetting error messages → 📄 64.

Load

See "Output signal"

Switch output

Status output

- Galvanically isolated
- Max. 30 V DC / 250 mA
- Open collector
- Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values

Low flow cut off

- Low flow cutoff
- Switch points permanently set (On at 0.02 m/s; Off at 0.04 m/s)

Galvanic isolation

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

10.1.5 Power supply

Electrical connections	→ 📄 29 ff.
Supply voltage (power supply)	■ 85 to 260 V AC, 45 to 65 Hz ■ 20 to 55 V AC, 45 to 65 Hz ■ 16 to 62 V DC
Cable entry	*Power supply and signal cables (inputs/outputs):* ■ Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47 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) ■ Threads for cable entries, ½" NPT, G ½"
Cable specifications	→ 📄 32
Power consumption	*Power consumption* ■ AC: <15 VA (including sensor) ■ DC: <15 W (including sensor) *Switch-on current* ■ Max 3 A (<5 ms) at 24 V DC ■ Max. 8.5 A (< 5 ms) at 260 V AC
Power supply failure	■ Lasting min. 1 power cycle ■ 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	→ 📄 37

10.1.6 Operating conditions: rated operating conditions

All specifications in accordance with MID, Annex I and Annex MI-001

Dimensions and flow range	→ 18
Accuracy class	The following error limits apply ± 2 % (for flow rates: $Q_2 \leq Q < Q_4$) ± 5 % (for flow rates: $Q_1 \leq Q < Q_2$)
Medium temperature range	Cold water +0.1 to +30 °C
Limiting medium pressure range (nominal pressure)	*Promag W* ■ EN 1092-1 (DIN 2501) – PN 6 (DN 350 to 800) – PN 10 (DN 200 to 800) – PN 16 (DN 65 to 800) – PN 25 (DN 200 to 800) – PN 40 (DN 25 to 150) *Promag P* ■ EN 1092-1 (DIN 2501) – PN 10 (DN 200 to 600) – PN 16 (DN 65 to 600) – PN 25 (DN 200 to 600) – PN 40 (DN 15 to 150)
Orientation	Any orientation (vertical, horizontal) Restrictions and additional installation instructions → 20
Mechanical ambient conditions	Class: M2
Climatic ambient conditions	–40 to +55 °C (–40 to +131 °F); condensation possible Note! At ambient temperatures below –20 (–4 °F) the readability of the display may be impaired. Sensor: ■ Carbon steel flange material: –10 to +60 °C (+14 to +140 °F) ■ Stainless steel flange material: –40 to +60 °C (–40 to +140 °F) Caution! The permitted temperature range for the liner may not be exceeded or undershot (→ "Medium temperature range"). Note the following points: ■ Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions. ■ If both fluid and ambient temperatures are high, install the transmitter at a remote location from the sensor.
Electromagnetic ambient conditions	Class: E2

10.1.7 Operating conditions: other operating conditions

Measured variable	Volume
Fluid conductivity	Cold water with a minimum conductivity of 5 µS/cm. (with demineralized water 20 µS/cm) Note that in the case of the remote version, the requisite conductivity is influenced by the length of the connecting cable → 🖹 19.
Inlet run	At least 5 × DN straight pipe section upstream from the measuring equipment
Outlet run	At least 2 × DN straight pipe section upstream from the measuring equipment
Rectifier	Not required
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. ■ Choose a storage location where moisture does not collect in the measuring device. This will help prevent fungus or bacteria infestation which can damage the liner.
Degree of protection	■ Standard: IP 67 (NEMA 4X) for transmitter and sensor ■ Optional: IP 68 (NEMA 6P) for remote version of Promag W and P sensor
Shock and vibration resistance	Acceleration up to 2 g by analogy with IEC 60068-2-6 (high-temperature version: no data available)
Electromagnetic compatibility (EMC)	■ To IEC/EN 61326 and NAMUR recommendation NE 21. ■ Emission: As per industry limit values, EN 55011

10.1.8 Operating conditions: process

Pressure tightness

Promag W

Nominal diameter [mm]	Nominal diameter [inch]	measuring tube lining	Resistance of measuring tube lining to partial vacuum: Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures of 25 °C (77 °F)
25 to 800	1" to 40"	Polyurethane	0
50 to 800	2" to 78"	Hard rubber	0

Promag P

Nominal diameter		Resistance of measuring tube lining to partial vacuum: Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures of 25 °C (77 °F)			
		PTFE		PFA	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]
15	½"	0	0	0	0
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	0	0
80	3"	0	0	0	0
100	4"	0	0	0	0
125	–	135	1.96	0	0
150	6"	135	1.96	0	0
200	8"	200	2.90	0	0
250	10"	330	4.79		
300	12"	400	5.80		
350	14"	470	6.82		
400	16"	540	7.83		
450	18"	Partial vacuum is impermissible			
500	20"				
600	24"				

Limiting flow

→ 18

Pressure loss

- No pressure loss if the sensor is installed in a pipe of the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (see "Adapters" → 17).

10.1.9 Mechanical construction

Design / dimensions

The dimensions and lengths of the sensor and transmitter are provided in the "Technical Information" document for the device in question. This 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 → 91.

Weights

Promag W

Weight data of Promag W in kg						
Nominal diameter		**Compact version**		**Remote version (without cable)**		
					Sensor	**Transmitter**
[mm]	**[inch]**		**EN (DIN)**		**EN (DIN)**	
25	1"	PN 40	7.3	PN 40	5.3	6.0
32	1 ¼"		8.0		6.0	6.0
40	1 ½"		9.4		7.4	6.0
50	2"		10.6		8.6	6.0
65	2 ½"	PN 16	12.0	PN 16	10.0	6.0
80	3"		14.0		12.0	6.0
100	4"		16.0		14.0	6.0
125	5"		21.5		19.5	6.0
150	6"		25.5		23.5	6.0
200	8"	PN 10	45	PN 10	43	6.0
250	10"		65		63	6.0
300	12"		70		68	6.0
350	14"		115		113	6.0
400	16"		135		133	6.0
450	18"		175		173	6.0
500	20"		175		173	6.0
600	24"		235		233	6.0
700	28"		355		353	6.0
–	30"		–		–	6.0
800	32"		435		433	6.0

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

Promag P

Weight data of Promag P in kg						
Nominal diameter		Compact version		Remote version (without cable)		
					Sensor	Transmitter
[mm]	[inch]		EN (DIN)		EN (DIN)	
15	½"	PN 40	6.5	PN 40	4.5	6.0
25	1"		7.3		5.3	6.0
32	1 ¼"		8.0		6.0	6.0
40	1 ½"		9.4		7.4	6.0
50	2"		10.6		8.6	6.0
65	2 ½"	PN 16	12.0	PN 16	10.0	6.0
80	3"		14.0		12.0	6.0
100	4"		14.4		14.0	6.0
125	5"		16.0		19.5	6.0
150	6"		21.5		23.5	6.0
200	8"	PN 10	45	PN 10	43	6.0
250	10"		65		63	6.0
300	12"		70		68	6.0
350	14"		115		113	6.0
400	16"		135		133	6.0
450	18"		175		173	6.0
500	20"		175		173	6.0
600	24"		235		233	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)
* Only DN sizes 25 and 50 sizes are available for flanges as per AS.

Materials

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: powder-coated die-cast aluminum
  – DN 350 to 800: painted steel
- Measuring tube
  – DN ≤ 300: stainless steel 1.4301 or 1.4306/304L
  (for flanges made of carbon steel with Al/Zn protective coating)
  – DN ≥ 350: stainless steel 1.4301 or 1.4306/304
  (for flanges made of carbon steel with protective lacquering)
- Electrodes: 1.4435 or Alloy C-22, tantalum
- Flanges
  EN 1092-1 (DIN2501): 1.4571/316L; RSt37-2 (S235JRG2); C22; FE 410W B
  (DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
- Seals: Seals to DIN 1514-1
- Ground disks: 1.4435/316L, Alloy C-22, tantalum, titanum

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: powder-coated die-cast aluminum
  – DN 350 to 600: painted steel
- Measuring tube
  – DN ≤ 300: stainless steel 1.4301 or 1.4306/304L; non-stainless flange material with AI/Zn protective coating
  – DN ≥ 350: stainless steel 1.4301 or 1.4306/304L; non-stainless flange material with AI/Zn protective coating
- Electrodes: 1.4435, Platinum, Alloy C-22, Tantalum, Titanium
- Flanges
  EN 1092-1 (DIN2501): 1.4571/316L; RSt37-2 (S235JRG2); C22; FE 410W B
  (DN ≤ 300: with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
- Seals: Seals to DIN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

Material load diagram

The material load diagrams (pressure-temperature graphs) for the process connections can be found in the "Technical Information" document for the device in question:
List of supplementary documentation → 91.

Fitted electrodes

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

Process connections

- EN 1092-1 (DIN 2501)
  – DN ≤ 300 = Form A
  – DN ≥ 350 = Form B
  – DN 65 PN 16 and DN 600 PN 16 only in accordance with EN 1092-1

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)

10.1.10 Human interface

Display elements

- Liquid crystal display: illuminated, two lines with 16 characters per line
- Custom configurations for presenting different measured values 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 operating keys (−, +, E)
- "Quick Setup" menus for straightforward commissioning

Language group

Language groups 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
- South and Eastern Asia (SEA):
  English, Japanese, Indonesian

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

Remote operation

Operation via HART protocol and FieldCare

10.1.11 Certificates and approvals

CE mark

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 mark

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 separate documentation which is also available upon request.

Sanitary compatibility

See Drinking water approval → 89.

Drinking water approval

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

Pressure measuring device approval

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

- With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.
- Devices with this identification (with PED) are suitable for the following types of fluid:
  – Fluids of Group 1 and 2 with a steam pressure of greater or less than 0.5 bar (7.3 psi)
  – Unstable gases
- Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.

Measuring device approval

The measuring device is approved as a cold water meter (MI-001) for volume measurement for operation subject to legal metrological control in accordance with the European Measuring Instruments Directive 2004/22/EC (MID) - type-examination certificate DE-07-MI001-PTB014. The device is qualified to OIML R49, with an associated OIML Test Report.

Other standards and guidelines

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

10.1.12 Ordering information

The Endress+Hauser service organization can provide detailed ordering information and information on specific order codes on request.

If the pulse output is required for custody transfer measurement, it is essential to provide the following values when ordering a device as per MID:
Pulse value, pulse width, output signal type (passive-positive, passive-negative)

The flowmeter is delivered with appropriate factory settings if no information is given on the full scale value for current output, the current range (0/4 to 20 mA), pulse value, display mode or totalizer units!

10.1.13 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor → 62.
The Endress+Hauser service organization can provide detailed information on the order codes of your choice.

10.1.14 Documentation

- Flow measurement (FA005D/06)
- Technical Information Promag 51W, P (TI058D/06)
- Description of Device Functions Promag 51 HART (BA081D/06)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA etc.

Index

A
Accessories 62
Adapters 17
Applicator (selection and configuration software) 63
Approvals 9, 89

C
Cable entry 82
Cable specifications 32
Calibration factor 8–9
CE mark 89
CE mark (Declaration of Conformity) 9
Certificates 9, 89
Cleaning (exterior cleaning) 61
Commissioning
  General information 53
  Two current outputs 58
Commissioning Quick Setup menu 57
Commubox FXA 195 (electrical connection) 36, 63
Communication 45
Connecting cable 19
Connection
  HART 35
  Remote version 29
C-tick mark 89
Current output
  configuration (active/passive) 58
Custody transfer measurement
  Setting-up custody transfer mode 53
Custody transfer mode
  Deactivating custody transfer mode 54

D
Deactivating custody transfer mode 54
Declaration of Conformity (CE mark) 9
Degree of protection 39, 84
Design 86
Device description files 46
Device fuse, replacing 78
Device variable via HART protocol 46
Display
  Elements 41, 89
  Turning the display 25
Documentation 91
Drinking water approval 89

E
Electrical connection
  Commubox FXA 195 36
  HART handheld terminal 36
Electrical connections 82
Electrodes
  EPD electrode 15
EMC (electromagnetic compatibility) 32, 83–84
Empty-pipe/full-pipe adjustment 59
Error message types 44
Error messages
  Process errors (application errors) 69
  System error (device error) 66
European Pressure Equipment Directive 90
Ex approval 89
Exterior cleaning 61

F
Field Xpert SFX100 36
FieldCare 45, 63
Fieldcheck (tester/simulator) 63
Fitted electrodes 88
Flow rate/flow limits 18
Fluid pressure range 83
Function matrix
  Brief guide 42
FXA193 63
FXA195 63

G
Galvanic isolation 81
Ground cable
  Promag P 22
  Promag W 20

H
HART
  Command classes 45
  Commands 47
  Device description files 46
  Device status / Error messages 51
  Electrical connection 36
  Write protection 46
HART connection 36
Hazardous substances 79
HOME position (operating mode) 41

I
Incoming acceptance 11
Inlet/outlet run 16
Installation
  Promag P 22
  see Installing sensor
Installation conditions
  Adapters 17
  Dimensions 13
  Down pipe 14
  EPD electrode 15
  Foundations, supports 17
  Inlet/outlet run 16
  Installation of pumps 13
  Mounting location 13
  Orientation 15
  Partially filled pipe 14
  Vibrations 16
Installation instructions
  Promag W 20

Installing the sensor
See Sensor installation
Installing the wall-mount transmitter housing 26

L
Language group 89
Load 81
Local display
see Display
Low flow cut off 81

M
Maintenance 61
Material load diagram 88
Materials 87
Measured variable 80
Measuring device approval 90
Measuring principle 80
Measuring range 80
Measuring system 80
Mechanical construction 86
Medium temperature range 83

N
Nameplate specifications
Connections 9
Sensor 8
Transmitter 7–8
Nominal diameter and flow rate
Promag W 18

O
Operable flow range 80
Operating conditions
Process 85
Operating elements 41, 89
Operation 41
Device description files 46
FieldCare 45
Operating programs 45
Operational safety 6
Ordering code
Accessories 62
Sensor 8–9
Transmitter 7–8
Ordering information 91
Output 81

P
Post-connection
Check 40
Post-installation
Check 28
Potential equalization 37
Power consumption 82
Power supply 82
Power supply failure 82
Pressure loss
Adapters (reducers, expanders) 17
Pressure measuring device approval 90
Pressure tightness 85
Process connections 88
Process error (definition) 44
Process error messages 69
Promag P
Ground cable 22
Installation 22
Seals 22
Tightening torques 23
Promag W
Ground cable 20
Installation instructions 20
Seals 20
Tightening torques 21

Q
Quick setup 57

R
Registered trademark 10
Remote operation 89
Remote version
Connection 29
Repair 79
Response to errors 71
Returning devices 79

S
Safety icons 6
Safety instructions 5
Sanitary compatibility 89
S-DAT (HistoROM) 60
Seals
Promag P 22
Promag W 20
Serial number
Sensor 8–9
Transmitter 7–8
Service interface FXA 193 63
Setting-up custody transfer mode 53
Signal on alarm 81
Software
Amplifier display 56
Spare parts 73
Standards, guidelines 90
Storage temperature 84
Supply voltage 82
Surface roughness 88
Switching on (measuring device) 56
System error (definition) 44
System error messages 66

T
Technical data 80
Temperature
Fluid 83
Storage 84
Tightening torques
Promag P 23
Promag W 21

Transmitter
Electrical connection 33
Installing the wall-mount transmitter housing. 26
Turning the field housing (aluminum) 24
Turning the field housing (stainless steel) 24
Troubleshooting 64
Types of error (system and process errors) 44

V

Vibration resistance 84
Vibrations 16

W

Wall-mount housing, installing 26
Weights. 86
Wiring. 29

Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System /** *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/ *Prozessdaten*

Temperature / *Temperatur*_____ [°F] _____ [°C]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Pressure / *Druck* _____ [psi] _____ [Pa]
Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium



	Medium /concentration *Medium /Konzentration*	Identification CAS No.	flammable *entzündlich*	toxic *giftig*	corrosive *ätzend*	harmful/ irritant *gesundheits-schädlich/ reizend*	other * *sonstiges**	harmless *unbedenklich*
Process medium / *Medium im Prozess*								
Medium for process cleaning / *Medium zur Prozessreinigung*								
Returned part cleaned with / *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____

_____

_____

Company data / *Angaben zum Absender*

Company / *Firma* _____

_____

Address / *Adresse*

_____

_____

Phone number of contact person / *Telefon-Nr. Ansprechpartner:*

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

(place, date / *Ort, Datum)*

Name, dept./*Abt.* (please print / *bitte Druckschrift*)

Signature / *Unterschrift*

www.endress.com/worldwide

Endress+Hauser

People for Process Automation

BA00137D/06/EN/03.10
71111278
FM+SGML6.0 ProMoDo