



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

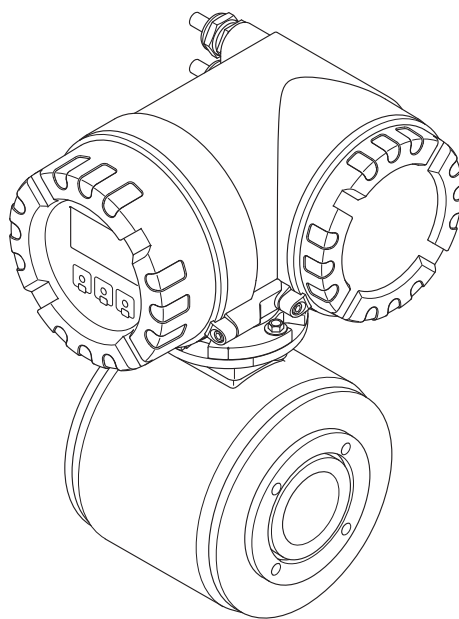
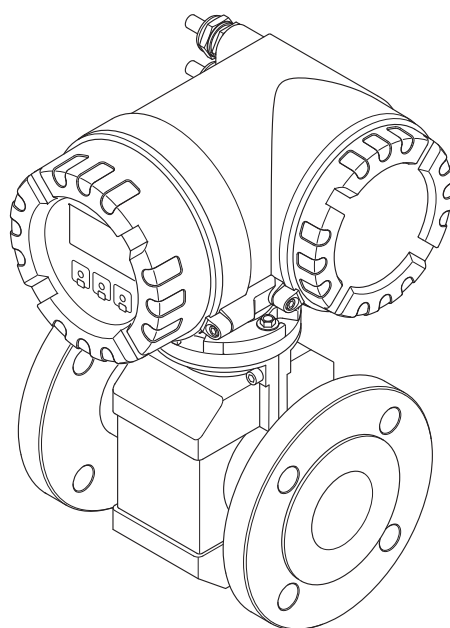


Solutions

Operating Manual

Proline Promag 53 PROFIBUS DP/PA

Electromagnetic Flow Measuring System



BA053D/06/EN/06.10
71116500

Valid as of version:
PROFIBUS DP: V 3.06.XX
(Device software)
PROFIBUS PA: V 3.06.XX
(Device software)

Endress+Hauser 
People for Process Automation

Table of contents

1	Safety instructions	5		
1.1	Designated use	5	4.4	Potential matching
1.2	Installation, commissioning and operation	5	4.4.1	Potential equalization, Promag W, Promag P
1.3	Operational safety	6	4.4.2	Potential equalization, Promag H
1.4	Returns	6	4.4.3	Connection examples for potential equalization
1.5	Safety conventions and icons	6	4.5	Degree of protection
2	Identification	7	4.6	Post-connection check
2.1	Device designation	7	5	Operation
2.1.1	Nameplate of the transmitter	7	5.1	Quick operation guide
2.1.2	Nameplate of the sensor	8	5.2	Local display
2.1.3	Nameplate for connections	9	5.2.1	Display and operating elements
2.2	Certificates and approvals	10	5.2.2	Display (operating mode)
2.3	Registered trademarks	10	5.2.3	Additional display functions
3	Installation	11	5.2.4	Icons
3.1	Incoming acceptance, transport and storage	11	5.2.5	Controlling the batching processes using the local display
3.1.1	Incoming acceptance	11	5.3	Brief Operating Manual to the function matrix
3.1.2	Transport	11	5.3.1	General notes
3.1.3	Storage	12	5.3.2	Enabling the programming mode
3.2	Installation conditions	13	5.3.3	Disabling the programming mode
3.2.1	Dimensions	13	5.4	Error messages
3.2.2	Mounting location	13	5.4.1	Type of error
3.2.3	Orientation	15	5.4.2	Error message type
3.2.4	Inlet and outlet runs	16	5.5	Operating options
3.2.5	Vibrations	16	5.5.1	Operating program "FieldCare"
3.2.6	Foundations, supports	17	5.5.2	Operating program "SIMATIC PDM" (Siemens)
3.2.7	Adapters	17	5.5.3	Device drivers for operating programs
3.2.8	Nominal diameter and flow rate	18	5.6	Hardware PROFIBUS DP settings
3.2.9	Length of connecting cable	20	5.6.1	Configuring the write protection
3.3	Installation	21	5.6.2	Configuring the device address
3.3.1	Installing the Promag W sensor	21	5.6.3	Configuring the terminating resistors
3.3.2	Installing the Promag P sensor	27	5.6.4	Current output configuration
3.3.3	Installing the Promag H sensor	32	5.6.5	Relay output configuration
3.3.4	Turning the transmitter housing	35	5.7	Hardware PROFIBUS PA settings
3.3.5	Turning the local display	36	5.7.1	Configuring the write protection
3.3.6	Installing the wall-mount housing	37	5.7.2	Configuring the device address
3.4	Post-installation check	39	6	Commissioning
4	Wiring	40	6.1	Function check
4.1	PROFIBUS cable specifications	40	6.2	Switching on the measuring device
4.1.1	PROFIBUS DP cable specification	40	6.3	Quick Setup
4.1.2	PROFIBUS PA cable specification	41	6.3.1	Quick Setup "Commissioning"
4.1.3	Shielding and grounding	43	6.3.2	Quick Setup "Pulsating Flow"
4.2	Connecting the remote version	44	6.3.3	Quick Setup "Batching"
4.2.1	Connecting Promag W/P/H	44	6.3.4	Quick Setup "Communication"
4.2.2	Cable specifications	48	6.3.5	Data backup/transmission
4.3	Connecting the measuring unit	49	6.4	Commissioning the PROFIBUS interface
4.3.1	Terminal assignment	49	6.4.1	PROFIBUS DP commissioning
4.3.2	Transmitter connection	50	6.4.2	PROFIBUS PA commissioning
4.3.3	PROFIBUS DP connection diagram	51		
4.3.4	PROFIBUS PA connection diagram	53		

6.5	PROFIBUS DP/PA system integration	96
6.5.1	Device master file (GSD file)	96
6.5.2	Selection of the GSD file in the measuring device	98
6.5.3	Compatibility to the previous model Promag 33 (Profile Version 2.0)	99
6.5.4	Maximum number of writes	99
6.6	PROFIBUS DP cyclic data transmission	100
6.6.1	Block model	100
6.6.2	Modules for cyclic data transmission	100
6.6.3	Description of the modules	101
6.6.4	Configuration examples with Simatic S7 HW-Konfig	108
6.7	PROFIBUS PA cyclic data transmission	110
6.7.1	Block model	110
6.7.2	Modules for cyclic data transmission	110
6.7.3	Description of the modules	111
6.7.4	Configuration examples with Simatic S7 HW-Konfig	117
6.8	PROFIBUS DP/PA acyclic data transmission	119
6.8.1	Master class 2 acyclic (MS2AC)	119
6.8.2	Master class 1 acyclic (MS1AC)	119
6.9	Adjustment	120
6.9.1	Empty-pipe/Full-pipe adjustment	120
6.10	Data storage device	121
6.10.1	HistoROM/S-DAT (Sensor DAT)	121
6.10.2	HistoROM/T-DAT (Transmitter DAT) ...	121
6.10.3	F-CHIP (Function Chip)	121
7	Maintenance	122
7.1	Exterior cleaning	122
7.2	Seals	122
8	Accessories	123
8.1	Device-specific accessories	123
8.2	Measuring principle-specific accessories	123
8.3	Service-specific accessories	124
9	Troubleshooting	125
9.1	Troubleshooting instructions	125
9.2	System error messages	127
9.2.1	Displaying the device status on PROFIBUS DP/PA	127
9.2.2	List of system error messages	128
9.3	Process error messages	136
9.3.1	Displaying the device status on PROFIBUS DP/PA	136
9.3.2	List of process error messages	136
9.4	Process errors without messages	139
9.5	Failsafe mode of outputs	140

9.6	Spare parts	141
9.6.1	PROFIBUS DP	141
9.6.2	PROFIBUS PA	142
9.6.3	Removing and installing printed circuit boards	143
9.6.4	Replacing the device fuse	147
9.6.5	Replacing exchangeable measuring electrodes	148
9.7	Return	150
9.8	Disposal	150
9.9	SoftwareHistory	150

10 Technical data152

10.1	Technical data at a glance	152
10.1.1	Applications	152
10.1.2	Function and system design	152
10.1.3	Input variables	152
10.1.4	Output variables	152
10.1.5	Power supply	153
10.1.6	Performance characteristics	154
10.1.7	Operating conditions: Installation	155
10.1.8	Operating conditions: Environment	155
10.1.9	Operating conditions: Process	156
10.1.10	Mechanical construction	161
10.1.11	Human interface	168
10.1.12	Certificates and approvals	168
10.1.13	Ordering information	170
10.1.14	Accessories	170
10.1.15	Documentation	170

Index171

1 Safety instructions

1.1 Designated use

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

A minimum conductivity of 20 $\mu\text{S}/\text{cm}$ is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5 $\mu\text{S}/\text{cm}$.

Examples:

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

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

1.2 Installation, commissioning and operation

Note the following points:

- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood this Operating Manual and must follow the instructions it contains.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in the Operating Manual is mandatory.
- 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 carrying out welding work on the piping, the welding unit must not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, except in cases where special protective measures have been taken (e.g. galvanically isolated power supply SELV or PELV).
- Always note the regulations applicable in your country to the operation, maintenance and repair of electrical devices. Special instructions relating to the device can be found in the relevant sections of this documentation.

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 this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this supplementary Ex documentation indicates the approval and the certification body (e.g.  Europe,  USA,  Canada)
- The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326, and NAMUR recommendations NE 21, NE 43 and NE 53.
- Depending on the application, the seals of the process connections of the Promag H sensor require periodic replacement.
- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to this Operating Manual.

1.4 Returns

- 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 →  150

1.5 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 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". The devices can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in this Operating Manual by the following icons:



Warning!

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



Caution!

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



Note!

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

2 Identification

2.1 Device designation

The flow measuring system consists of the following components:

- Promag 53 transmitter
- Promag W, Promag P or Promag H sensor

Two versions are available:

- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

2.1.1 Nameplate of the transmitter

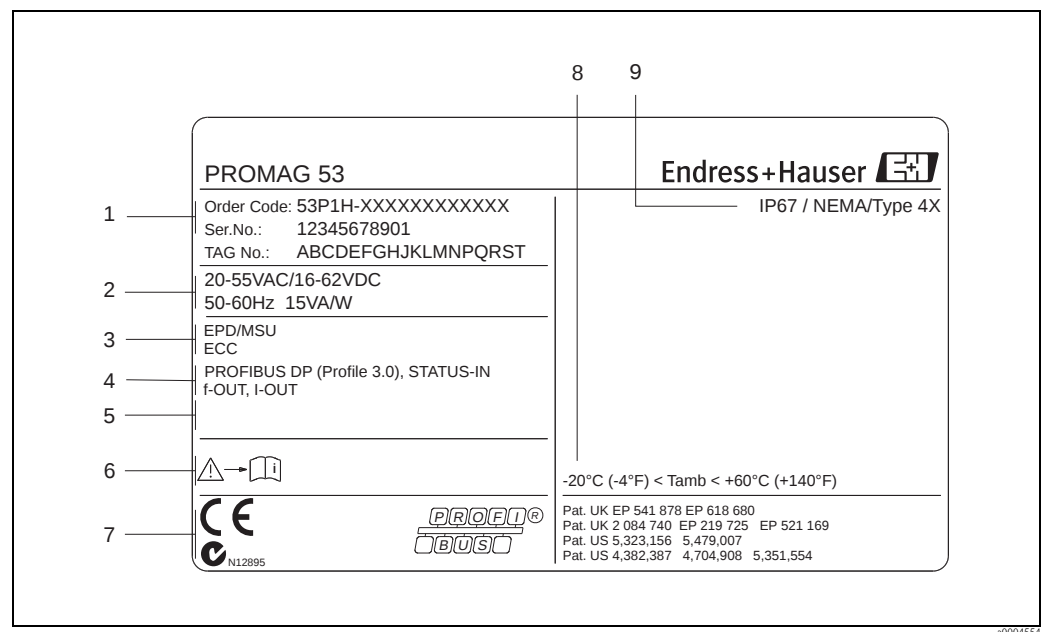


Fig. 1: Nameplate specifications for the "Promag 53" transmitter (example)

- 1 Order code/serial number: Refer to the specifications on the order confirmation for the meanings of the individual letters and digits.
- 2 Power supply/frequency/power consumption
- 3 Additional functions and software
- 4 Available inputs and outputs
- 5 Reserved for information on special products
- 6 Please refer to operating instructions / documentation
- 7 Reserved for certificates, approvals and for additional information on device version
- 8 Ambient temperature range
- 9 Degree of protection

2.1.2 Nameplate of the sensor

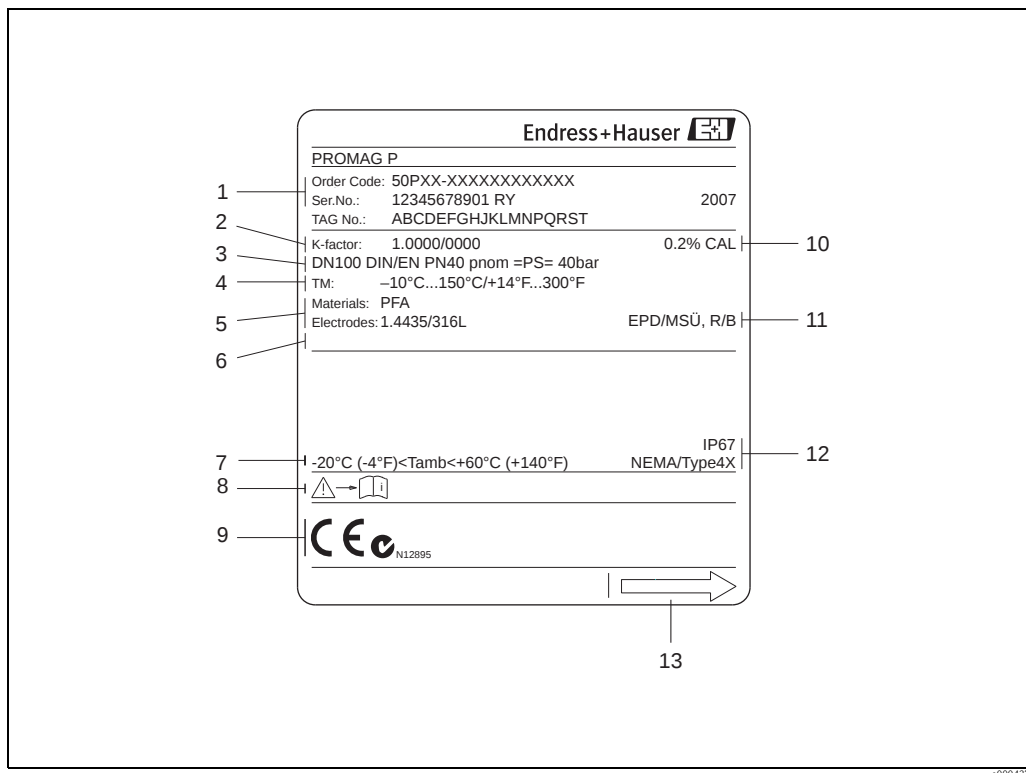


Fig. 2: Nameplate specifications for the "Promag" sensor (example)

- 1 Order code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
- 2 Calibration factor with zero point
- 3 Nominal diameter/nominal pressure
- 4 Medium temperature range
- 5 Materials: lining/measuring electrode
- 6 Reserved for information on special products
- 7 Permitted ambient temperature range
- 8 Please refer to operating instructions / documentation
- 9 Reserved for additional information on device version (approvals, certificates)
- 10 Calibration tolerance
- 11 Additional information
 - EPD: with empty pipe detection electrode
 - R/B: with reference electrode (only for Promag P)
- 12 Degree of protection
- 13 Flow direction

2.1.3 Nameplate for connections

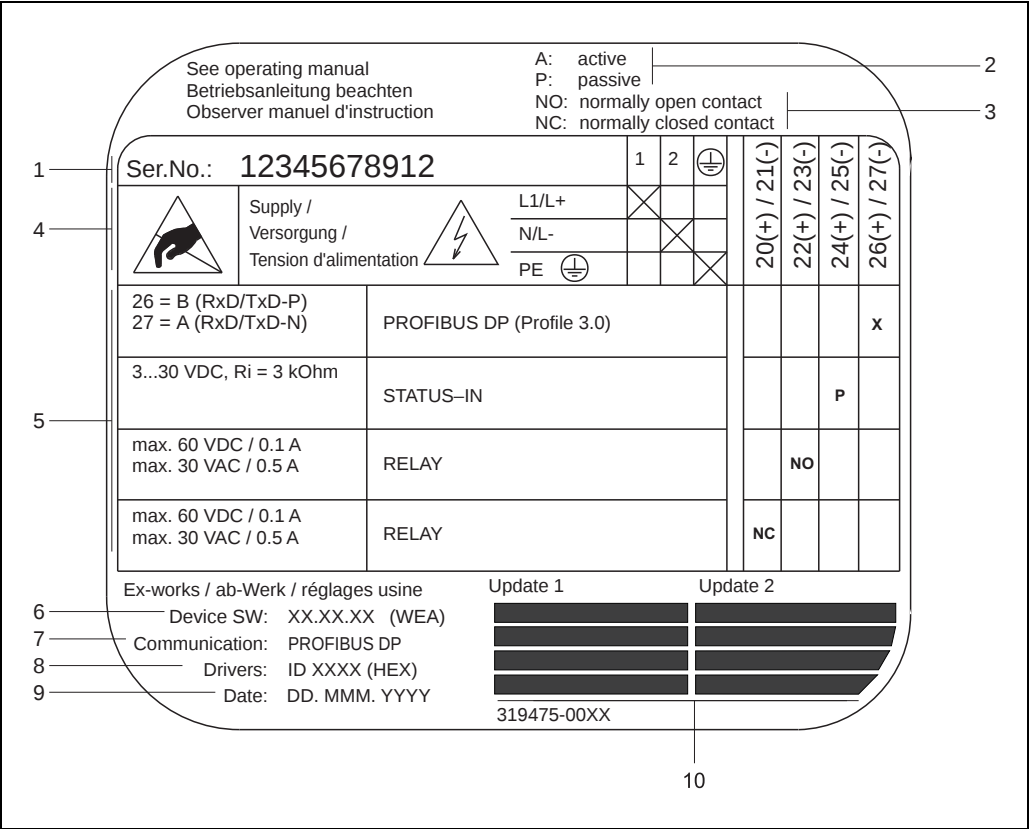


Fig. 3: Nameplate specifications for "Promag" transmitter connections (example)

- 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 Pending signals at the inputs and outputs
possible configurations and terminal assignment
- 6 Version of device software currently installed (inclusive language group)
- 7 Installed communication type
- 8 PROFIBUS ID No.
- 9 Date of installation
- 10 Current updates to data specified in points 6 to 9

2.2 Certificates and approvals

The devices are designed in accordance with good engineering practice 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 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of IEC/EN 61326.

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

The measuring system is in conformity with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization).

The device thus meets all the requirements of the following specifications:

- Certified to PROFIBUS Specification Profile 3.0 version
(Device certification number: provided upon request)
- The measuring device can also be operated with certified devices of other manufacturers (interoperability).

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

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, D

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, 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 protection 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 protection plates until *immediately before* the device is installed in the pipe.
- Do not lift flanged devices by the transmitter housing or, in the case of the remote version, by the connection housing.

Transporting flanged devices ($DN \leq 300$) 12"

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



Warning!

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

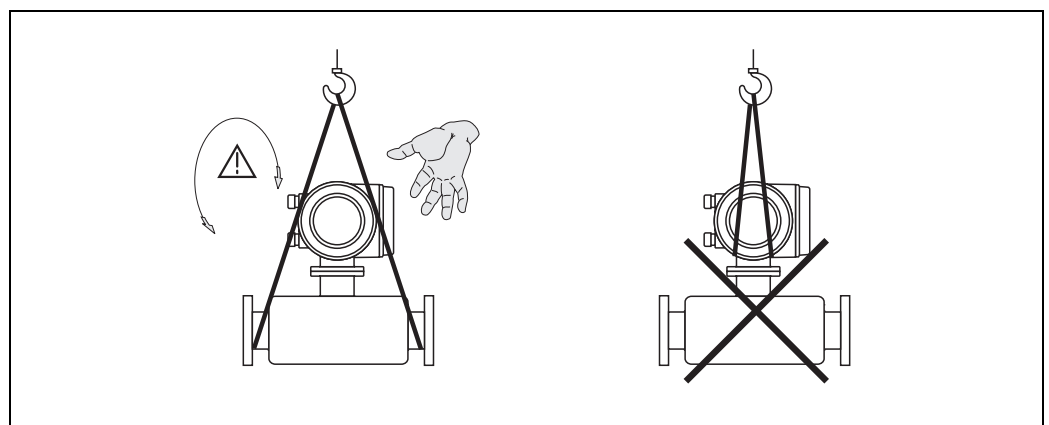


Fig. 4: Transporting sensors with $DN > \leq 300$ (12")

a0004294

Transporting flanged devices DN 300 (12")

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



Caution!

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

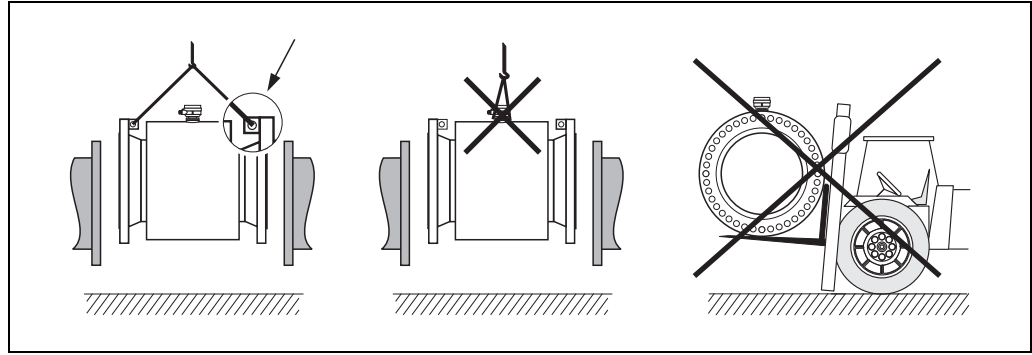


Fig. 5: Transporting sensors with DN > 300 (12")

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 → 155.
- 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 lining.
- Do not remove the protection 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.

3.2 Installation conditions

3.2.1 Dimensions

The dimensions and installation lengths of the sensor and transmitter can be found in the "Technical Information" for the device in question. This document can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section on → 170.

3.2.2 Mounting location

The accumulation of air or gas bubbles in the measuring tube could result in an increase in measuring errors.

Avoid the following locations:

- At the highest point of a pipeline. Risk of air accumulating.
- Directly upstream from a free pipe outlet in a vertical pipeline.

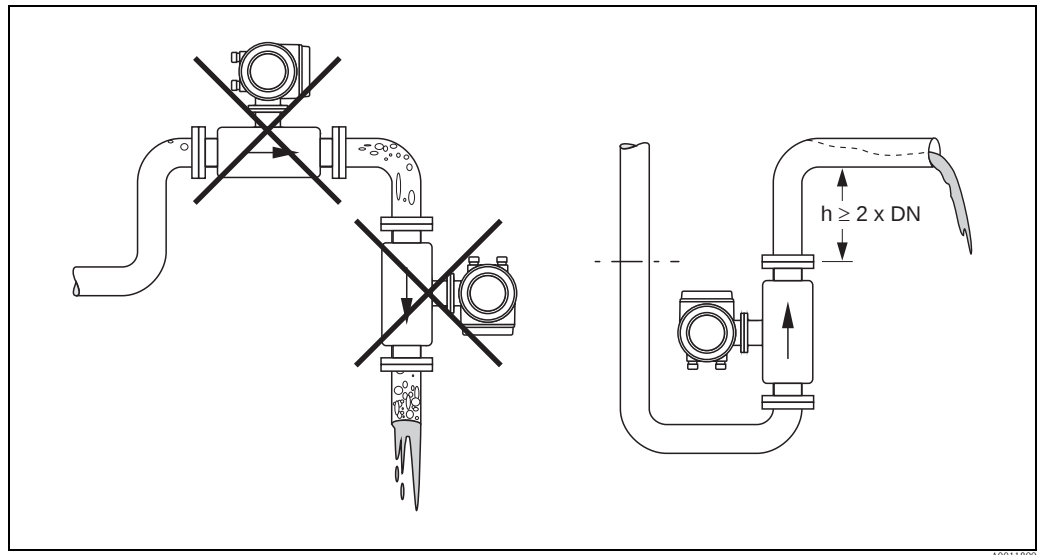


Fig. 6: Mounting location

Installing 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 → 158.

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 → 155.

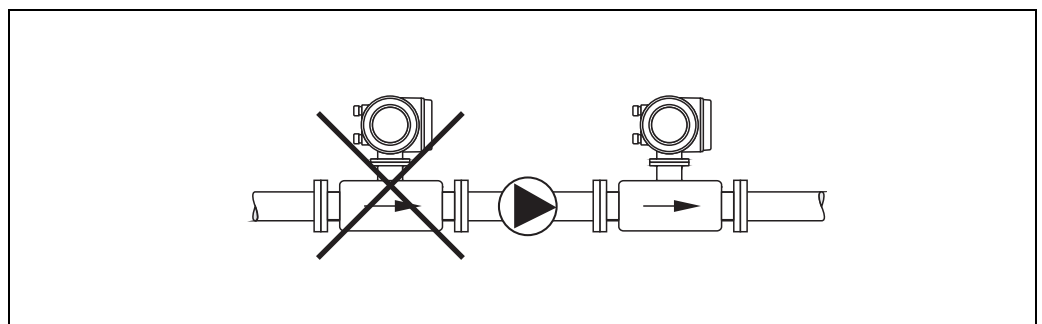


Fig. 7: Installing pumps

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration. The Empty Pipe Detection function offers additional protection by detecting empty or partially filled pipes → 120.



Caution!

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

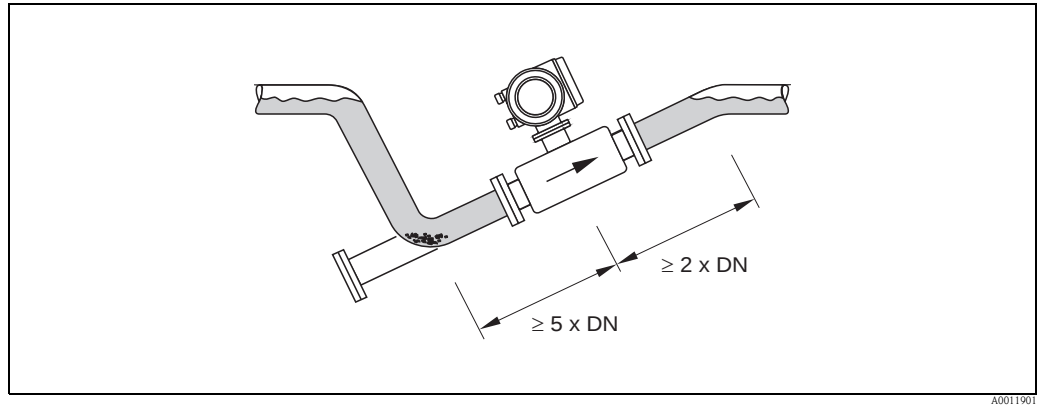


Fig. 8: Installation in partially filled pipe

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes longer than 5 meters (16,3 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 → 158

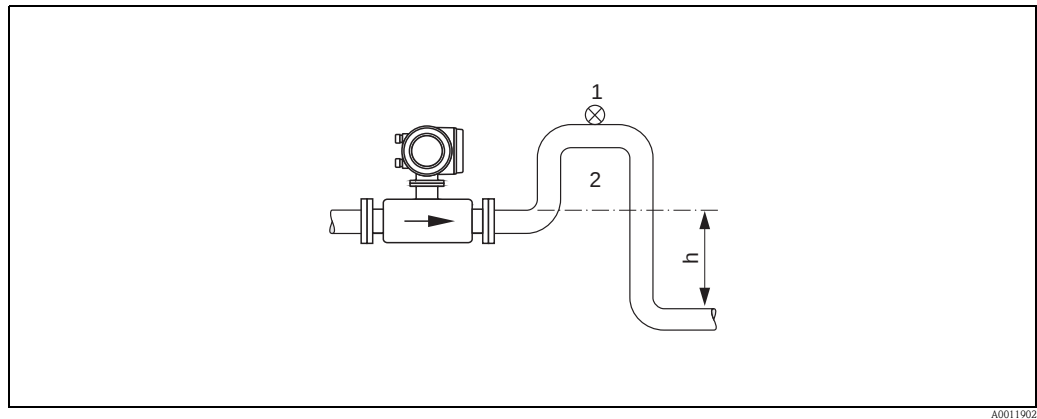


Fig. 9: Measures for installation in a down pipe

- 1 Vent valve
- 2 Siphon
- h Length of down pipe $h \geq 5 \text{ m (16,3 ft)}$

3.2.3 Orientation

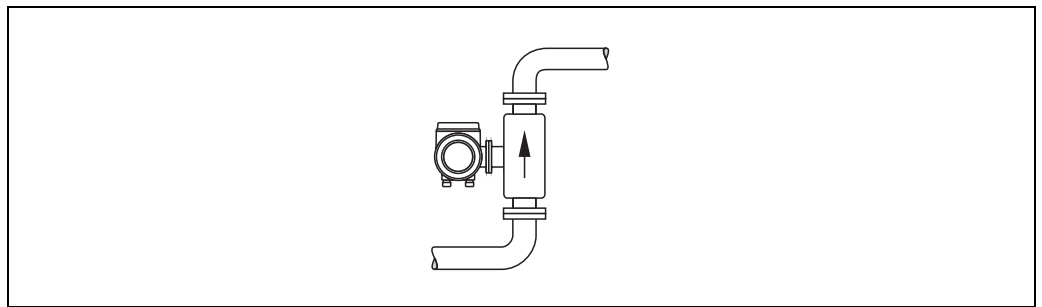
An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube. Promag, nevertheless, supplies a range of functions and accessories for correct measuring of problematic fluids:

- Electrode Cleaning Circuitry (ECC) to prevent electrically conductive deposits in the measuring tube, e.g. for fluids causing buildup (see "Description of Device Functions" manual).
- Empty Pipe Detection (EPD) ensures the detection of partially filled measuring tubes or in the case of degassing fluids → 120.

Vertical orientation

A vertical orientation is ideal in the following cases:

- For self-emptying piping systems and when using empty pipe detection.
- For sludge containing sand or stones and where the solids cause sedimentation.



A0011903

Fig. 10: Vertical orientation

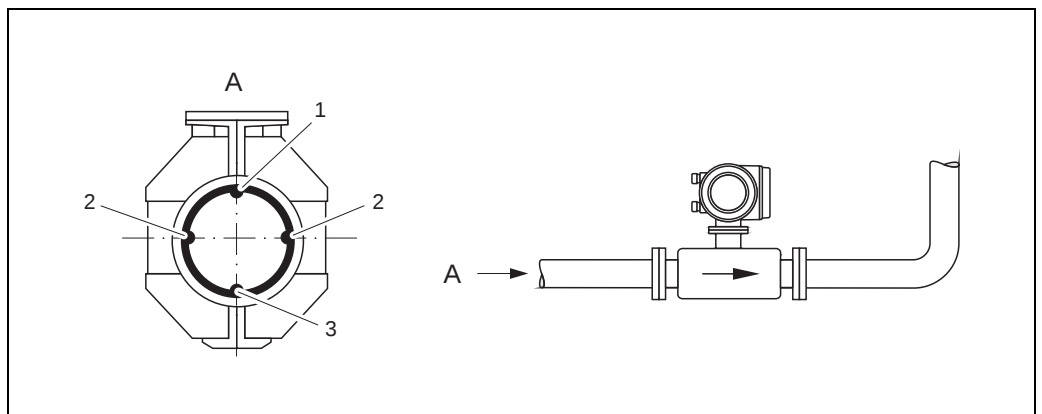
Horizontal orientation

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 with the measuring device installed horizontally only when the transmitter housing is facing upward (see diagram). Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled.



A0011904

Fig. 11: Horizontal orientation

- 1 EPD electrode for empty pipe detection
(not available for "measuring electrode only" option, not in Promag H, DN 2 to 15 (1/12" to 1/2"))
- 2 Measuring electrodes for signal detection
- 3 Reference electrode for potential equalization
(not available for "measuring electrode only" option, not in Promag H)

3.2.4 Inlet and outlet runs

If possible, install the sensor in a location upstream 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 $\geq 5 \times \text{DN}$
- Outlet run $\geq 2 \times \text{DN}$

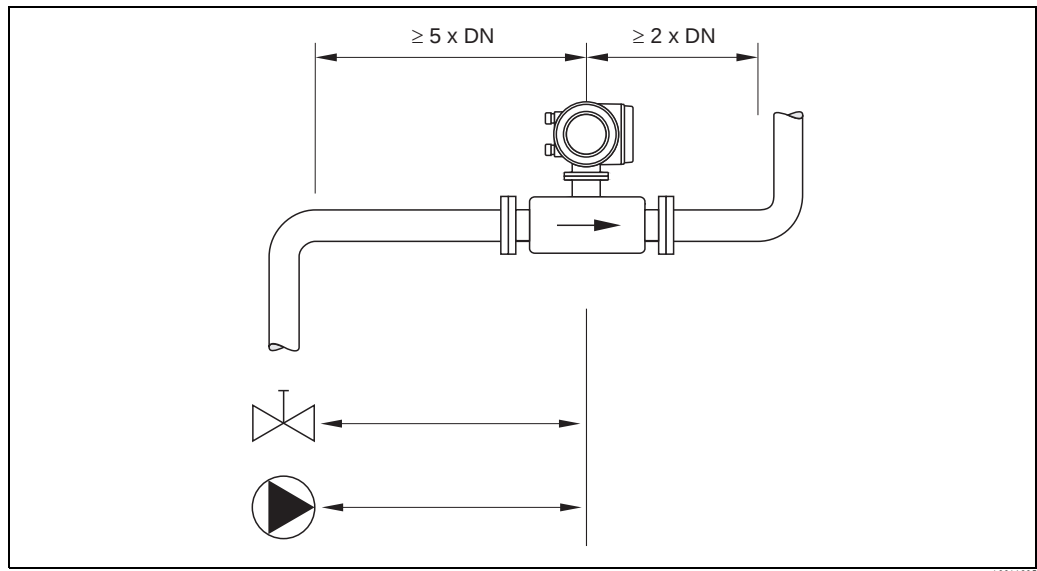


Fig. 12: Inlet and outlet runs

3.2.5 Vibrations

Secure and fix both the piping and the sensor if the vibrations are severe.



Caution!

It is advisable to install sensor and transmitter separately if vibration is excessively severe. Information on the permitted resistance to vibration and shock → 155.

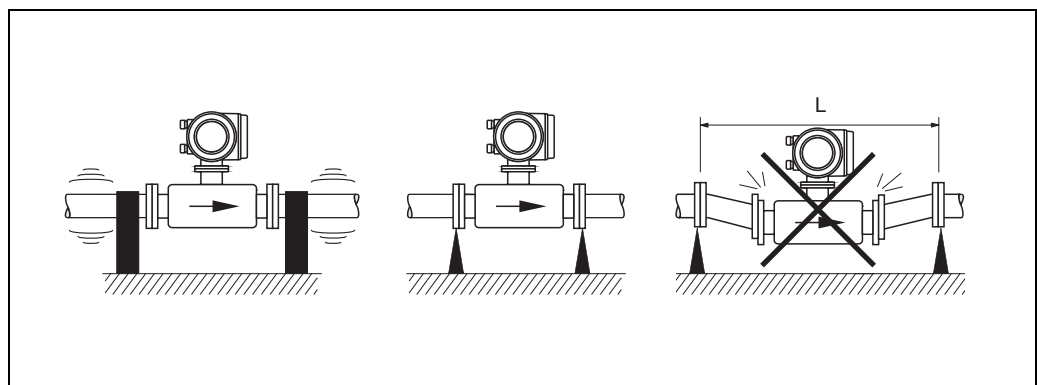


Fig. 13: Measures to prevent vibration of the measuring device ($L > 10 \text{ m}/33 \text{ ft}$)

3.2.6 Foundations, supports

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



Caution!

Risk of damage.

Do not support the weight of the sensor on the metal casing; the casing would buckle and damage the internal magnetic coils.

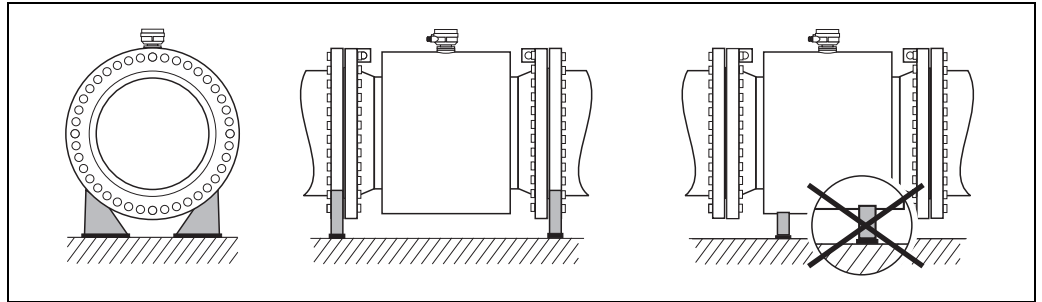


Fig. 14: Correct support for large nominal diameters ($DN \geq 350/14"$)

3.2.7 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 only applies to liquids 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 fluid velocity (*downstream* from the reduction) and the d/D ratio.

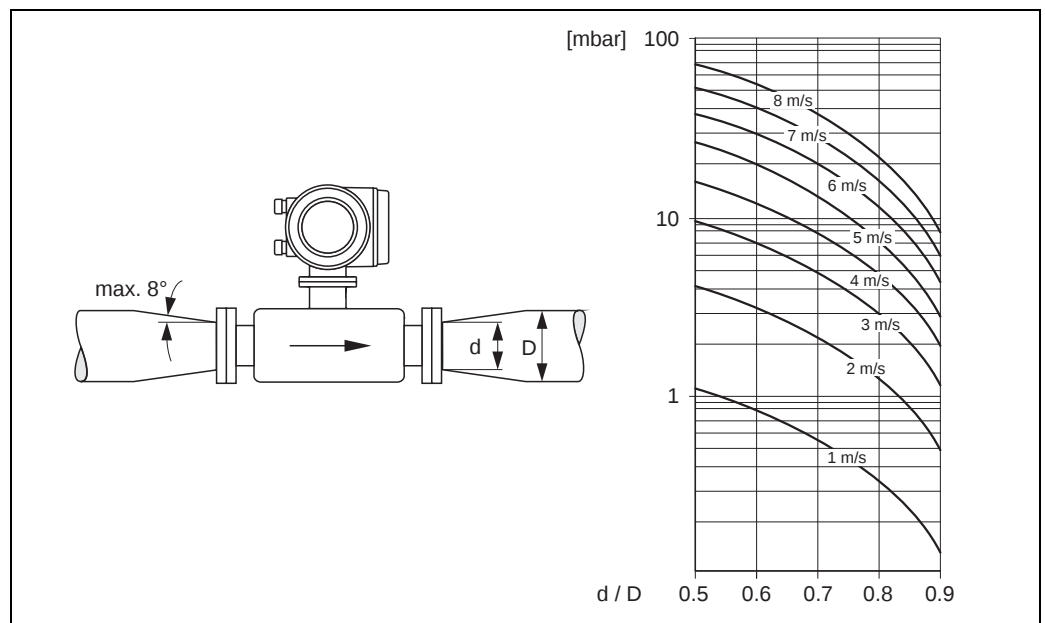


Fig. 15: Pressure loss due to adapters

3.2.8 Nominal diameter and flow rate

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

The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- $v < 2$ m/s ($v < 6.5$ ft/s): for abrasive fluids
- $v > 2$ m/s ($v > 6.5$ ft/s): for fluids producing buildup



Note!

Flow velocity can be increased, if necessary, by reducing the nominal diameter of the sensor (→ 17).

Recommended flow (SI units)

Nominal diameter [mm]	Promag W Min./max. full scale value ($v \approx 0.3$ or 10 m/s) in [dm ³ /min]	Promag P Min./max. full scale value ($v \approx 0.3$ or 10 m/s) in [dm ³ /min]	Promag H Min./max. full scale value ($v \approx 0.3$ or 10 m/s) in [dm ³ /min]
2	–	–	0.06 to 1.8
4	–	–	0.25 to 7
8	–	–	1 to 30
15	–	4 to 100	4 to 100
25	9 to 300	9 to 300	9 to 300
32	15 to 500	15 to 500	–
40	25 to 700	25 to 700	25 to 700
50	35 to 1100	35 to 1100	35 to 1100
65	60 to 2000	60 to 2000	60 to 2000
80	90 to 3000	90 to 3000	90 to 3000
100	145 to 4700	145 to 4700	145 to 4700
125	220 to 7500	220 to 7500	–
[mm]	Min./max. full scale value ($v \approx 0.3$ or 10 m/s) in [m ³ /h]		
150	20 to 600	20 to 600	–
200	35 to 1100	35 to 1100	–
250	55 to 1700	55 to 1700	–
300	80 to 2400	80 to 2400	–
350	110 to 3300	110 to 3300	–
375	140 to 4200	–	–
400	140 to 4200	140 to 4200	–
450	180 to 5400	180 to 5400	–
500	220 to 6600	220 to 6600	–
600	310 to 9600	310 to 9600	–
700	420 to 13500	–	–
800	550 to 18000	–	–
900	690 to 22500	–	–
1000	850 to 28000	–	–
1200	1250 to 40000	–	–
1400	1700 to 55000	–	–
1600	2200 to 70000	–	–
1800	2800 to 90000	–	–
2000	3400 to 110000	–	–

Recommended flow (US units)

Nominal diameter [inch]	Promag W Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [gal/min]	Promag P	Promag H
1 1/12"	–	–	0.015 to 0.5
5/32"	–	–	0.07 to 2
5/16"	–	–	0.25 to 8
1/2"	–	1.0 to 27	1.0 to 27
1"	2.5 to 80	2.5 to 80	2.5 to 80
1 1/4"	4 to 130	4 to 130	–
1 1/2"	7 to 190	7 to 190	7 to 190
2"	10 to 300	10 to 300	10 to 300
2 1/2"	16 to 500	16 to 500	16 to 500
3"	24 to 800	24 to 800	24 to 800
4"	40 to 1250	40 to 1250	40 to 1250
5"	60 to 1950	60 to 1950	–
6"	90 to 2650	90 to 2650	–
8"	155 to 4850	155 to 4850	–
10"	250 to 7500	250 to 7500	–
12"	350 to 10600	350 to 10600	–
14"	500 to 15000	500 to 15000	–
15"	600 to 19000	–	–
16"	600 to 19000	600 to 19000	–
18"	800 to 24000	800 to 24000	–
20"	1000 to 30000	1000 to 30000	–
24"	1400 to 44000	1400 to 44000	–
28"	1900 to 60000	–	–
30"	2150 to 67000	–	–
32"	2450 to 80000	–	–
36"	3100 to 100000	–	–
40"	3800 to 125000	–	–
42"	4200 to 135000	–	–
48"	5500 to 175000	–	–
[inch]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [Mgal/d]		
54"	9 to 300	–	–
60"	12 to 380	–	–
66"	14 to 500	–	–
72"	16 to 570	–	–
78"	18 to 650	–	–

3.2.9 Length of connecting cable

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

- Secure the cable run or route the cable in an armored 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.
- Ensure potential equalization between sensor and transmitter, if necessary.
- The permissible cable length $L_{\max}$ depends on the fluid conductivity ($\rightarrow$ 16).
- The maximum connecting cable length is 10 m (32.8 ft) when empty pipe detection (EPD $\rightarrow$ 120) is switched on.

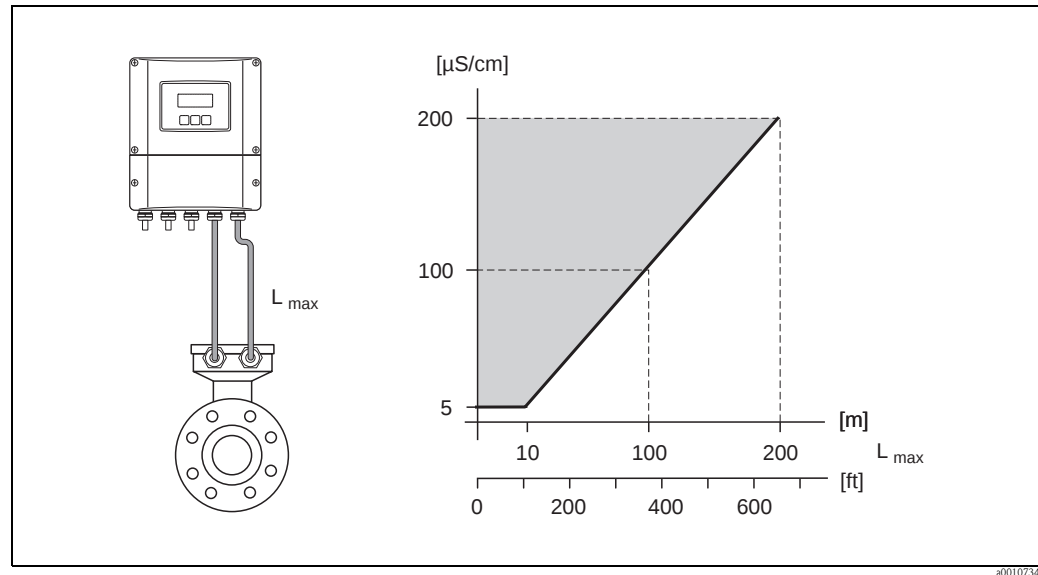


Fig. 16: Permitted lengths for connecting cable in remote version, as a function of the conductivity of the fluid

Gray shaded area = permissible range

$L_{\max}$ = length of connecting cable

3.3 Installation

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:

- It is essential that you observe the necessary screw tightening torques on → 22.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

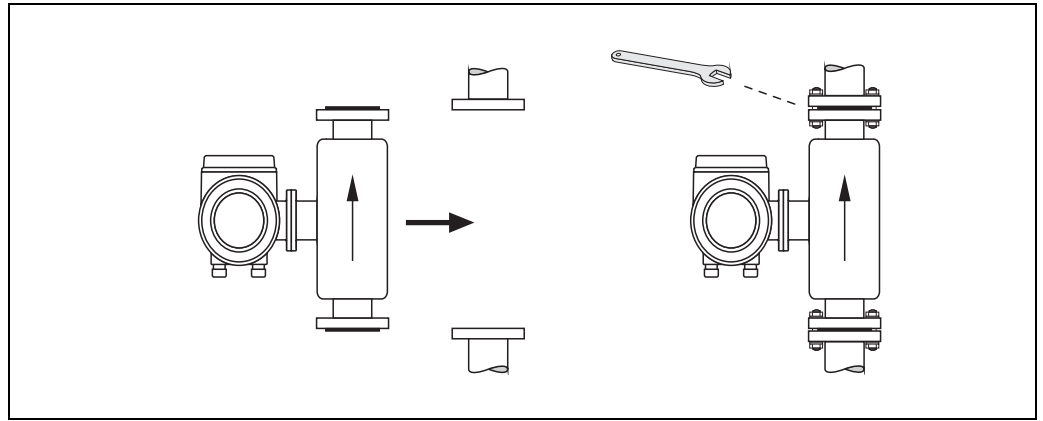


Fig. 17: Installing the Promag W sensor

Seals

Comply with the following instructions when installing seals:

- Hard rubber lining → additional seals are **always** required.
- Polyurethane lining → seals are **not** required.
- Only use seals that comply with DIN EN 1514-1 for DIN flanges.
- 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 can be ordered as accessories for potential equalization, → 123.
- For information on potential equalization and detailed installation instructions for using ground cables, please refer to → 56.

Screw tightening torques (Promag W)

Note the following points:

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

Tightening torques for:

- EN (DIN) → 22
- JIS → 24
- ANSI → 24
- AWWA → 25
- AS 2129 → 25
- AS 4087 → 26

Promag W tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Screws	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 6	16 × M 20	112	126
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

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Screws	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
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
800	PN 10	24 × M 30	331	316
800	PN 16	24 × M 36	369	385
800	PN 25	24 × M 45	664	721
900	PN 6	24 × M 27	230	637
900	PN 10	28 × M 30	316	307
900	PN 16	28 × M 36	353	398
900	PN 25	28 × M 45	690	716
1000	PN 6	28 × M 27	218	208
1000	PN 10	28 × M 33	402	405
1000	PN 16	28 × M 39	502	518
1000	PN 25	28 × M 52	970	971
1200	PN 6	32 × M 30	319	299
1200	PN 10	32 × M 36	564	568
1200	PN 16	32 × M 45	701	753
1400	PN 6	36 × M 33	430	398
1400	PN 10	36 × M 39	654	618
1400	PN 16	36 × M 45	729	762
1600	PN 6	40 × M 33	440	417
1600	PN 10	40 × M 45	946	893
1600	PN 16	40 × M 52	1007	1100
1800	PN 6	44 × M 36	547	521
1800	PN 10	44 × M 45	961	895
1800	PN 16	44 × M 52	1108	1003
2000	PN 6	48 × M 39	629	605
2000	PN 10	48 × M 45	1047	1092
2000	PN 16	48 × M 56	1324	1261
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag W tightening torques for JIS

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

Promag W tightening torques for ANSI

Sensor Nominal diameter [inch]	ANSI Pressure rating [lbs]	Screws	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
1"	Class 150	4 × ½"	–	7
1"	Class 300	4 × 5/8"	–	8
1 ½"	Class 150	4 × ½"	–	10
1 ½"	Class 300	4 × ¾"	–	15
2"	Class 150	4 × 5/8"	35	22
2"	Class 300	8 × 5/8"	18	11
3"	Class 150	4 × 5/8"	60	43
3"	Class 300	8 × ¾"	38	26
4"	Class 150	8 × 5/8"	42	31
4"	Class 300	8 × ¾"	58	40
6"	Class 150	8 × ¾"	79	59
6"	Class 300	12 × ¾"	70	51
8"	Class 150	8 × ¾"	107	80
10"	Class 150	12 × 7/8"	101	75
12"	Class 150	12 × 7/8"	133	103
14"	Class 150	12 × 1"	135	158

Sensor Nominal diameter [inch]	ANSI Pressure rating [lbs]	Screws	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
16"	Class 150	16 × 1"	128	150
18"	Class 150	16 × 1 1/8"	204	234
20"	Class 150	20 × 1 1/8"	183	217
24"	Class 150	20 × 1 1/4"	268	307

Promag W tightening torques for AWWA

Sensor Nominal diameter [inch]	AWWA Pressure rating	Screws	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
28"	Class D	28 × 1 1/4"	247	292
30"	Class D	28 × 1 1/4"	287	302
32"	Class D	28 × 1 1/2"	394	422
36"	Class D	32 × 1 1/2"	419	430
40"	Class D	36 × 1 1/2"	420	477
42"	Class D	36 × 1 1/2"	528	518
48"	Class D	44 × 1 1/2"	552	531
54"	Class D	44 × 1 3/4"	730	633
60"	Class D	52 × 1 3/4"	758	832
66"	Class D	52 × 1 3/4"	946	955
72"	Class D	60 × 1 3/4"	975	1087
78"	Class D	64 × 2"	853	786

Promag W tightening torques for AS 2129

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

Promag W tightening torques for AS 4087

Sensor Nominal diameter [mm]	AS 4087 Pressure rating	Screws	Max. tightening torque [Nm]
			Hard rubber
50	PN 16	4 × M 16	32
80	PN 16	4 × M 16	49
100	PN 16	8 × M 16	38
150	PN 16	8 × M 20	52
200	PN 16	8 × M 20	77
250	PN 16	8 × M 20	147
300	PN 16	12 × M 24	103
350	PN 16	12 × M 24	203
375	PN 16	12 × M 24	137
400	PN 16	12 × M 24	226
500	PN 16	16 × M 24	271
600	PN 16	16 × M 30	393
700	PN 16	20 × M 27	330
750	PN 16	20 × M 30	529
800	PN 16	20 × M 33	631
900	PN 16	24 × M 33	627
1000	PN 16	24 × M 33	595
1200	PN 16	32 × M 33	703

3.3.2 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 protection plates **until immediately before** the sensor is installed in the pipe.
- Protection plates 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:

- It is essential that you observe the necessary screw tightening torques on → 28.
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

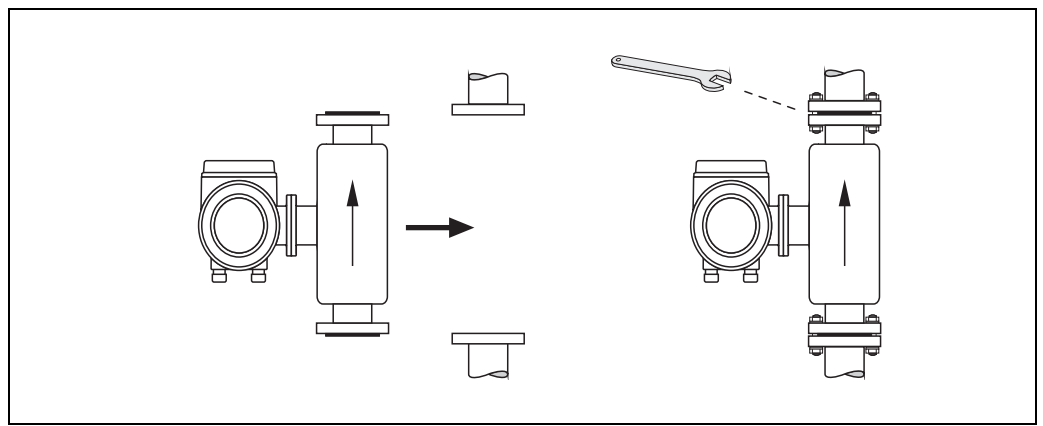


Fig. 18: Installing the Promag P sensor

Seals

Comply with the following instructions when installing seals:

- PFA or PTFE lining → seals are **not** required.
- Only use seals that comply with DIN EN 1514-1 for DIN flanges.
- 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 can be ordered as accessories for potential equalization, → 123.
- For information on potential equalization and detailed installation instructions for using ground cables, please refer to → 56.

Installing the high-temperature version (with PFA lining)

The high-temperature version has a housing support for the thermal separation of sensor and transmitter. The high-temperature version is always used for applications in which high ambient temperatures are encountered in conjunction with high fluid temperatures. The high-temperature version is obligatory if the fluid temperature exceeds +150 °C (+300 °F).



Note!

You will find information on permissible temperature ranges on → 156.

Insulation

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



Caution!

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

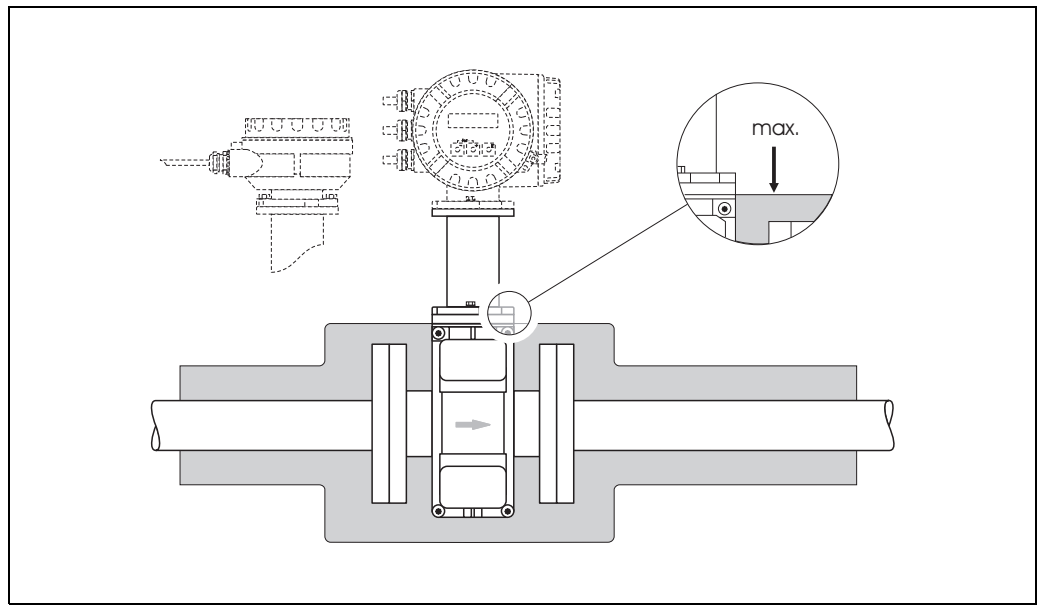


Fig. 19: Promag P sensor (high-temperature version): insulating the pipe

Screw tightening torques (Promag P)

Note the following points:

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

Tightening torques for:

- EN (DIN) → 29
- ANSI → 30
- JIS → 30
- AS 2129 → 31
- AS 4087 → 31

Promag P tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Screws	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)				

Promag P tightening torques for ANSI

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

Promag P tightening torques for JIS

Nominal diameter [mm]	JIS Pressure rating	Screws	Max. tightening torque [Nm]	
			PTFE	PFA
15	10K	4 × M 12	16	–
15	20K	4 × M 12	16	–
25	10K	4 × M 16	32	27
25	20K	4 × M 16	32	27
32	10K	4 × M 16	38	–
32	20K	4 × M 16	38	–
40	10K	4 × M 16	41	37
40	20K	4 × M 16	41	37
50	10K	4 × M 16	54	46
50	20K	8 × M 16	27	23
65	10K	4 × M 16	74	63
65	20K	8 × M 16	37	31
80	10K	8 × M 16	38	32
80	20K	8 × M 20	57	46
100	10K	8 × M 16	47	38
100	20K	8 × M 20	75	58
125	10K	8 × M 20	80	66
125	20K	8 × M 22	121	103
150	10K	8 × M 20	99	81

Nominal diameter [mm]	JIS Pressure rating	Screws	Max. tightening torque [Nm]	
			PTFE	PFA
150	20K	12 × M 22	108	72
200	10K	12 × M 20	82	54
200	20K	12 × M 22	121	88
250	10K	12 × M 22	133	–
250	20K	12 × M 24	212	–
300	10K	16 × M 22	99	–
300	20K	16 × M 24	183	–

Promag P tightening torques for AS 2129

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

Promag P tightening torques for AS 4087

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

3.3.3 Installing the Promag H sensor

The sensor is supplied, as per your order, with or without installed process connections. Installed process connections are screwed onto the sensor using 4 or 6 hexagonal-headed bolts.



Caution!

Depending on the application and the length of the pipe, the sensor must be supported or more securely mounted if necessary. Particularly when using process connections made of plastic, it is essential that the sensor be mounted securely. A wall mounting kit for this purpose can be ordered separately as an accessory from Endress+Hauser → 123.

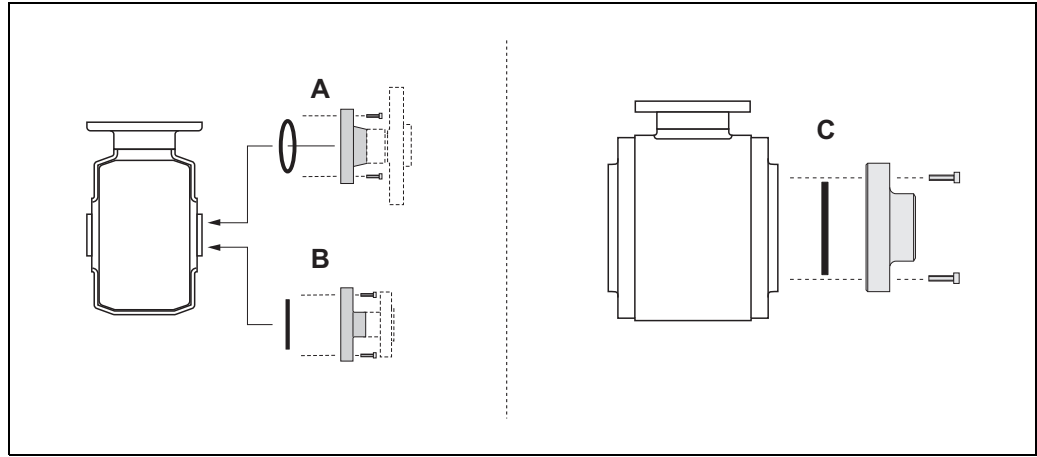


Fig. 20: Promag H process connections; DN 2 to 25 / DN 40 to 100 (1/12" to 1" / 1 1/2" to 4")

A = DN 2 to 25 (1/12" to 1") / Process connections with O-ring

Weld nipple (DIN EN ISO 1127, ODT / SMS), flange (EN (DIN), ANSI, JIS), flange made of PVDF (EN (DIN), ANSI, JIS), external thread, internal thread, hose connection, PVC adhesive fitting

B = DN 2 to 25 (1/12" to 1") / Process connections with aseptic molded seal

Weld nipple (DIN 11850, ODT / SMS), clamp (ISO 2852, DIN 32676, L14 AM7), coupling (DIN 11851, DIN 11864-1, SMS 1145), flange DIN 11864-2

C = DN 40 to 100 (1 1/2" to 4") / Process connections with aseptic molded seal

Weld nipple (DIN 11850, ODT / SMS), clamp (ISO 2852, DIN 32676, L14 AM7), coupling (DIN 11851, DIN 11864-1, ISO 2853, SMS 1145), flange DIN 11864-2

Seals

When mounting the process connections, please ensure that the relevant seals are clean and properly centered.



Caution!

- In the case of metallic process connections, the screws must be fully tightened. The process connection forms a metallic connection with the sensor, which ensures a defined compression of the seal.
- In the case of process connections made of plastic, the maximum screw tightening torques for lubricated threads (7 Nm / 5.2 lbf ft) must be adhered to. In the case of plastic flanges, a seal must always be used between the connection and the counterflange.
- Depending on the application, the seals should be replaced periodically, particularly when molded seals (aseptic version) are used!

The interval between replacements depends on the frequency of the cleaning cycles and on the temperatures of the fluid and the cleaning process. Replacement seals can be ordered as an accessory at a later stage → 123.

Using and installing grounding rings (DN 2 to 25, 1/12" to 1")

In case the process connections are made of plastic (e.g. flanges or adhesive fittings), the potential between the sensor and the fluid must be equalised using additional ground rings.

If the ground rings are not installed this can affect the accuracy of the measurements or cause the destruction of the sensor through the galvanic corrosion of the electrodes.



Caution!

- Depending on the option ordered, plastic rings may be installed at the process connections instead of ground rings. These plastic rings serve only as spacers and have no potential equalization function. In addition, they provide a sealing function at the interface between the sensor and process connection. For this reason, with process connections without ground rings, these plastic rings/seals must not be removed, or must always be installed.
- Ground rings can be ordered separately from Endress+Hauser as accessories → [123](#). When placing the order, make certain that the ground ring is compatible with the material used for the electrodes. Otherwise, there is a risk that the electrodes may be destroyed by galvanic corrosion! Information about the materials can be found on → [165](#).
- Ground rings, including the seals, are mounted within the process connections. Therefore, the fitting length is not affected.

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

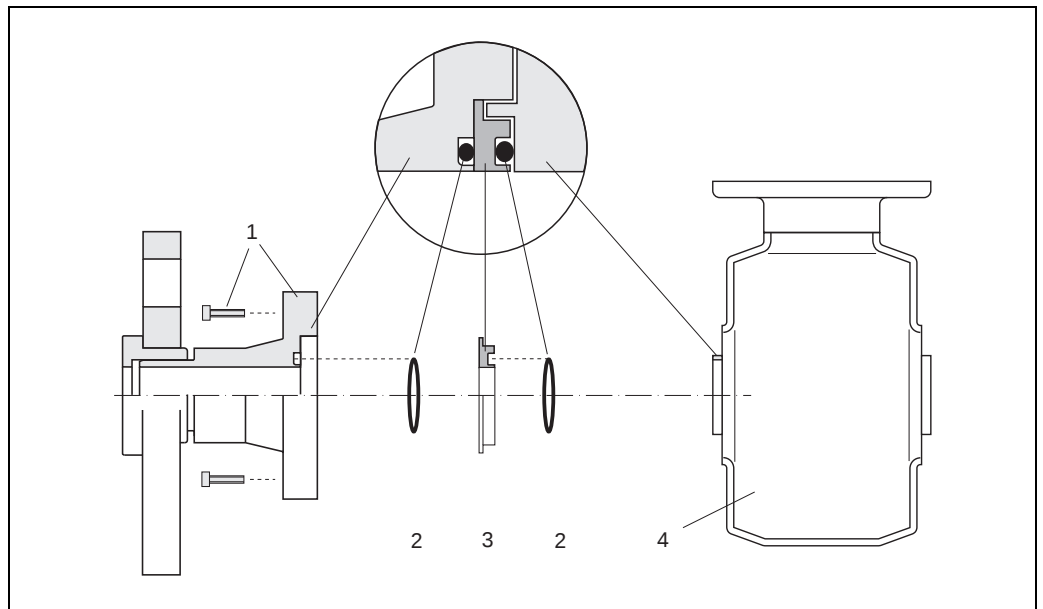


Fig. 21: Installing grounding rings in the Promag H (DN 2 to 25, 1/12" to 1")

- 1 = Hexagonal-headed bolts, process connection
 2 = O-ring seals
 3 = Grounding ring or plastic ring (spacer)
 4 = Sensor

Welding the transmitter into the pipe (weld nipple)



Caution!

Risk of electronics being destroyed. Please ensure that the welding system is *not* grounded via the sensor or transmitter.

1. Secure the sensor using several welding points in the piping. A welding jig suitable for this purpose can be ordered separately as an accessory → 123.
2. Loosen the screws at the process connection flange, and remove the sensor incl. seal from the piping.
3. Weld the process connection into the pipe.
4. Mount the sensor back into the pipe. When doing so, make sure that the seal is clean and positioned correctly.



Note!

- If the welding is done properly with thin-walled food pipes, the seal will not be damaged by heat even when mounted. Nonetheless, it is recommended that you dismantle the sensor and seal.
- For dismantling purposes, it must be possible to open the piping a total of approx. 8 mm.

Cleaning using pigs

When cleaning using pigs, please note the internal diameters of the measuring tube and the process connection. All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation "Technical Information" → 170.

3.3.4 Turning the transmitter housing

Turning the aluminum field housing



Warning!

The rotating mechanism in devices with Ex d/de or FM/CSA Cl. I Div. 1 approval is different to that described here. The relevant procedure 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. $2 \times 90^\circ$ in either direction).
5. Lower the housing into position and reengage the bayonet catch.
6. Retighten the two securing screws.

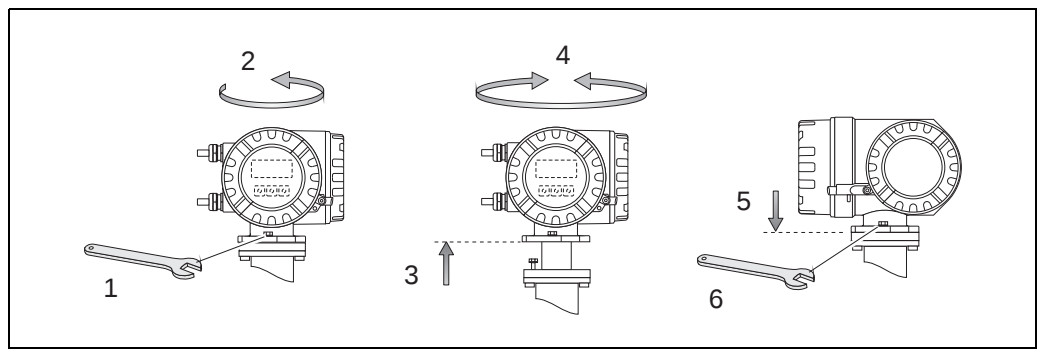


Fig. 22: Turning the transmitter housing (aluminum field housing)

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. $2 \times 90^\circ$ in either direction).
4. Lower the housing into position once more.
5. Retighten the two securing screws.

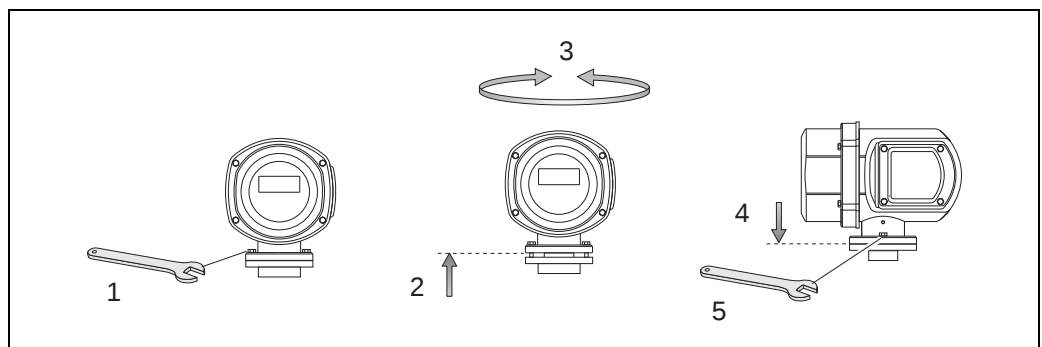


Fig. 23: Turning the transmitter housing (stainless steel field housing)

3.3.5 Turning the local display

1. Unscrew the electronics compartment cover from the transmitter housing.
2. Press the latches on the side of the display module and pull the module out of the electronics compartment cover.
3. Turn the display to the desired position (max. $4 \times 45^\circ$ in both directions) and position it back on the electronics compartment cover.
4. Screw the cover of the electronics compartment firmly onto the transmitter housing.

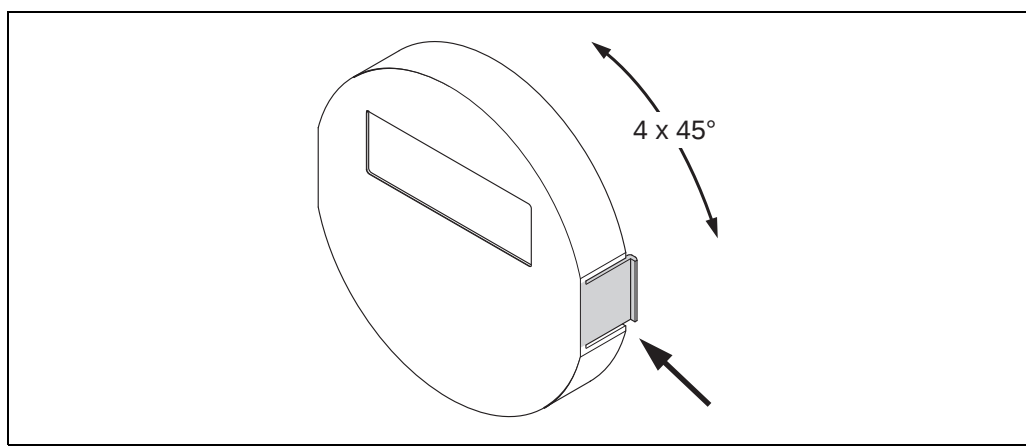


Fig. 24: Turning the local display (field housing)

a0003236

3.3.6 Installing the wall-mount housing

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

- Mounted directly on the wall
- Panel mounting (with separate mounting kit, accessories) → 38
- Pipe mounting (with separate mounting kit, accessories) → 38



Caution!

- Make sure that the permitted ambient temperature range is observed (see nameplate or → 155). Install the device in a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Mounted directly on the wall

1. Drill the holes as illustrated.
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 (0.24")
 - Screw head: max. Ø 10.5 mm (0.4")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

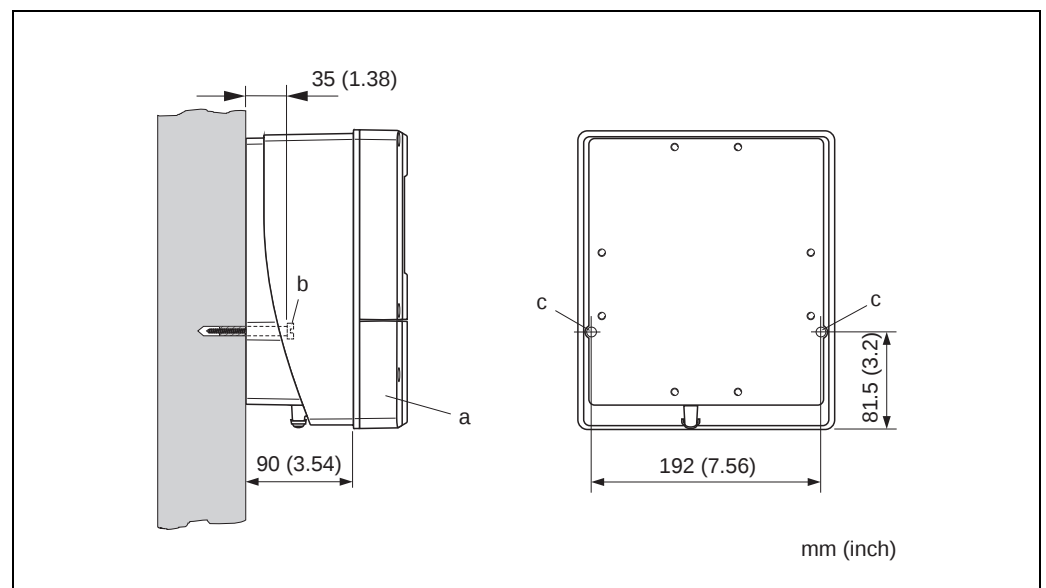


Fig. 25: Mounted directly on the wall

a0001130-ae

Panel mounting

1. Prepare the opening in the panel as illustrated.
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 wall. Afterwards, tighten the locking nuts. Additional support is not necessary.

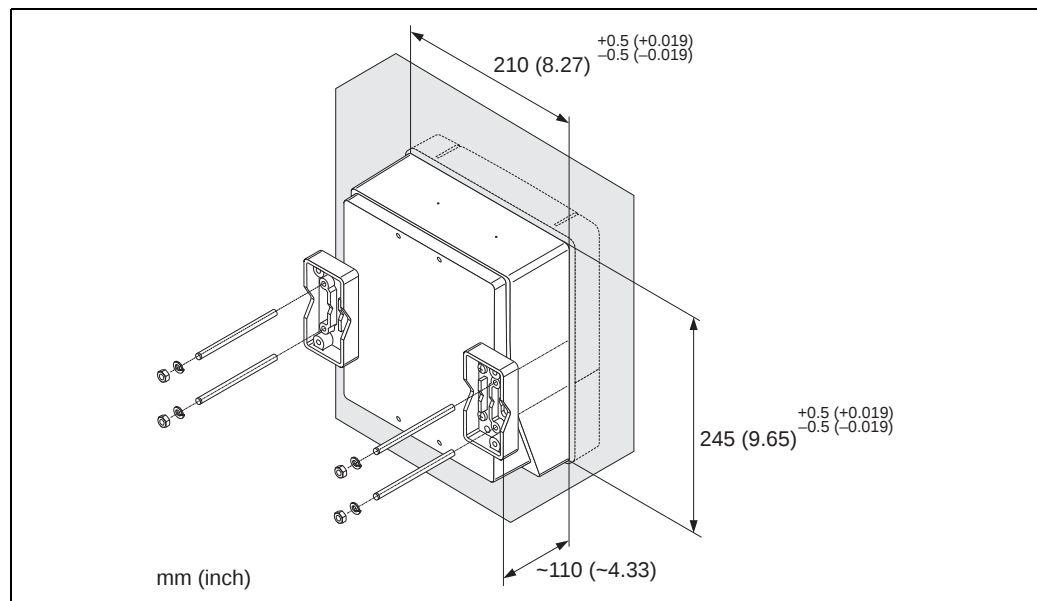


Fig. 26: Panel mounting (wall-mount housing)

Pipe mounting

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



Caution!

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

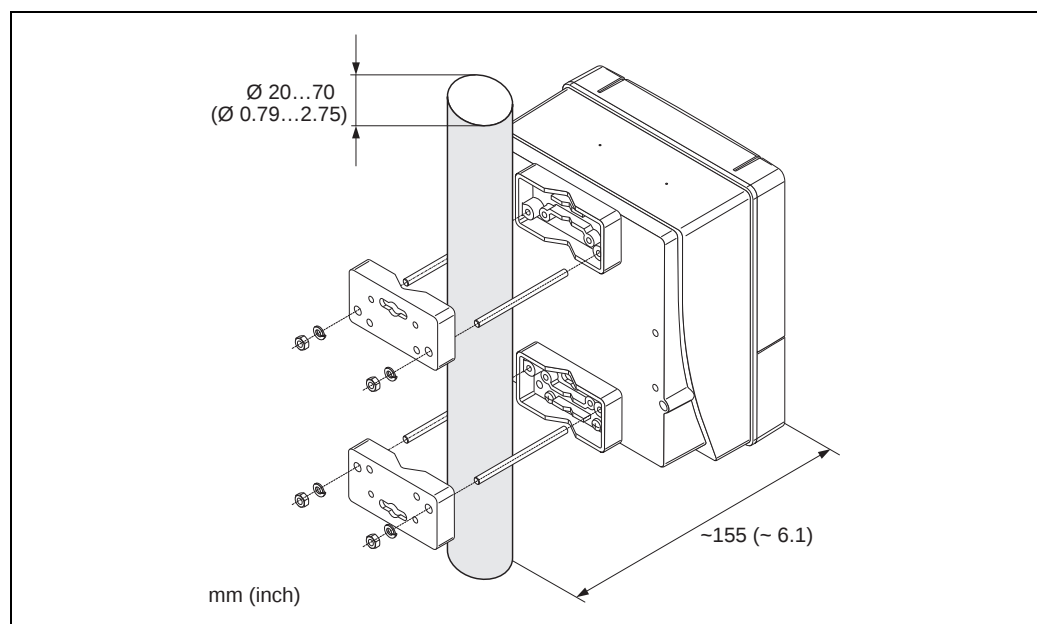


Fig. 27: Pipe mounting (wall-mount housing)

3.4 Post-installation check

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

Device condition/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.?	→ 152
Installation	Notes
Does the arrow on the sensor nameplate match the direction of flow through the pipe?	-
Is the position of the measuring electrode plane correct?	→ 15
Is the position of the empty pipe detection electrode correct?	→ 15
Were all screws tightened to the specified tightening torques when the sensor was installed?	→ 21
Were the correct seals installed (type, material, installation)?	→ 21
Are the measuring point number and labeling correct (visual inspection)?	-
Process environment / process conditions	Notes
Are the inlet and outlet runs respected?	Inlet run $\geq 5 \times \text{DN}$ Outlet run $\geq 2 \times \text{DN}$
Is the measuring device protected against moisture and direct sunlight?	-
Is the sensor adequately protected against vibration (attachment, support)?	Acceleration up to 2 g in accordance with IEC 600 68-2-6 → 155

4 Wiring



Warning!

When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to this Operating Manual. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.



Note!

The device does not have an internal power switch. For this reason, assign the device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

4.1 PROFIBUS cable specifications

4.1.1 PROFIBUS DP cable specification

Cable type

Two versions of the bus line are specified in IEC 61158. Cable type A can be used for all transmission rates up to 12 Mbit/s. Please refer to the table for the cable parameters:

Cable type A	
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Core cross-section	>0.34 mm ² , corresponds to AWG 22
Cable type	Twisted in pairs, 1 x 2, 2 x 2 or 1 x 4 wire
Loop-resistance	110 Ω /km
Signal damping	Max. 9 dB over the entire length of the cable section
Shielding	Copper braided shielding or braided shielding and foil shielding

Bus structure

Note the following points:

- The maximum line length (segment length) depends on the transmission rate.
For cable type A, the maximum line length (segment length) is as follows:

Transmission rate [kBit/s]	9.6 to 93.75	187.5	500	1500	3000 to 12000
Line length [m] ([inch])	1200 (4000)	1000 (3300)	400 (1300)	200(650)	100(330)

- A maximum of 32 users are permitted per segment.
- Each segment is terminated at either end with a terminating resistor.
- The bus length or the number of users can be increased by introducing a repeater.
- The first and last segment can comprise max. 31 devices.
The segments between the repeaters can comprise max. 30 stations.
- The maximum distance between two bus users can be calculated as follows: $(NO_REP + 1) \times$ segment length

Note!

NO_REP = maximum number of repeaters that may be switched in series depending on the repeater in question.

Example

In accordance with manufacturer specifications, 9 repeaters can be switched in series when using a standard line. The maximum distance between two bus users at a transmission rate of 1.5 MBit/s can be calculated as follows: $(9 + 1) \times 200 \text{ m} = 2000 \text{ m}$

Spurs

Note the following points:

- Length of spurs < 6.6 m (21.7 ft) (at max. 1.5 MBit/s)
- No spurs should be used for transmission rates > 1.5 MBit/s. The line between the connector and the bus driver is described as a spur. Experience has shown that you should proceed with caution when configuring spurs. For this reason, you cannot assume that the sum of all spurs at 1.5 MBit/s will be 6.6 m (21.7 ft). This is affected greatly by the arrangement of the field devices. Therefore, we recommend that if possible, you do not use any spurs at transmission rates > 1.5 MBit/s.
- If you cannot avoid using spurs, then they may not include any bus terminators.

Bus termination

It is important to terminate the RS485 line correctly at the start and end of the bus segment, since impedance mismatch results in reflections on the line which can cause faulty data transmission. →  74

Further information

General information and further notes regarding the wiring are contained in BA034S/04: "Guidelines for planning and commissioning, PROFIBUS DP/PA, field communication."

4.1.2 PROFIBUS PA cable specification

Cable type

Twin-core cables are recommended for connecting the device to the fieldbus. Following IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the fieldbus, only two of which (cable types A and B) are shielded.

- Cable types A or B are particularly preferable for new installations. Only these types have cable shielding that guarantees adequate protection from electromagnetic interference and thus the most reliable data transfer. In the case of type B multi-pair cables, multiple fieldbuses with the same degree of protection may be operated on one cable. No other circuits are permissible in the same cable.
- Practical experience has shown that cable types C and D should not be used due to the lack of shielding, since the freedom from interference generally does not meet the requirements described in the standard.

The electrical data of the fieldbus cable have not been specified but determine important characteristics of the design of the fieldbus, such as distances bridged, number of users, electromagnetic compatibility etc.

	Type A	Type B
Cable structure	Twisted pair, shielded	One or more twisted pairs, fully shielded
Wire cross-section	0.8 mm ² (AWG 18)	0.32 mm ² (AWG 22)
Loop-resistance (DC)	44 Ω/km	112 Ω/km
Characteristic impedance at 31.25 kHz	100 Ω ± 20%	100 Ω ± 30%
Attenuation constant at 39 kHz	3 dB/km	5 dB/km
Capacitive asymmetry	2 nF/km	2 nF/km
Envelope delay distortion (7.9 to 39 kHz)	1.7 μs/km	*
Shield coverage	90%	*
Max. cable length (incl. spurs > 1 m (> 3 ft))	1 900 m (6200 ft)	1 200 m (4000 ft)

* Not specified

Suitable fieldbus cables from various manufacturers for non-hazardous areas are listed below:

- Siemens: 6XV1 830-5BH10
- Belden: 3076F
- Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Maximum overall cable length

The maximum network expansion depends on the type of explosion protection and the cable specifications. The overall cable length combines the length of the main cable and the length of all spurs >1 m (>3 ft).

Note the following points:

- The maximum permissible overall cable length depends on the cable type used:

Type A	1900 m	6200 ft
Type B	1200 m	4000 ft

- If repeaters are used, the maximum permissible cable length is doubled.
A maximum of three repeaters are permitted between user and master.

Maximum spur length

The line between the distribution box and field device is described as a spur.

In the case of non-Ex applications, the max. length of a spur depends on the number of spurs (>1 m):

Number of spurs		1 to 12	13 to 14	15 to 18	19 to 24	25 to 32
Max. length per spur	[m]	120	90	60	30	1
	[ft]	400	300	200	100	3

Number of field devices

In systems that meet FISCO with EEx ia type of protection, the line length is limited to max. 1000 m (3280 in) . A maximum of 32 users per segment in non-Ex areas or a maximum of 10 users in an Ex-area (EEx ia IIC) is possible. The actual number of users must be determined during configuration.

Bus termination

The start and end of each fieldbus segment are always to be terminated with a bus terminator. With various junction boxes (non-Ex), the bus termination can be activated via a switch. If this is not the case, a separate bus terminator must be installed.

Note the following points:

- In the case of a branched bus segment, the device furthest from the segment coupler represents the end of the bus.
- If the fieldbus is extended with a repeater then the extension must also be terminated at both ends.

Further information

General information and further notes regarding the wiring are contained in BA034S/04: "Guidelines for planning and commissioning, PROFIBUS DP/PA, field communication."

4.1.3 Shielding and grounding

When planning the shielding and grounding for a fieldbus system, there are three important points to consider:

- Electromagnetic compatibility (EMC)
- Explosion protection
- Safety of the personnel

To ensure the optimum electromagnetic compatibility of systems, it is important that the system components and above all the cables, which connect the components, are shielded and that no portion of the system is unshielded. Ideally, the cable shields are connected to the normally metal housings of the connected field devices. Since these are generally connected to the protective ground, the shield of the bus cable is grounded many times. Keep the stripped and twisted lengths of cable shield to the terminals as short as possible.

This approach, which provides the best electromagnetic compatibility and personal safety, can be used without restriction in systems with good potential matching.

In the case of systems without potential matching, a power supply frequency (50 Hz) equalizing current can flow between two grounding points which, in unfavorable cases, e.g. when it exceeds the permissible shield current, may destroy the cable.

To suppress the low frequency equalizing currents on systems without potential matching, it is therefore recommended to connect the cable shield directly to the building ground (or protective ground) at one end only and to use capacitive coupling to connect all other grounding points.



Caution!

The legal EMC requirements are fulfilled **only** when the cable shield is grounded on both sides!

4.2 Connecting the remote version

4.2.1 Connecting Promag W/P/H



Warning!

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



Caution!

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

Procedure

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



Caution!

Secure the connecting cable (see "Length of connecting cable" → 20).

4. Terminate the signal and coil current cable in accordance with the table:
Promag W, Promag P → Please see the "Cable termination" table → 46
Promag H → Please see the "Cable termination" table → 47
5. Set up the wiring between the sensor and the transmitter.
The wiring diagram applicable to your device can be found:
 - in the relevant diagram:
→ 28 (Promag W, Promag P); → 29 (Promag H)
 - in the cover of the sensor and transmitter.



Note!

The cable shields of the Promag H sensor are grounded using strain relief clamps (please see the "Cable termination" table → 47).



Caution!

Insulate the cable shields that are not connected. This eliminates the risk of short-circuits with neighboring cable shields inside the connection housing.

6. Transmitter: Secure the cover on the connection compartment (a).
7. Sensor: Mount the cover on the connection housing (b).

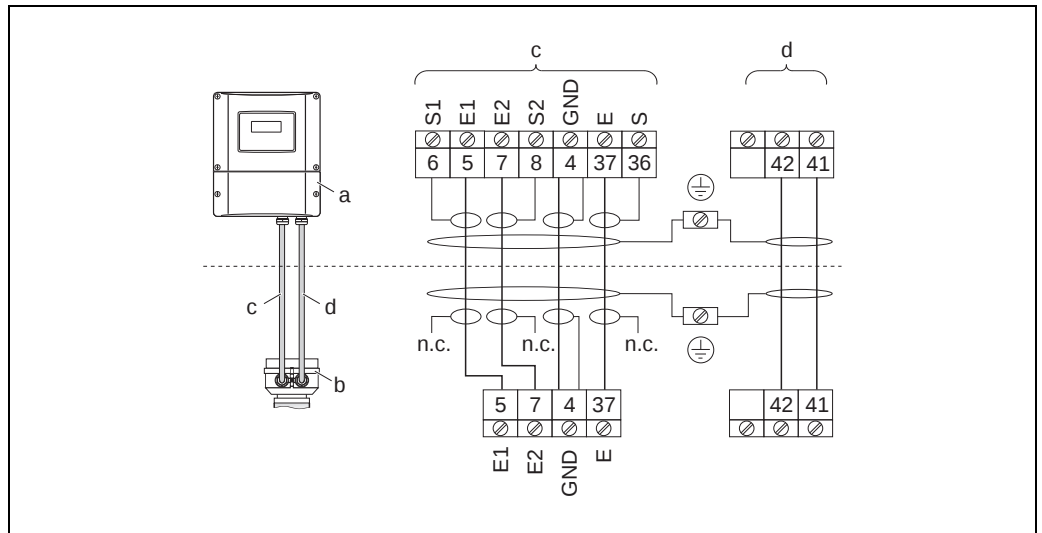
Promag W, P

Fig. 28: 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 = brown, 7/8 = white, 4 = green, 37/36 = yellow

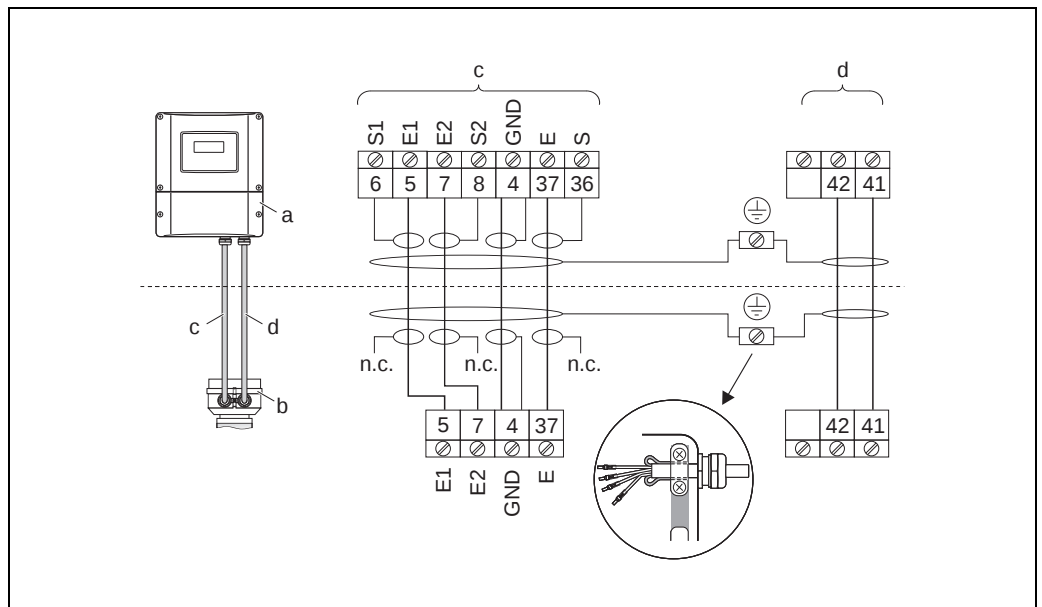
Promag H

Fig. 29: Connecting the remote version of Promag H

- 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.:

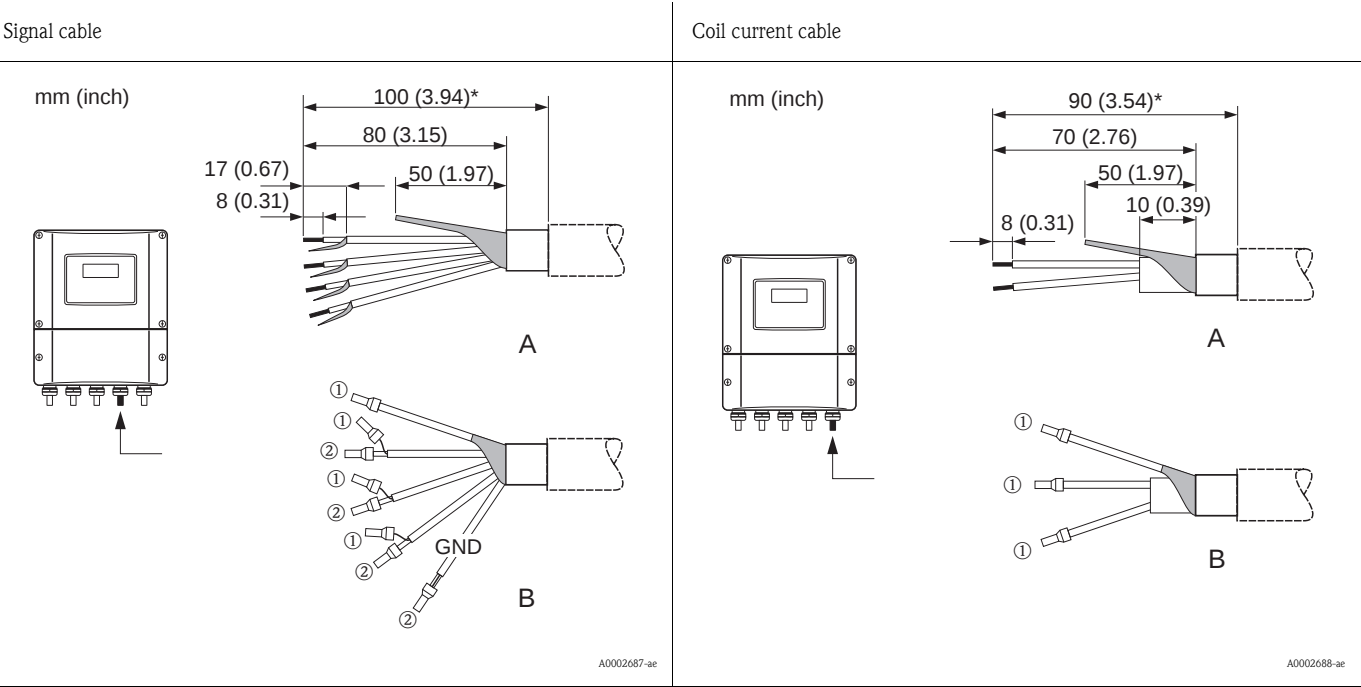
5/6 = brown, 7/8 = white, 4 = green, 37/36 = yellow

Cable termination in remote version
Promag W, Promag P

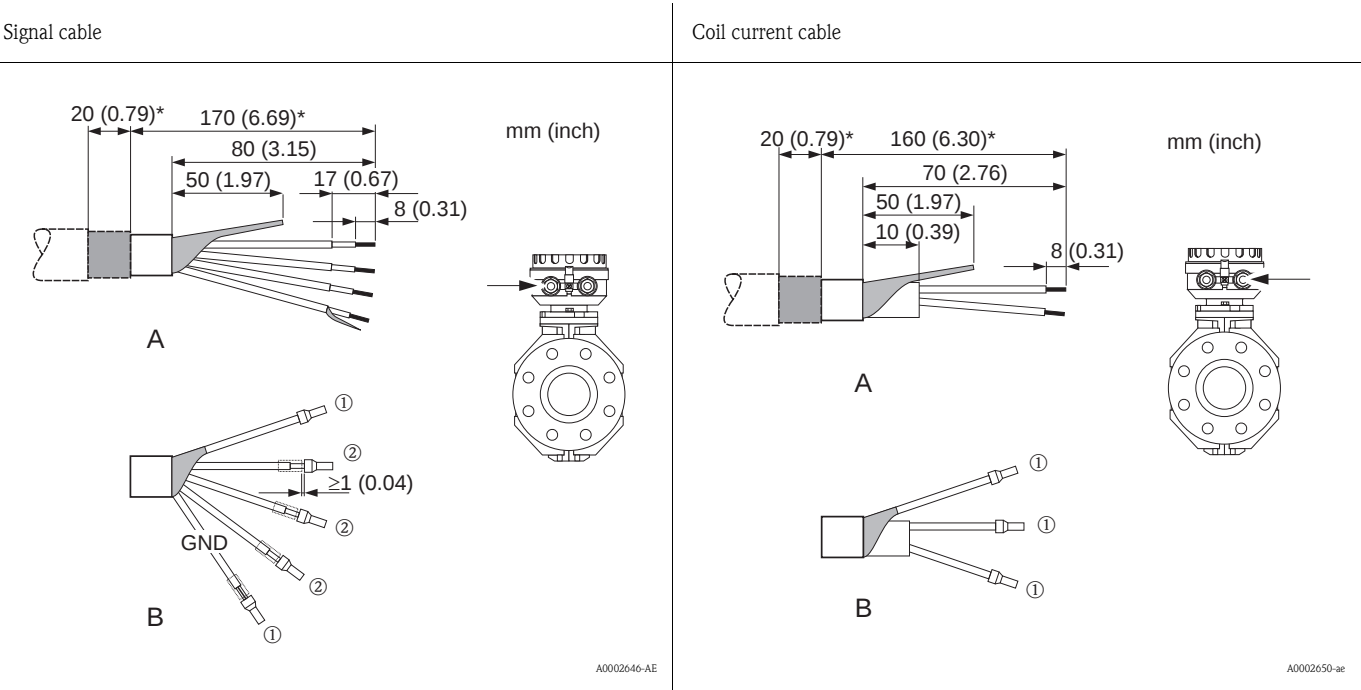
Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with wire end ferrules (detail B: ① = red ferrules, Ø 1.0 mm; ② = white ferrules, Ø 0.5 mm)
* Stripping for reinforced cables only

- ⚠ Caution!
- When fitting the connectors, pay attention to the following points:
- *Signal cable* → Make sure that the wire end ferrules 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



SENSOR



Cable termination in remote version Promag H

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 = ferrules red, Ø 1.0 mm; ② = ferrule white, Ø 0.5 mm)

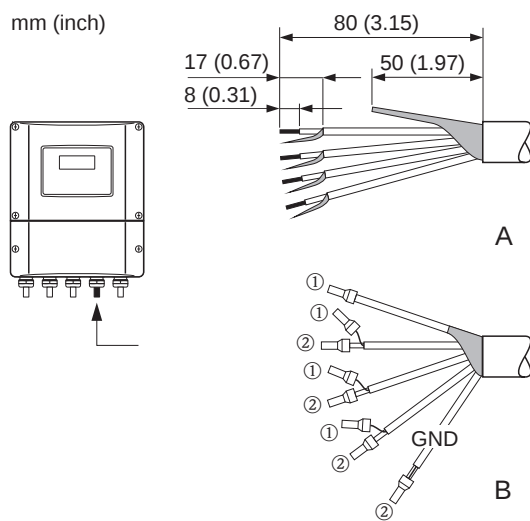
⚠ Caution!

When fitting the connectors, pay attention to the following points:

- *Signal cable* → Make sure that the wire end ferrules 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.
- On the sensor side, reverse both cable shields approx. 15 mm over the outer jacket. The strain relief ensures an electrical connection with the connection housing.

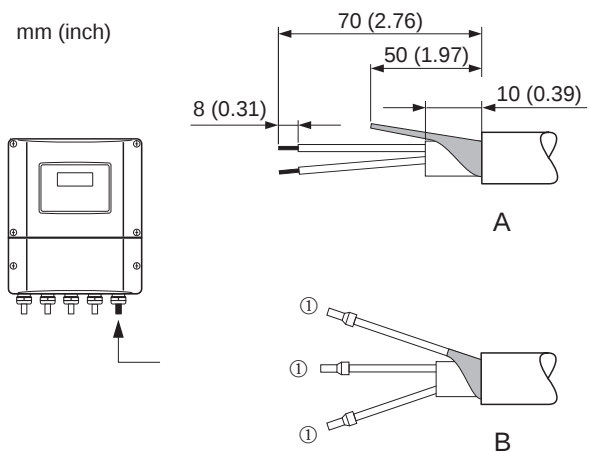
TRANSMITTER

Signal cable



A0002686-ae

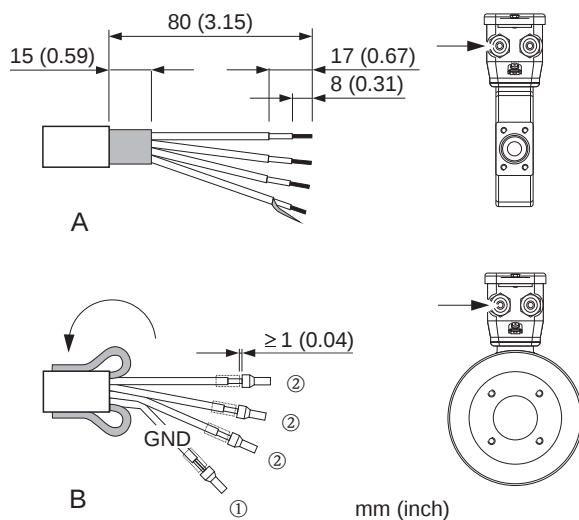
Coil current cable



A0002684-ae

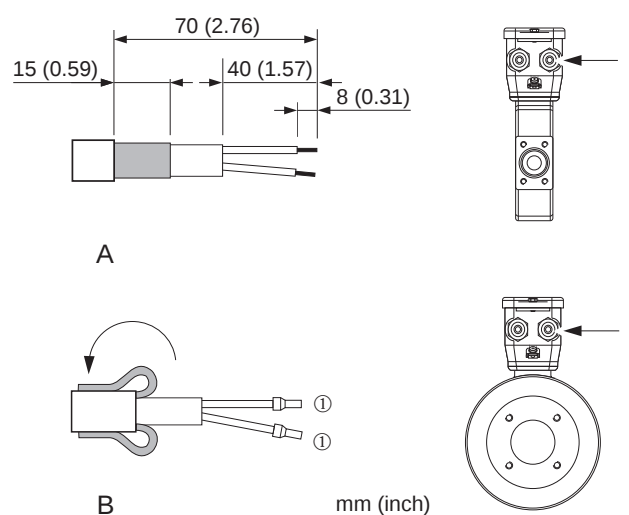
SENSOR

Signal cable



A0002647-ae

Coil current cable



A0002648-ae

4.2.2 Cable specifications

Signal cable

- $3 \times 0.38 \text{ mm}^2$ PVC cable with common, braided copper shield ($\varnothing \sim 7 \text{ mm}$) and individually shielded cores
- With Empty Pipe Detection (EPD): $4 \times 0.38 \text{ mm}^2$ PVC cable with common, braided copper shield ($\varnothing \sim 7 \text{ mm}$) and individually shielded cores
- Conductor resistance: $\leq 50 \text{ } \Omega/\text{km}$
- Capacitance: core/shield: $\leq 420 \text{ pF/m}$
- Operating temperature: -20 to $+80 \text{ } ^\circ\text{C}$
- Conductor cross-section: max. 2.5 mm^2

Coil cable

- $2 \times 0.75 \text{ mm}^2$ PVC cable with common, braided copper shield ($\varnothing \sim 7 \text{ mm}$)
- Conductor resistance: $\leq 37 \text{ } \Omega/\text{km}$
- Capacitance: core/core, shield grounded: $\leq 120 \text{ pF/m}$
- Operating temperature: -20 to $+80 \text{ } ^\circ\text{C}$
- Conductor cross-section: max. 2.5 mm^2
- Test current for cable insulation: $\geq 1433 \text{ V AC rms } 50/60 \text{ Hz}$ or $\geq 2026 \text{ V DC}$

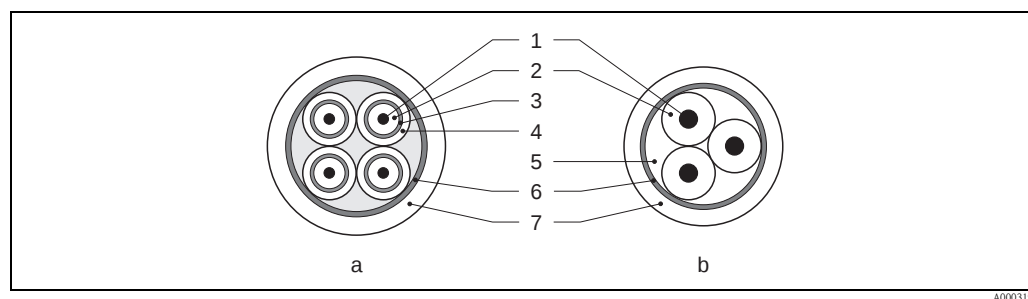


Fig. 30: Cable cross-section

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.

We recommend such cables for the following cases:

- Directly buried cable
- Cables endangered by rodents
- Device operation which should comply with the IP 68 (NEMA 6P) standard 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.

4.3 Connecting the measuring unit

4.3.1 Terminal assignment



Note!

The electrical characteristic quantities are listed in the "Technical data" section.

PROFIBUS DP



Caution!

Only certain combinations of submodules (see Table) on the I/O board are permissible. The individual slots are also marked and assigned to the following terminals in the connection compartment of the transmitter:

- "INPUT / OUTPUT 3" slot = terminals 22/23
- "INPUT / OUTPUT 4" slot = terminals 20/21

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-) Submodule on slot No. 4	22 (+) / 23 (-) Submodule on slot No. 3	24 (+) / 25 (-) Fixed on I/O board	26 = B (RxD/TxD-P) 27 = A (RxD/TxD-N) Fixed on I/O board
53***_*****J	–	–	+5V(ext. termination)	PROFIBUS DP
53***_*****V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
53***_*****P	Current output	Frequency output	Status input	PROFIBUS DP

PROFIBUS PA

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 = PA + ¹⁾ 27 = PA - ¹⁾
53***_*****F	–	–	–	PROFIBUS PA, Ex i
53***_*****H	–	–	–	PROFIBUS PA

¹⁾With integrated reverse polarity protection

4.3.2 Transmitter connection



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 parts of the electronics.
- Risk of electric shock. Connect the protective ground 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 supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

1. Unscrew the connection compartment cover (a) from the transmitter housing.
2. Feed the power supply cable (b), the signal cable (d) and the fieldbus cable (e) through the appropriate cable entries.
3. Perform wiring in accordance with the respective terminal assignment and the associated wiring diagram.



Caution!

- Risk of damage to the fieldbus cable!
Observe the information about shielding and grounding the fieldbus cable. →  43
 - We recommend that the fieldbus cable not be looped using conventional cable glands. If you later replace even just one measuring device, the bus communication will have to be interrupted.
4. Screw the cover of the connection compartment (a) back onto the transmitter housing.

4.3.3 PROFIBUS DP connection diagram

Permanent assignment board (order version 53***_*****J)

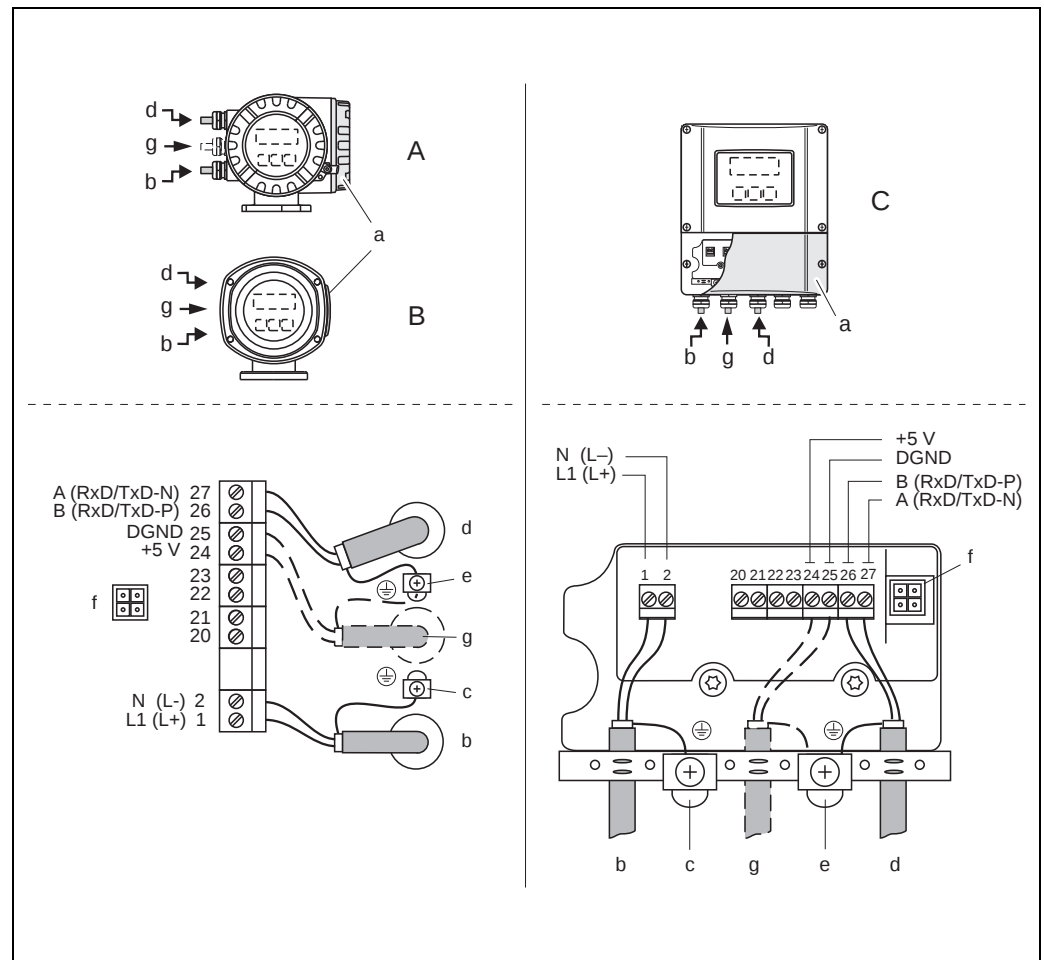


Fig. 31: Connecting the transmitter, cable cross-section: max. 2.5 mm² (14 AWG)

A View A (field housing)

B View B (stainless steel field housing)

C View C (wall-mount housing)

a Connection compartment cover

b 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

c Ground terminal for protective conductor

d Fieldbus cable

Terminal No. 26: B (Rx/D/TxD-P)

Terminal No. 27: A (Rx/D/TxD-N)

e Ground terminal for fieldbus cable shield

Observe the following:

– the shielding and grounding of the fieldbus cable → 43

– that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible

f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

g Cable for external termination:

Terminal No. 24: +5 V

Terminal No. 25: DGND

Flexible assignment boards (order version 53*-*****V and 53***-*****P)**

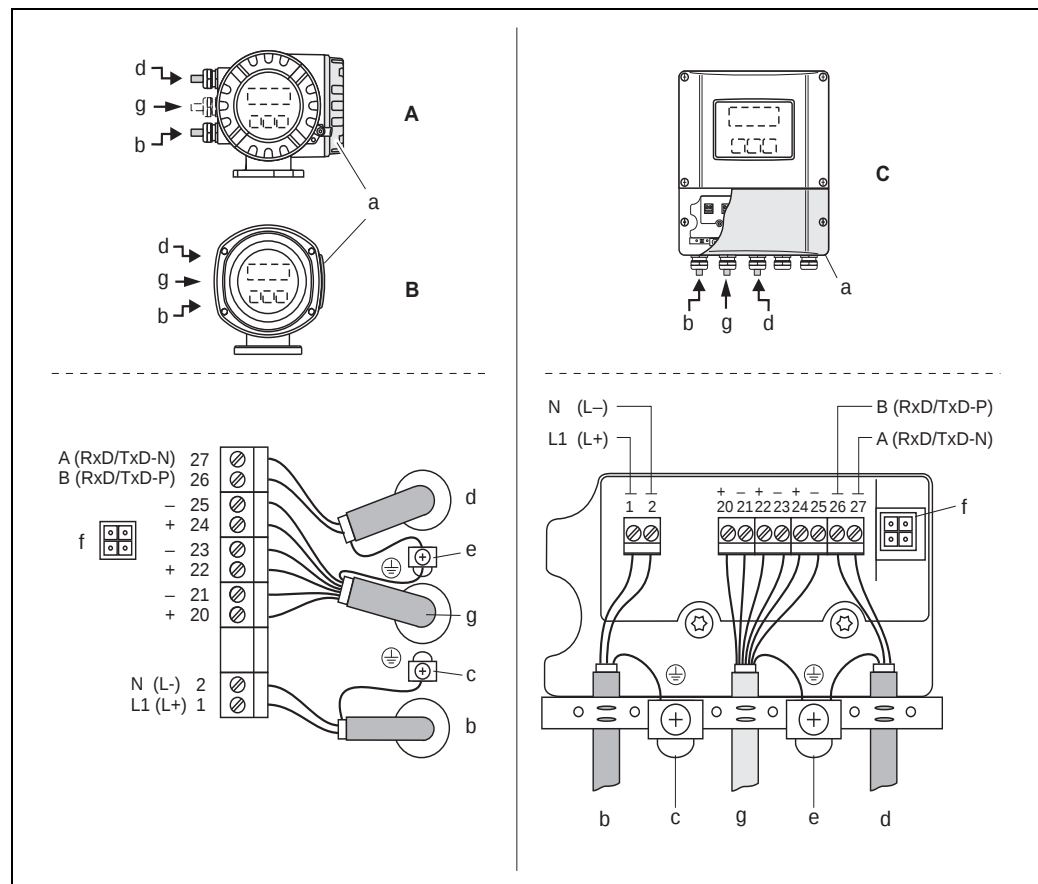


Fig. 32: Connecting the transmitter, cable cross-section: max. 2.5 mm² (14 AWG)

- A View A (field housing)
- B View B (stainless steel field housing)
- C View C (wall-mount housing)
- a Connection compartment cover
- b 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
- c Ground terminal for protective conductor
- d Fieldbus cable
Terminal No. 26: B (Rx/D/TxD-P)
Terminal No. 27: A (Rx/D/TxD-N)
- e Ground terminal for signal cable shield/fieldbus cable shield
Observe the following:
 - the shielding and grounding of the fieldbus cable → 43
 - that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
- f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
- g Signal cable: see Terminal assignment → 49

4.3.4 PROFIBUS PA connection diagram

Permanent assignment boards (order version 53***-*****F and 53***-*****H)

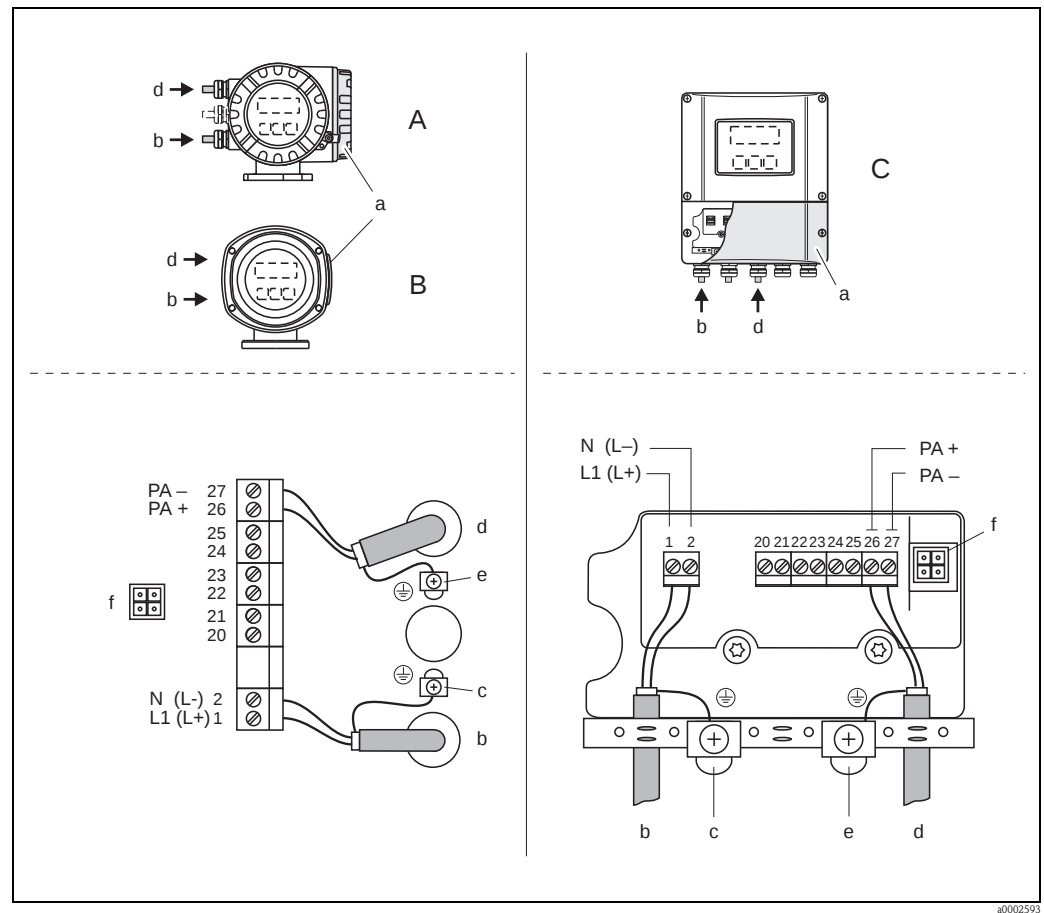


Fig. 33: Connecting the transmitter, cable cross-section: max. 2.5 mm² (14 AWG)

- A View A (field housing)
- B View B (stainless steel field housing)
- C View C (wall-mount housing)
- a Connection compartment cover
- b 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
- c Ground terminal for protective conductor
- d Fieldbus cable:
Terminal No. 26: PA + (with reverse polarity protection)
Terminal No. 27: PA - (with reverse polarity protection)
- e Ground terminal for fieldbus cable shield
- Observe the following:
 - the shielding and grounding of the fieldbus cable → 43
 - that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
- f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

Fieldbus connector



Note!

The connector can only be used for PROFIBUS PA devices.

The connection technology of PROFIBUS PA allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, distribution modules etc.

This connection technology, which uses prefabricated distribution modules and plug-in connectors, offers substantial advantages over conventional wiring:

- Field devices can be removed, replaced or added at any time during normal operation. Communication is not interrupted.
- Installation and maintenance are significantly easier.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel distribution modules.

The device can therefore be supplied with the option of a ready-mounted fieldbus connector.

Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as a spare part → 123.

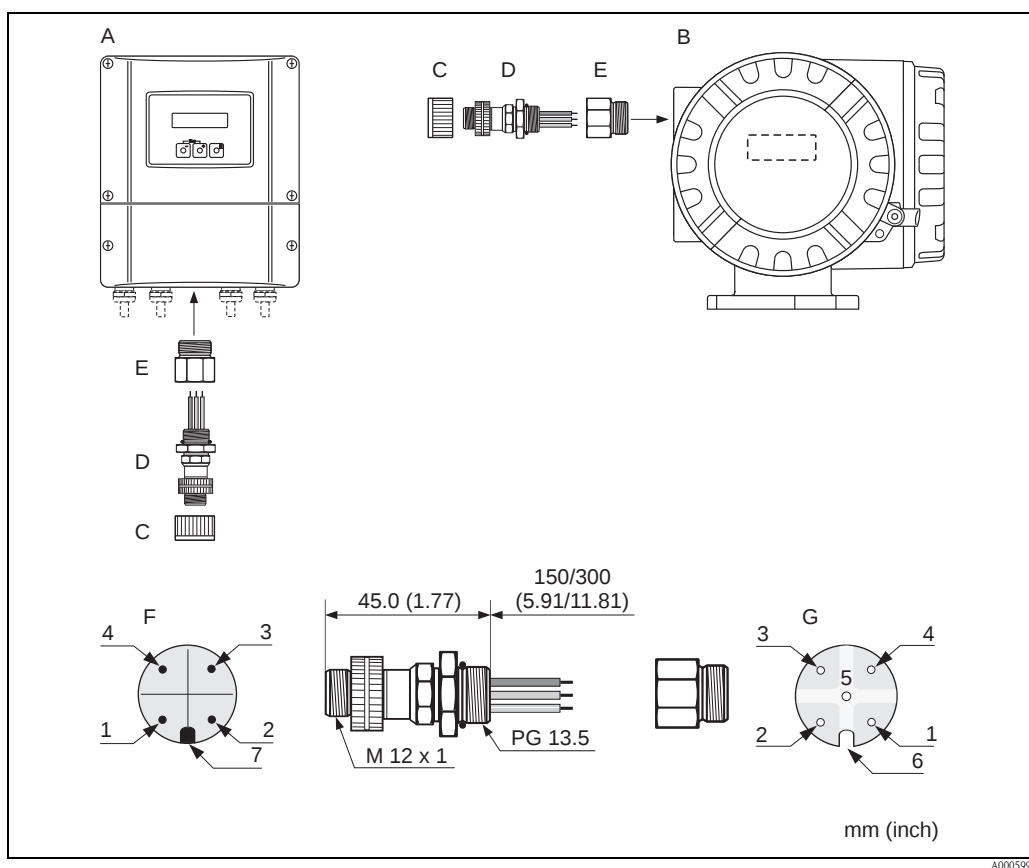


Fig. 34: Connectors for connecting to the PROFIBUS PA

A0005999

- A Aluminum field housing
- B Stainless steel field housing
- C Protection cap for connector
- D Fieldbus connector
- E Adapter PG 13.5 / M 20.5
- F Connector at housing (male)
- G Female connector

Pin assignment / color codes:

- 1 Brown wire: PA + (terminal 26)
- 2 Not connected
- 3 Blue wire: PA - (terminal 27)
- 4 Black wire: ground (instructions for connection → 51)
- 5 Middle female connector not assigned
- 6 Positioning groove
- 7 Positioning key

Technical data (fieldbus connector)

Connection cross section	0.75 mm ² (19 AWG)
Connector thread	PG 13.5
Degree of protection	IP 67 in accordance with DIN 40 050 IEC 529
Contact surface	CuZnAu
Housing material	Cu Zn, surface Ni
Flammability	V - 2 in accordance with UL - 94
Operating temperature	−40 to +85 °C, (−40 to +185 °F)
Ambient temperature	−40 to +150 °C, (−40 to +302 °F)
Nominal current per contact	3 A
Nominal voltage	125 to 150 V DC in accordance with the VDE Standard 01 10/ISO Group 10
Resistance to tracking	KC 600
Volume resistance	≤ 8 mΩ in accordance with IEC 512 Part 2
Insulation resistance	≤ 10 ¹² Ω in accordance with IEC 512 Part 2

Shielding of the supply line/T-box

Use cable glands with good EMC properties, with surrounding contact of the cable gland (iris spring). This requires small differences in potential, and possibly potential matching.

- Do not interrupt the shielding of the PA cable.
- Always keep the connection of the shielding as short as possible.

Ideally, cable glands with iris springs should be used for the connection of the shielding. The shield is placed on the T-box via the iris spring that is inside the cable gland. The shielding mesh is located under the iris spring. When the PG thread is screwed closed, the iris spring is pressed onto the shield, making a conductive connection between the shielding and the metal housing.

A junction box or connection is to be considered part of the shielding (Faraday cage). This is particularly true for offset boxes when these are connected to a PROFIBUS PA measuring device using a plug-in cable. In such a case, use a metallic plug in which the cable shielding is attached to the plug housing (such as prefabricated cables).

4.4 Potential matching



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

Perfect measurement is only ensured when the medium and the sensor have the same electrical potential. Most Promag sensors have a reference electrode installed as standard, which guarantees the required potential equalization.

The following must also be taken into account for potential equalization:

- Company-internal grounding guidelines
- Operating conditions such as material/grounding of piping etc. (see table)

4.4.1 Potential equalization, Promag W, Promag P

Reference electrode available as standard

4.4.2 Potential equalization, Promag H

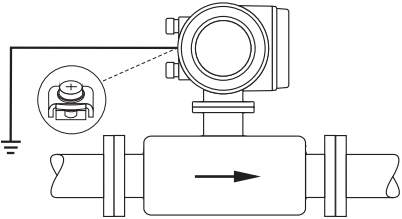
No reference electrode available!
There is always one electrical connection to the fluid via the metallic process connection.



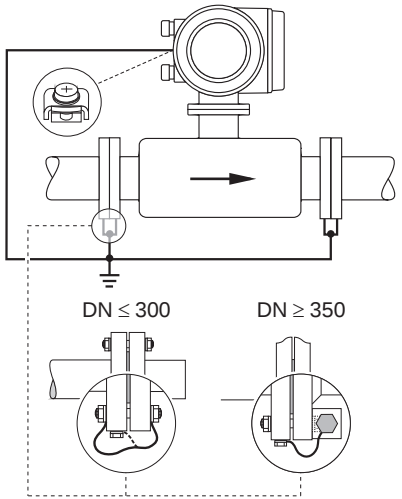
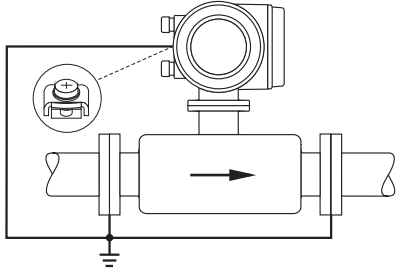
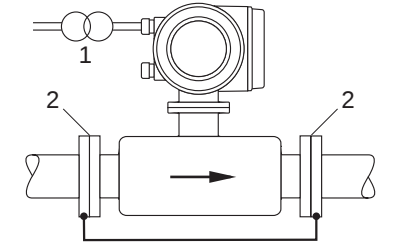
Caution!
When using process connections made of plastic, potential equalization must be guaranteed through the use of grounding rings → 33.
The necessary grounding rings may be ordered separately as an accessory from Endress+Hauser (→ 123).

4.4.3 Connection examples for potential equalization

Standard case

Operating conditions	Potential equalization
When using the measuring device in: ■ metallic, grounded piping Potential equalization is carried out via the ground terminal of the transmitter.  Note! For installation in metal pipes, it is advisable to connect the ground terminal of the transmitter housing to the piping.	 <i>Fig. 35: Via the transmitter's ground terminal</i> A0011892

Special cases

Operating conditions	Potential equalization
When using the measuring device in: ■ metallic, ungrounded piping This type of connection occurs when: ■ the usual potential equalization cannot be guaranteed ■ extremely high equalizing currents are expected A ground cable (copper wire, at least 6 mm² (0.0093 in²)) is used to connect both sensor flanges to the respective pipe flange and ground them. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose. The installation of the ground cable depends on the nominal diameter: ■ DN ≤ 300 (12"): The ground cable is in direct connection with the conductive flange coating and is secured by the flange screws. ■ DN ≥ 350 (14"): The ground cable connects directly to the metal transport bracket.  Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 DN ≤ 300 DN ≥ 350 <i>Fig. 36: Via the transmitter's ground terminal and the pipe flanges</i> AD0011893
When using the measuring device in: ■ Plastic pipes ■ Isolating lined pipes This type of connection occurs when: ■ the usual potential equalization cannot be guaranteed ■ extremely high equalizing currents are expected Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, min. 6 mm² (0.0093 in²)). When installing the ground disks, please comply with the enclosed Installation Instructions.	 <i>Fig. 37: Via the transmitter's ground terminal and the optionally available ground disks</i> AD0011895
When using the measuring device in: ■ pipes with cathodic protection The device is installed in the pipeline in such a way that it is potential-free. Using a ground cable (copper wire, min. 6 mm² (0.0093 in²)), only the two pipe flanges are connected. When doing so, the ground cable is mounted directly on the conductive flange coating using flange screws. Please note the following during installation: ■ The relevant regulations for potential-free installations must be observed. ■ There must not be an electrically conductive connection between the piping and the device. ■ The mounting material must be able to withstand the relevant torques.	 <i>Fig. 38: Potential equalization and cathodic protection</i> 1 Isolation transformer power supply 2 Electrically isolated AD0011896

4.5 Degree of protection

The devices fulfill all the requirements for IP 67 (NEMA 4X).

Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection (NEMA 4X) 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 housing screws and screw covers must be firmly tightened.
- The cables used for connection must be of the specified external diameter → 153.
- Tighten cable glands to prevent leakages.
- 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.
- Close off unused cable entries using suitable insert plugs.
- Do not remove the grommet from the cable entry.

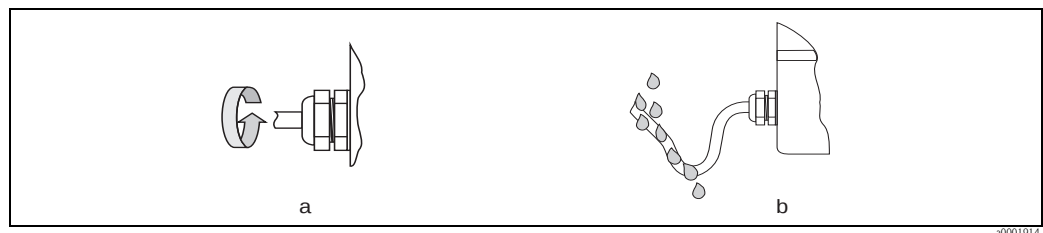


Fig. 39: Installation instructions, cable entries



Caution!

Do not loosen the screws of the sensor housing as otherwise the degree of protection guaranteed by Endress+Hauser no longer applies.



Note!

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

4.6 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 260 V AC (45 to 65 Hz) 20 to 55 V AC (45 to 65 Hz) 16 to 62 V DC
Do the cables comply with the specifications?	PROFIBUS DP → 40 PROFIBUS PA → 41 Sensor cable → 48
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 connection compartment
Are all screw terminals firmly tightened?	-
Have the measures for grounding and potential matching been correctly implemented?	→ 56
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as "water traps"?	→ 58
Are all housing covers installed and firmly tightened?	-
Electrical connection of PROFIBUS DP/PA	Notes
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected to each other correctly?	-
Has each fieldbus segment been terminated at both ends with a bus terminator?	PROFIBUS DP → 74
Has the max. length of the fieldbus cable been observed in accordance with the PROFIBUS specifications?	PROFIBUS DP → 40 PROFIBUS PA → 42
Has the max. length of the spurs been observed in accordance with the PROFIBUS specifications?	PROFIBUS DP → 41 PROFIBUS PA → 42
Is the fieldbus cable fully shielded and correctly grounded?	→ 43

5 Operation

5.1 Quick operation guide

The user has a number of options for configuring and commissioning the device:

1. **Local display (option)** → 61
The local display enables you to read all important variables directly at the measuring point, configure device-specific parameters in the field and perform commissioning.
2. **Configuration programs** → 69
The configuration of profile and device-specific parameters is primarily done via the PROFIBUS interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.
3. **Jumpers/miniature switches for hardware settings**
 - PROFIBUS DP → 72
 - PROFIBUS PA → 77

You can make the following hardware settings using a jumper or miniature switches on the I/O board:

- Address mode configuration (select software or hardware addressing)
- Device bus address configuration (for hardware addressing)
- Hardware write protection enabling/disabling

 **Note!**

A description of the configuration of the current output (active/passive) and the relay output (NC contact/NO contact) is contained in the "Hardware settings" section → 75.

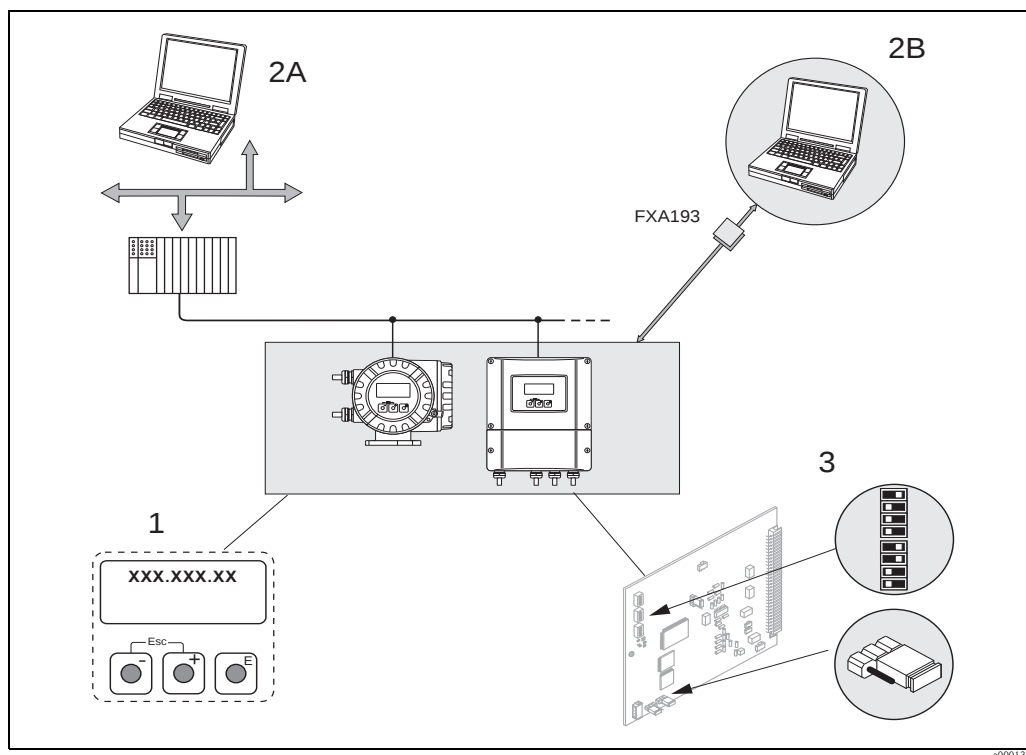


Fig. 40: Methods of operating PROFIBUS PA/DP

- 1 Local display for device operation in the field (option)
- 2A Configuration/operating programs (e.g. FieldCare) for operation via PROFIBUS DP/PA
- 2B Configuration/operating program for operating by means of the FXA193 service interface (e.g. FieldCare)
- 3 Jumper/miniature switches for hardware settings (write protection, device address, address mode)

5.2 Local display

5.2.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the "Quick Setup" or the function matrix.

The display consists of four lines; this is where measured values and/or status variables (direction of flow, empty pipe, bar graph, etc.) are displayed. You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the "Description of Device Functions" manual).

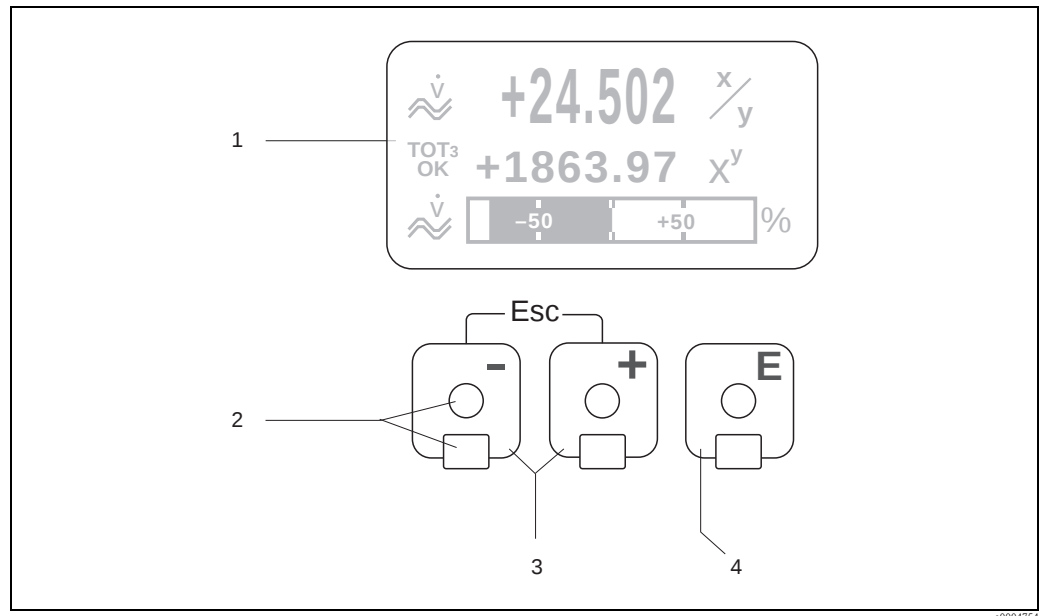


Fig. 41: Display and operating elements

1 Liquid crystal display

The backlit, four-line liquid crystal display shows measured values, dialog texts, fault messages and notice messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode).

Display

2 Optical sensors for Touch Control

3 / keys

- HOME position → Direct access to totalizer values and actual values of inputs/outputs
- Enter numerical values, select parameters
- Select different blocks, groups and 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 the HOME position
- Cancel data entry

4 key (Enter key)

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

5.2.2 Display (operating mode)

The display area consists of three lines in all; this is where measured values are displayed, and/or status variables (direction of flow, bar graph, etc.). You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the "Description of Device Functions" manual).

Multiplex mode:

A maximum of two different display variables can be assigned to each line. Variables multiplexed in this way alternate every 10 seconds on the display.

Error messages:

Display and presentation of system/process errors → 68

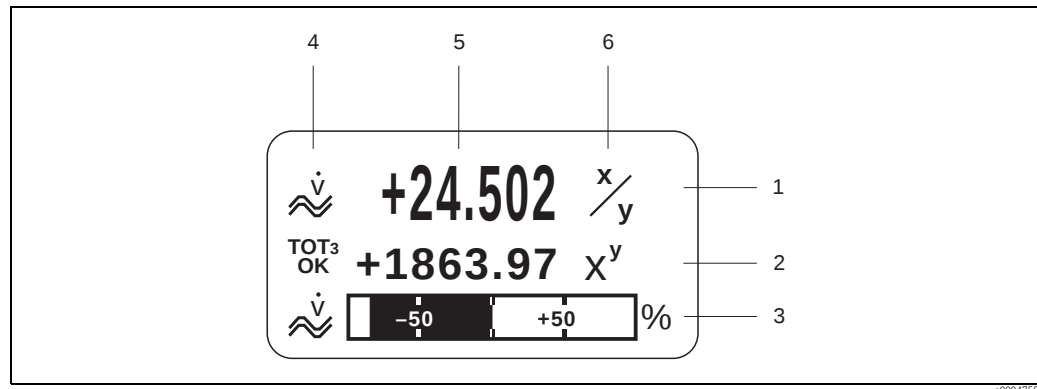


Fig. 42: Typical display for normal operating mode (HOME position)

- 1 Main display line: shows primary measured values, e.g. mass flow in [kg/h]
- 2 Additional line: shows measured variables and status variables, e.g. totalizer No. 3 in [t]
- 3 Information line: shows additional information on the measured variables and status variables, e.g. bar graph display of the full scale value achieved by the mass flow
- 4 "Info icons" field: icons representing additional information on the measured values are shown in this field.
→ 63
- 5 "Measured values" field: the current measured values appear in this field
- 6 "Unit of measure" field: the units of measure and time defined for the current measured values appear in this field

5.2.3 Additional display functions

Depending on the order option (F-CHIP → 121), the local display has different display functions:

Device without batching software:

From HOME position, use the $\boxed{+}\boxed{-}$ keys to open an "Info Menu" containing the following information:

- Totalizer (including overflow)
- Actual values or states of the configured inputs/outputs
- Device TAG number (user-definable)

$\boxed{+}\boxed{-}$ → Scan of individual values within the Info Menu

$\boxed{\text{Esc}}$ (Esc key) → Back to HOME position

Device with batching software:

On measuring devices with installed batching software (F-Chip → 121) and a suitably configured display line, you can carry out filling processes directly using the local display. You will find a detailed description on → 65.

5.2.4 Icons

The icons which appear in the field on the left make it easier to read and recognize measured variables, device status, and error messages.

Icon	Meaning	Icon	Meaning
S	System error	P	Process error
	Fault message (with effect on outputs)	!	Notice message (without effect on outputs)
I 1 to n	Current output 1 to n	P 1 to n	Pulse output 1 to n
F 1 to n	Frequency output 1 to n	S 1 to n	Status output/relay output 1 to n
 a0001181	Measuring mode: PULSATING FLOW	 a0001182	Measuring mode: SYMMETRY (bidirectional)
 a0001183	Measuring mode: STANDARD		
 a0001188	Volume flow	 a0001195	Mass flow
 a0001201	Batching quantity upwards	 a0001202	Batching quantity downwards
 a0001203	Batching quantity	 a0001204	Batch sum
 a0001205	Batch counter (x times)	 ← → (scrolling display)	Cyclic communication via PROFIBUS active, for example via PLC (Class 1 master)
 a0001206	Acyclic communication via PROFIBUS active (e.g. via FieldCare)		
 a0002322	Display value (DISPLAY_VALUE module) with status GOOD = good	 a0002321	Display value (DISPLAY_VALUE module) with status UNC = uncertain
 a0002320	Display value (DISPLAY_VALUE module) with status BAD = bad		
 a0004616	Output value OUT, analog input 1 to 2 (AI module) with status GOOD = good	 a0002325	Output value OUT, totalizer 1 to 3 (TOTAL module) with status GOOD = good

Icon	Meaning	Icon	Meaning
AI 1 AI 2 UNC... UNC a0004617	Output value OUT, analog input 1 to 2 (AI module) with status UNC = uncertain	TOT 1 TOT 3 UNC... UNC a0002327	Output value OUT, totalizer 1 to 3 (TOTAL module) with status UNC= unclear
AI 1 AI 2 BAD... BAD a0004618	Output value OUT, analog input 1 to 2 (AI module) with status BAD = bad	TOT 1 TOT 3 BAD... BAD a0002329	Output value OUT, totalizer 1 to 3 (TOTAL module) with status BAD= bad

5.2.5 Controlling the batching processes using the local display

Filling processes can be carried out directly by means of the local display with the aid of the optional "(Batching)" software package (F-CHIP, accessories → 123). Therefore, the device can be fully deployed in the field as a "batch controller."

Procedure:

- 1. Configure all the required batching functions and assign the lower display info line (= BATCHING KEYS) using the "Batch" Quick Setup menu (→ 85) or use the function matrix (→ 66).
The following "softkeys" then appear on the bottom line of the local display → 43:
 - START = left display key (−)
 - PRESET = middle display key (+)
 - MATRIX = right display key (E)
- 2. Press the "PRESET (+)" key. Various batching process functions requiring configuration will now appear on the display:

"PRESET" → Initial settings for the batching process		
No.	Function	Settings
7200	BATCH SELECTOR	□□ → Selection of the batching fluid (BATCH #1 to 6)
7203	BATCHING QUANTITY	If the "ACCESS CUSTOMER" option was selected for the "PRESET batch quantity" prompt in the "Batching" Quick Setup, the batching quantity can be altered via the local display. If the "LOCKED" option was selected, the batching quantity can only be read and cannot be altered until the private code has been entered.
7265	RESET TOTAL QUANTITY/ TOTALIZER	Resets the batching quantity counter or the total batching quantity to "0".

- 3. After exiting the PRESET menu, you can now start the batching process by pressing "START (−)". New softkeys (STOP/HOLD or GO ON) now appear on the display. You can use these to interrupt, continue or stop the batching process at any time. → 43
STOP (−) → Stops batching process
HOLD (+) → Interrupts batching process (softkey changes to "GO ON")
GO ON (+) → Continues batching process (softkey changes to "HOLD")
After the batch quantity is reached, the "START" or "PRESET" softkeys reappear on the display.

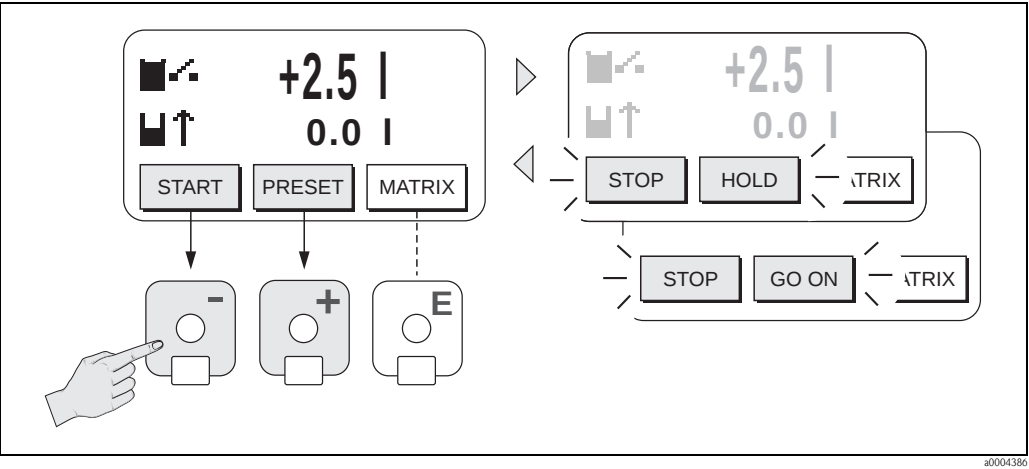


Fig. 43: Controlling batching processes using the local display (softkeys)

5.3 Brief Operating Manual to the function matrix



Note!

- Be certain to observe the general notes → 67
 - Function descriptions → see the "Description of Device Functions" manual
1. HOME position → **E** → Entry into the function matrix
 2. **+** / **-** → Select a block (e.g. OUTPUTS)
 3. **+** / **-** → Select a group (e.g. CURRENT OUTPUT 1)
 4. **+** / **-** → Select a function group (e.g. CONFIGURATION)
 5. Select a function (e.g. TIME CONSTANT)
Change parameter/enter numerical values:
 - +** **-** → Select or enter enable code, parameters, numerical values
 - E** → Save your entries
 6. Exit the function matrix:
 - Press and hold down the Esc key (**Esc**) for longer than 3 seconds → HOME position
 - Repeatedly press the Esc key (**Esc**) → Return step-by-step to HOME position

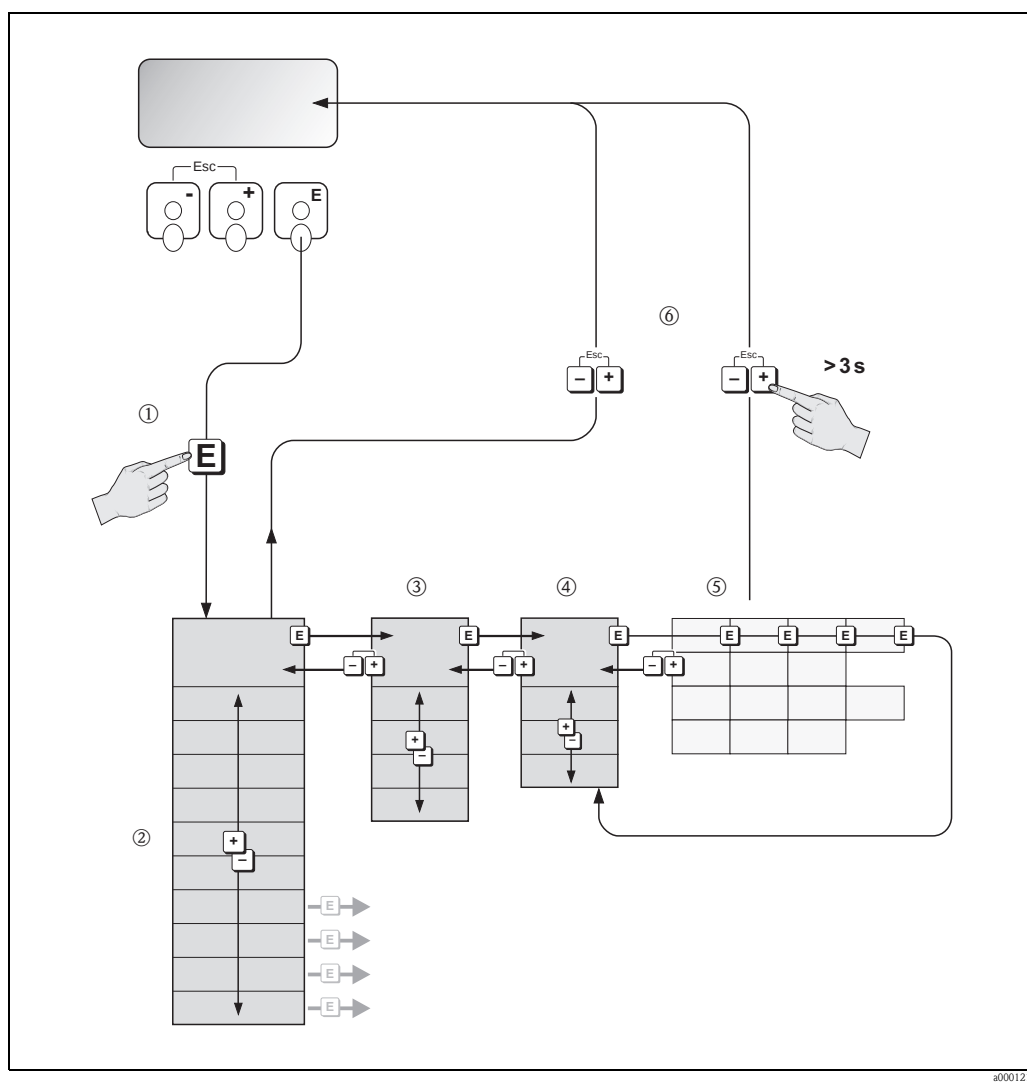


Fig. 44: Selecting functions and configuring parameters (function matrix)

5.3.1 General notes

The Quick Setup menu contains the default settings that are adequate for commissioning. 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 on a number of menu levels (blocks, groups, and function groups).

Comply with the following instructions when configuring functions:

- You select functions as described →  66.
Each cell in the function matrix is identified by a numerical or letter code on the display.
- 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  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.
- Programming mode is disabled automatically if you do not press a key within 60 seconds following automatic return to the HOME position.



Caution!

All functions are described in detail, as is the function matrix itself, in the "Description of Device Functions" manual which is a separate part of this Operating Manual.



Note!

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

5.3.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 53) has to be entered before settings can again be changed.

If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ see the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:

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



Caution!

Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy.

There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to Endress+Hauser. Please contact your Endress+Hauser service organization if you have any questions.

5.3.3 Disabling the programming mode

Programming mode is again disabled if you do not press an operating element within 60 seconds following automatic return to the HOME position.

You can also disable programming in the "ACCESS CODE" function by entering any number (other than the customer's code).

5.4 Error messages

5.4.1 Type of error

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

The measuring system distinguishes between two types of error:

- **System error:**
Includes all device errors, e.g. communication errors, hardware errors, etc. → 127.
- **Process error:**
Includes all application errors, e.g. empty pipe etc. → 136.

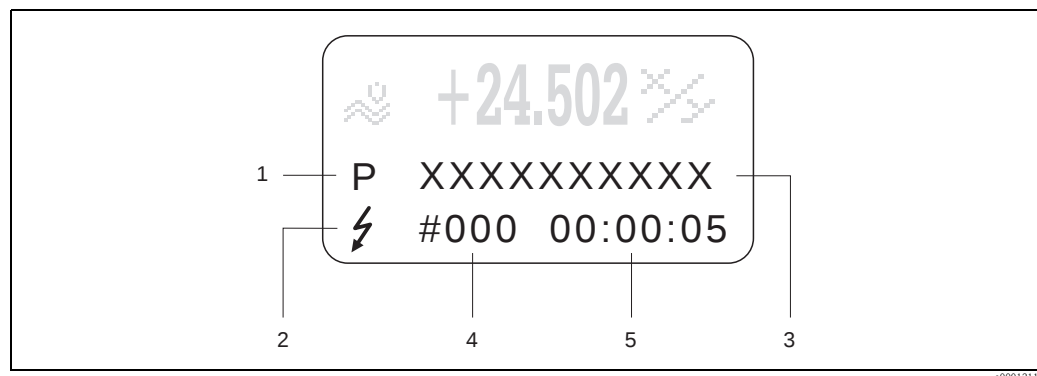


Fig. 45: Error messages on the display (example)

- 1 Error type: P = process error, S = system error
- 2 Error message type: ⚡ = fault message, ! = notice message
- 3 Error designation
- 4 Error number
- 5 Duration of most recent error occurrence (hours:minutes:seconds)

5.4.2 Error message type

The measuring device always assigns system and process errors which occur to two types of error messages (**fault** or **notice messages**) resulting in different weightings. → 127

Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)

- The error in question has no effect on the current operation and the outputs of the measuring device.
- Displayed as → Exclamation mark (!), error type (S: system error, P: process error).
- Displaying the device status on PROFIBUS DP/PA → 127

Fault message (⚡)

- The error in question interrupts or stops the current operation and has an immediate effect on the outputs.
- Displayed as → Lightning flash (⚡), error type (S: system error, P: process error)
- Displaying the device status on PROFIBUS DP/PA → 127



Note!

- Error conditions can be output via the relay outputs or the fieldbus communication.
- If an error message occurs, an upper or lower signal level for the breakdown information according to NAMUR NE 43 can be output via the current output.

5.5 Operating options

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

5.5.1 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.

5.5.2 Operating program "SIMATIC PDM" (Siemens)

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

5.5.3 Device drivers for operating programs

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

PROFIBUS DP

Valid for device software:	3.06.XX	→ DEVICE SOFTWARE function (8100)
PROFIBUS DP device data:		
Profile Version:	3.0	→ PROFILE VERSION function (6160)
Promag 53 ID No.:	1526hex	→ DEVICE ID function (6162)
Profile ID No.:	9741hex	
GSD file information:		
Promag 53 GSD file:	Extended Format (recommended): eh3x1526.gsd Standard Format: eh3_1526.gsd	
	 Note! Before configuring the PROFIBUS network, read and follow the information for using the GSD file →  96	
Bitmaps:	EH_1526_d.bmp/.dib EH_1526_n.bmp/.dib EH_1526_s.bmp/.dib	
Profile GSD file:	PA039741.gsd	
Software release:	06.2010	
Operating program/Device driver:	Sources for obtaining device drivers/program updates:	
Promag 53 GSD file:	■ www.endress.com → Download ■ www.profibus.com ■ CD-ROM (Endress+Hauser order number: 56003894)	
FieldCare/DTM	■ www.endress.com → Download ■ CD-ROM (Endress+Hauser order number: 56004088) ■ DVD (Endress+Hauser order number: 70100690)	
SIMATIC PDM	■ www.endress.com → Download	

Tester/simulator:	
Device:	How to acquire:
Fieldcheck	■ Update by means of FieldCare with the Flow Device FXA193/291 DTM in the Fieldflash module.



Note!

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

PROFIBUS PA

Valid for device software:	3.06.XX	→ DEVICE SOFTWARE function (8100)
PROFIBUS PA device data:		
Profile Version:	3.0	→ PROFILE VERSION function (6160)
Promag 53 ID No.:	1527hex	→ DEVICE ID function (6162)
Profile ID No.:	9741hex	
GSD file information:		
Promag 53 GSD file:	Extended Format (recommended): eh3x1527.gsd Standard Format: eh3_1527.gsd	
	 Note! Before configuring the PROFIBUS network, read and follow the information for using the GSD file → 96	
Bitmaps:	EH_1527_d.bmp/.dib EH_1527_n.bmp/.dib EH_1527_s.bmp/.dib	
Profile GSD file:	PA139741.gsd	
Software release:	06.2010	
Operating program/device driver:	Sources for obtaining device drivers/program updates:	
Promag 53 GSD file:	■ www.endress.com → Download ■ www.profibus.com ■ CD-ROM (Endress+Hauser order number: 56003894)	
FieldCare/DTM	■ www.endress.com → Download ■ CD-ROM (Endress+Hauser order number: 56004088) ■ DVD (Endress+Hauser order number: 70100690)	
SIMATIC PDM	■ www.endress.com → Download	

Tester/simulator:	
Device:	How to acquire:
Fieldcheck	■ Update by means of FieldCare with the Flow Device FXA193/291 DTM in the Fieldflash module.

**Note!**

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

5.6 Hardware PROFIBUS DP settings

5.6.1 Configuring the write protection

A jumper on the I/O board provides the means of switching hardware write protection on or off. When the hardware write protection is switched on, it is **not** possible to write to the device parameters via PROFIBUS (cyclic data transmission, e.g. via FieldCare).



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. → 143
3. Configure the hardware write protection accordingly with the aid of the jumpers (see Figure).
4. Installation is the reverse of the removal procedure.

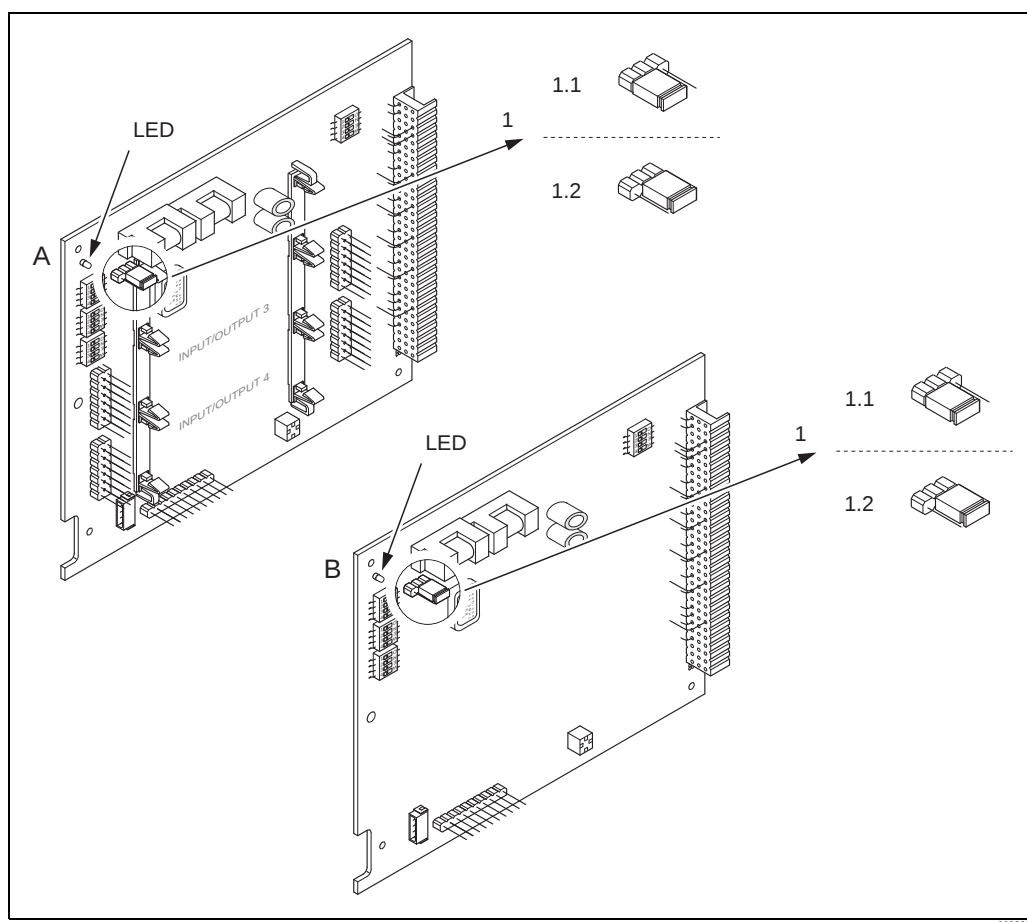


Fig. 46: Switching write protection on and off with the aid of a jumper on the I/O board

A Flexible assignment board

B Permanent assignment board

1 Jumper for switching write protection on and off

1.1 Write protection switched on = it is **not** possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare)

1.2 Write protection switched off (factory setting) = it is possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare).

LED Overview of LED states:

- Lit continuously → Ready for operation
- Not lit → Not ready for operation
- Flashing → System or process error present → 125

5.6.2 Configuring the device address

The address must always be configured for a PROFIBUS DP/PA device. The valid device addresses are in the range from 0 to 126. In a PROFIBUS DP/PA network, each address can only be assigned once. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the address 126 and with software addressing.

Addressing via local operation

Addressing takes place in the FIELDBUS ADDRESS function (6101) → see the "Description of Device Functions" manual.

Addressing via miniature switches



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. Loosen the Allen screw (3 mm) of the securing clamp.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Remove the local display (if present) by loosening the set screws of the display module.
4. Set the position of the miniature switches on the I/O board using a sharp pointed object.
5. Installation is the reverse of the removal procedure.

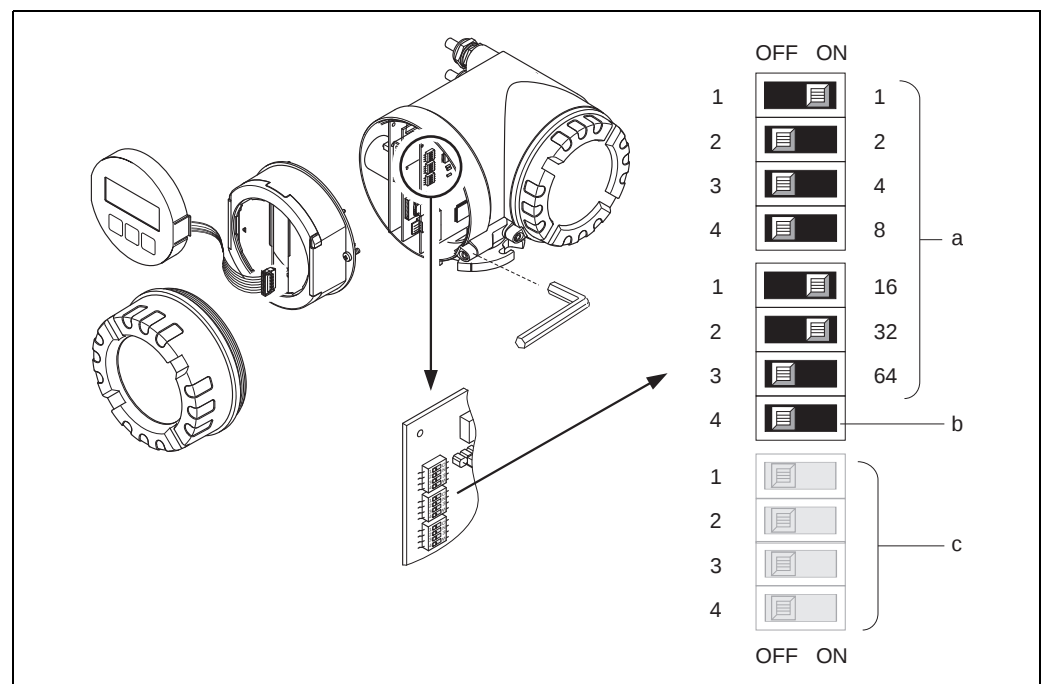


Fig. 47: Addressing with the aid of miniature switches on the I/O board

- a Miniature switches for setting the device address (illustrated: $1 + 16 + 32 = \text{device address } 49$)
- b Miniature switches for the address mode (method of addressing):
 OFF = software addressing via local operation (factory setting)
 ON = hardware addressing via miniature switches
- c Miniature switches not assigned

5.6.3 Configuring the terminating resistors



Note!

It is important to terminate the RS485 line correctly at the start and end of the bus segment since impedance mismatch results in reflections on the line which can cause faulty communication transmission.



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.

- For baud rates up to 1.5 MBaud, the termination is set via the terminating switch SW 1 for the last transmitter on the bus: ON - ON - ON - ON.
- Device is operated with a baud rate >1.5 MBaud: due to the capacitive load of the user and the resulting line reflection, make sure that an external termination is used.
In addition, the signal lines have to be protected (= shielded and grounded) for flexible assignment boards → 52.

The miniature switch for termination is located on the I/O board (see Figure):

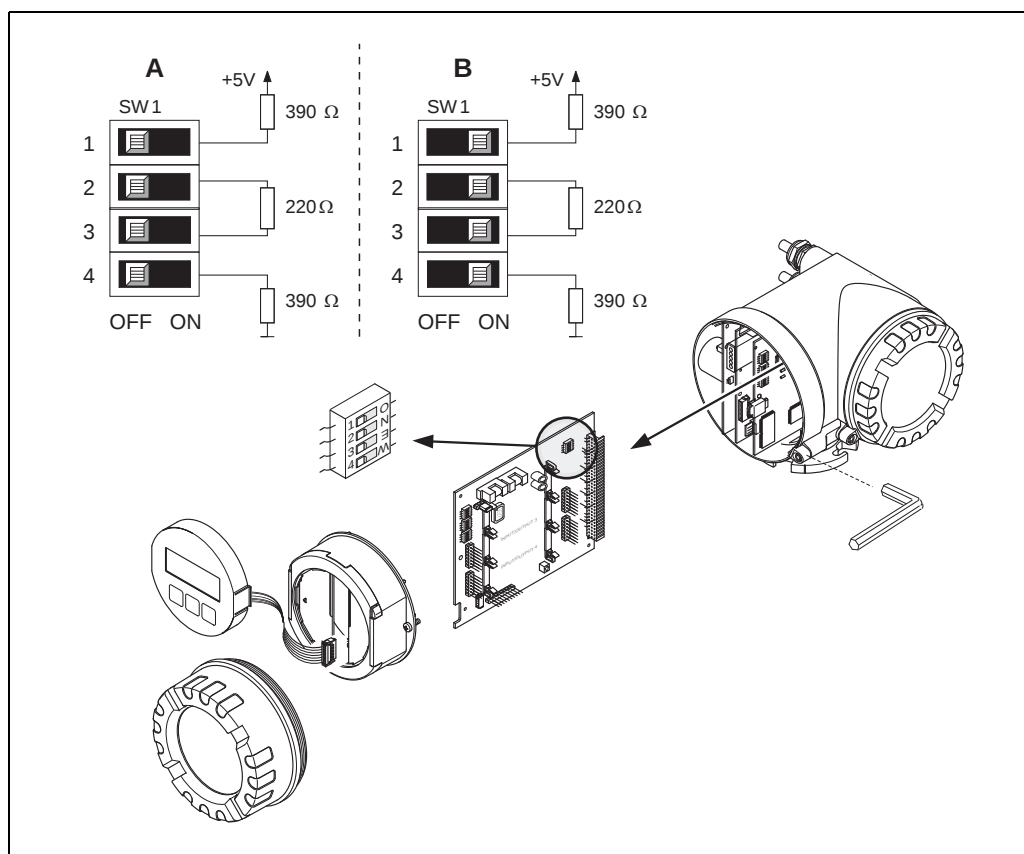


Fig. 48: Configuring the terminating resistors (for baud rates < 1.5 MBaud)

A = Factory setting

B = Setting at the last transmitter



Note!

It is generally recommended to use external termination since if a device that is terminated internally is defect, this can result in the failure of the entire segment.

5.6.4 Current output configuration

The current output is configured as "active" or "passive" by means of various jumpers on the current submodule.



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 → 143.
3. Position the jumpers (see Figure).



Caution!

Risk of destroying the measuring device. Set the jumpers exactly as shown in the diagram. 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.

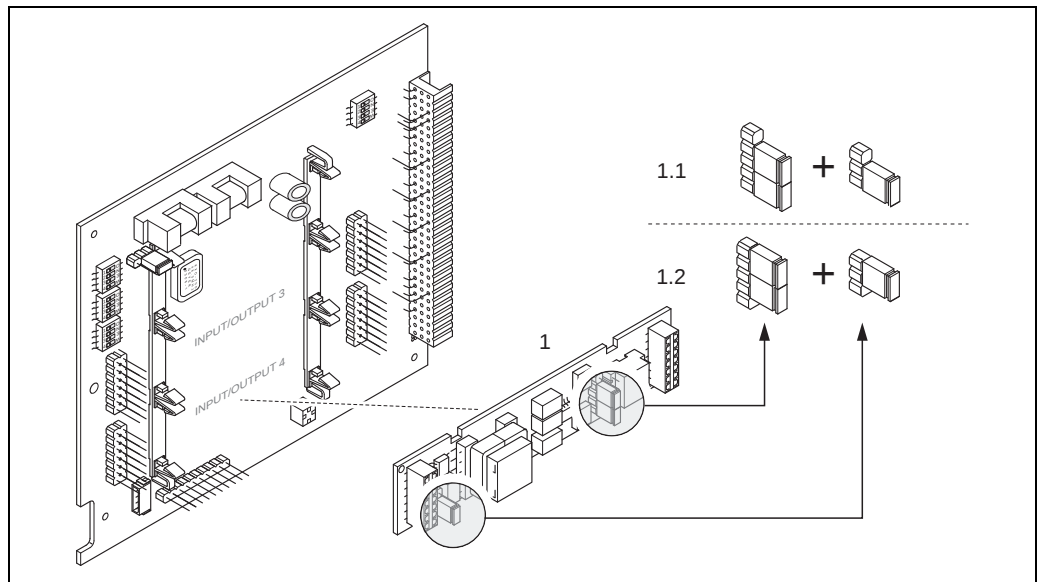


Fig. 49: Configuring the current input with the aid of jumpers (I/O board)

- 1 Current output
- 1.1 Active current output (default)
- 1.2 Passive current output

5.6.5 Relay output configuration

The relay contact can be configured as normally open (NO or make) or normally closed (NC or break) contacts by means of two jumpers on the pluggable submodule. This configuration can be called up at any time with the ACTUAL STATUS RELAY function (4740).



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 → 143.
3. Position the jumpers (see Figure).



Caution!

If you change the setting, you must always change the positions of **both** jumpers!
Note precisely the specified positions of the jumpers.

4. Installation of the I/O board is the reverse of the removal procedure.

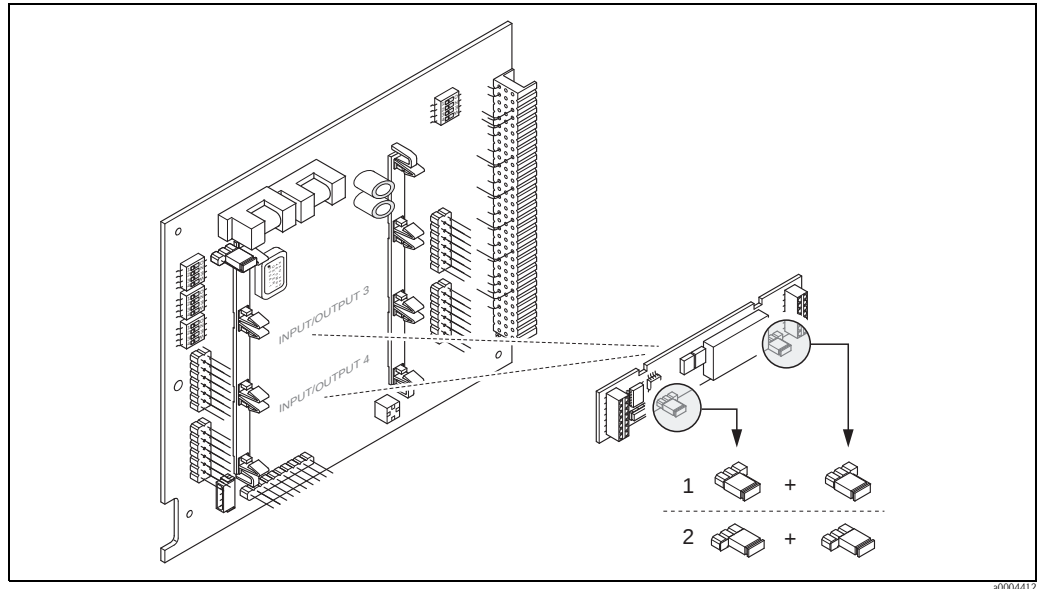


Fig. 50: Configuring relay contacts (NC/NO) on the convertible I/O board (submodule) with the help of jumpers.

- 1 Configured as NO contact (factory setting, relay 1)
- 2 Configured as NC contact (factory setting, relay 2)

5.7 Hardware PROFIBUS PA settings

5.7.1 Configuring the write protection

A jumper on the I/O board provides the means of switching hardware write protection on or off. When the hardware write protection is switched on, it is **not** possible to write to the device parameters via PROFIBUS (cyclic data transmission, e.g. via FieldCare).



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 → 143.
3. Configure the hardware write protection accordingly with the aid of the jumpers (see Figure).
4. Installation is the reverse of the removal procedure.

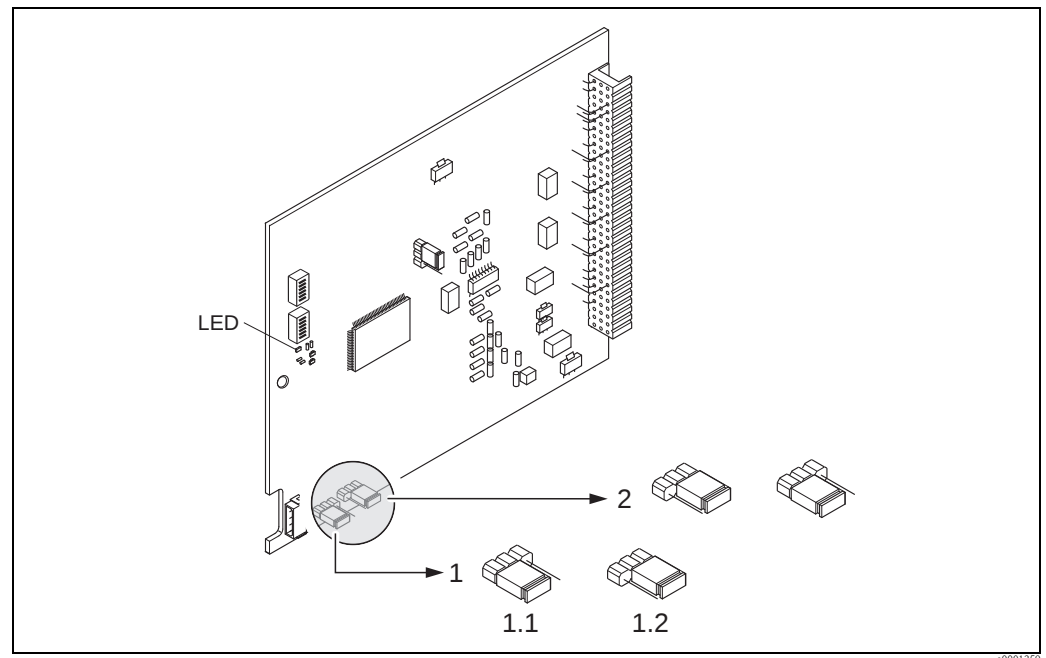


Fig. 51: Switching write protection on and off with the aid of a jumper on the I/O board

- 1 Jumper for switching write protection on and off
 - 1.1 Write protection switched on = it is **not** possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare)
 - 1.2 Write protection switched off (factory setting) = it is possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare).
- 2 Jumper without function
- LED Overview of LED states:
 - Lit continuously → Ready for operation
 - Not lit → Not ready for operation
 - Flashing → System or process error present → 125

5.7.2 Configuring the device address

The address must always be configured for a PROFIBUS DP/PA device. The valid device addresses are in the range from 1 to 126. In a PROFIBUS DP/PA network, each address can only be assigned once. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the address 126 and with software addressing.

Addressing via local operation

Addressing takes place in the FIELDBUS ADDRESS function (6101) → see the "Description of Device Functions" manual.

Addressing via miniature switches



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. Loosen the Allen screw (3 mm) of the securing clamp.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Remove the local display (if present) by loosening the set screws of the display module.
4. Set the position of the miniature switches on the I/O board using a sharp pointed object.
5. Installation is the reverse of the removal procedure.

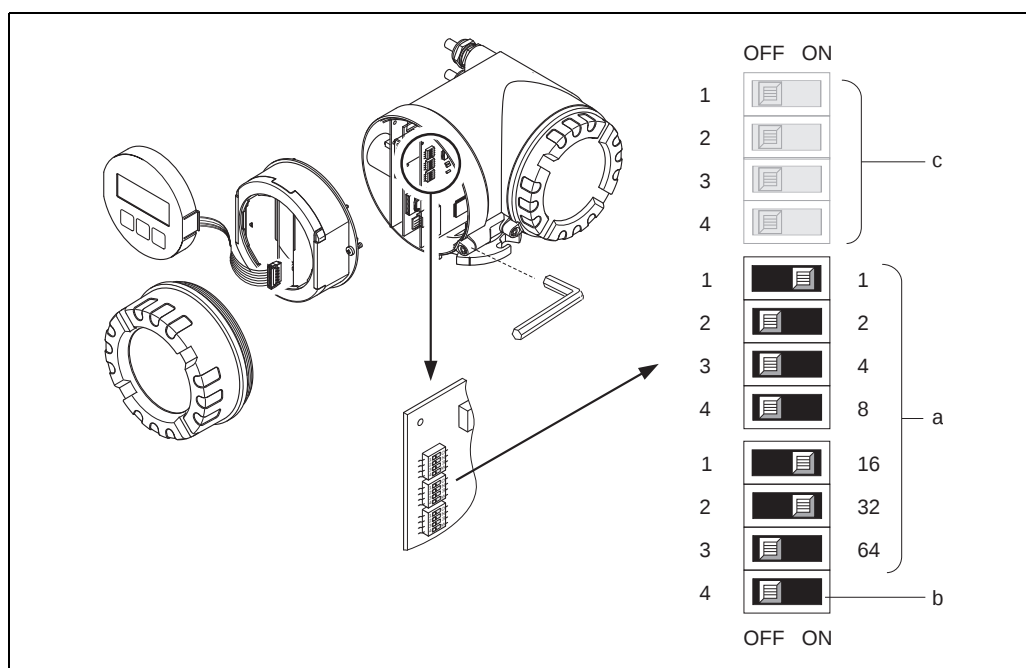


Fig. 52: Addressing with the aid of miniature switches on the I/O board

- a Miniature switches for setting the device address (illustrated: $1 + 16 + 32 = \text{device address } 49$)
- b Miniature switches for the address mode (method of addressing):
 OFF = software addressing via local operation (factory setting)
 ON = hardware addressing via miniature switches
- c Miniature switches not assigned

6 Commissioning

6.1 Function check

- Make sure that all final checks have been completed before you start up your measuring point:
- Checklist for "Post-installation check" → 39
 - Checklist for "Post-connection check" → 59



Note!

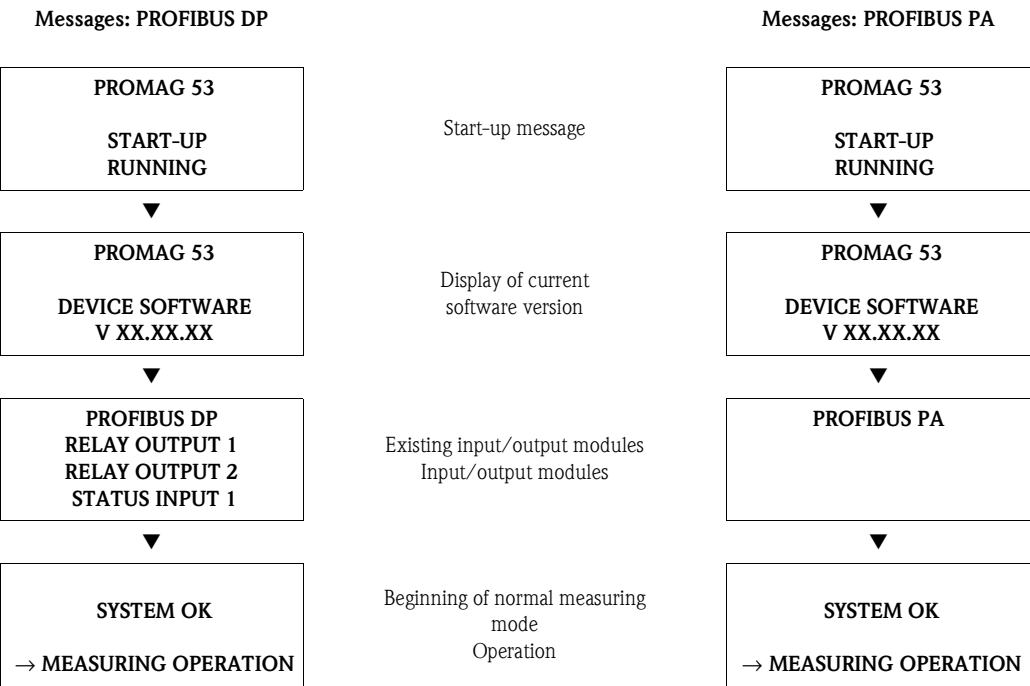
When using PROFIBUS PA, please note the following:

- The PROFIBUS interface's technical data must be maintained in accordance with IEC 61158-2 (MBP).
- A normal multimeter can be used to check the bus voltage of 9 to 32 V and the current consumption of 11 mA at the device.

6.2 Switching on the measuring device

Once the post-connection checks have been successfully completed, it is time to switch on the supply voltage. The device is now operational.

The measuring device performs a number of power on self-tests. As this procedure progresses the following sequence of messages appears on the local display:



Normal measuring mode commences as soon as startup completes.

Various measured-value and/or status variables (HOME position) appear on the display.



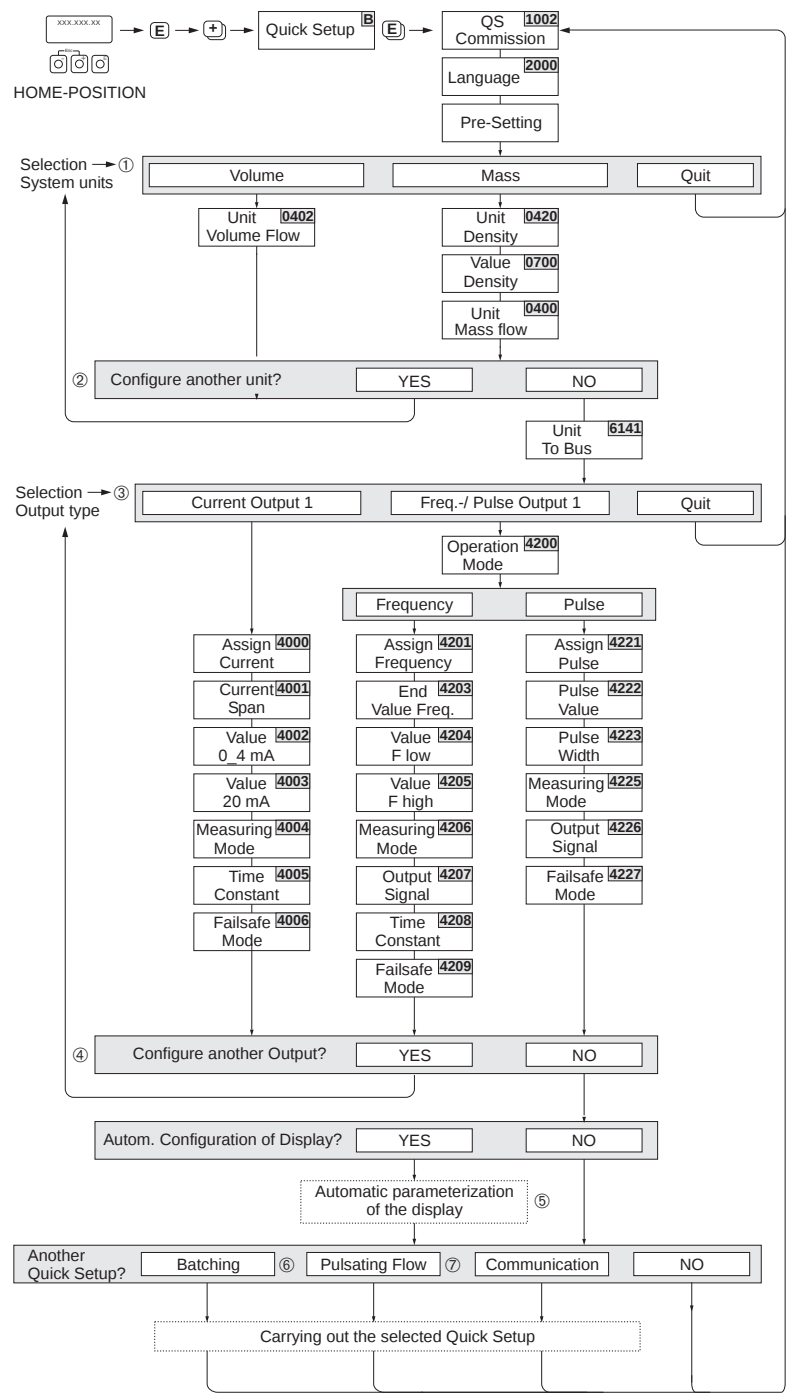
Note!

If startup fails, an error message indicating the cause is displayed.

6.3 Quick Setup

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

6.3.1 Quick Setup "Commissioning"



a0004551-en

Fig. 53: Quick Setup for fast commissioning

**Note!**

- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ESC key combination during parameter interrogation. The stored parameters remain valid.
 - The "Commissioning" Quick Setup must be carried out before one of the other Quick Setups described in this Operating Manual is run.
- ① Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass and volume is derived from the corresponding flow unit.
 - ② The "YES" option remains visible until all the units have been configured.
"NO" is the only option displayed when no further units are available.
 - ③ This prompt only appears if a current output and/or pulse/frequency output is available. Only the outputs not yet configured in the current Setup are offered for selection in each cycle.
 - ④ The "YES" option remains visible until all the outputs have been configured.
"NO" is the only option displayed when no further outputs are available.
 - ⑤ The "automatic display configuration" option contains the following basic settings/factory settings
 - YES Main line = volume flow
 Additional line = totalizer 1
 Information line = operating/system condition
 - NO The existing (selected) settings remain.
 - ⑥ The BATCHING QUICK SETUP is only available when the optional software package BATCHING is installed.
 - ⑦ The PULSATING FLOW QUICK SETUP is only available if the device has a current output or a pulse/frequency output.

6.3.2 Quick Setup "Pulsating Flow"



Note!

The "Pulsating flow" Quick Setup is only available if the device has a current output or a pulse/frequency output.

Certain types of pump such as reciprocating, peristaltic and cam-type pumps, for example, create a flow characterized by severe periodic fluctuations. Negative flows can occur with pumps of these types on account of the closing volume of the valves or valve leaks.



Note!

Before carrying out the Quick Setup "Pulsating flow" the Quick Setup "Commissioning" has to be executed → 80.

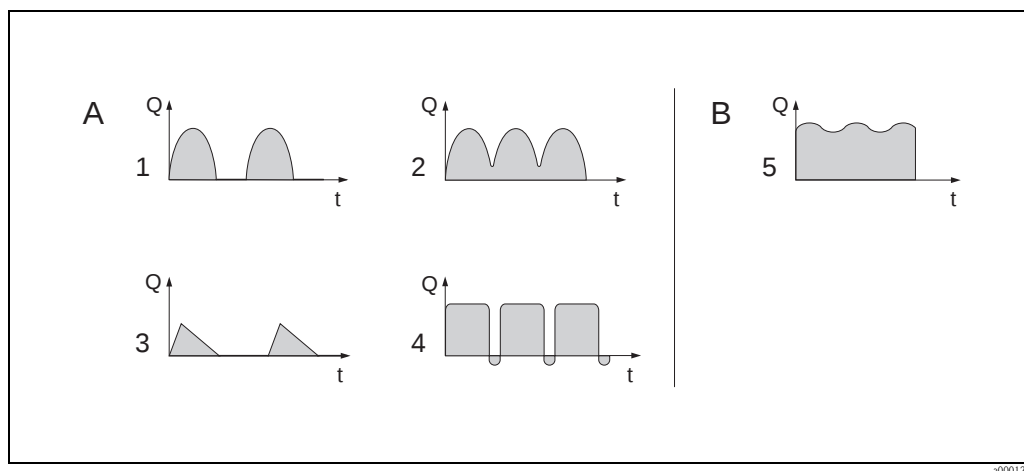


Fig. 54: Flow characteristics of various types of pump

- A With severely pulsating flow
B With low pulsating flow

- 1 1-cylinder cam pump
2 2-cylinder cam pump
3 Magnetic pump
4 Peristaltic pump, flexible connecting hose
5 Multi-cylinder reciprocating pump

Severely pulsating flow

Once several device functions have been configured in the "Pulsating flow" Quick Setup menu, flow fluctuations of this nature can be compensated over the entire flow range and pulsating liquid flows measured correctly. Below you will find detailed instructions on how to use this Quick Setup menu.



Note!

It is always advisable to work through the "Pulsating flow" Quick Setup menu if there is any uncertainty about the exact flow characteristic.

Slightly pulsating flow

If flow fluctuations are no more than minor, as is the case, for example with gear-type, three-cylinder or multi-cylinder pumps, it is **not** absolutely necessary to work through the Quick Setup menu.

In cases of this nature, however, it is advisable to adapt the functions listed below in the function matrix (see the "Description of Device Functions" manual) to suit local process conditions in order to ensure a stable, unvarying output signal:

- Measuring system damping: "FLOW DAMPING" function → increase the value
- Current output damping: "TIME CONSTANT" function → increase the value

Performing the "Pulsating Flow" Quick Setup

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be modified and configured for measuring pulsating flows. Note that this has no effect on values configured beforehand, such as measuring range, current range or full scale value.

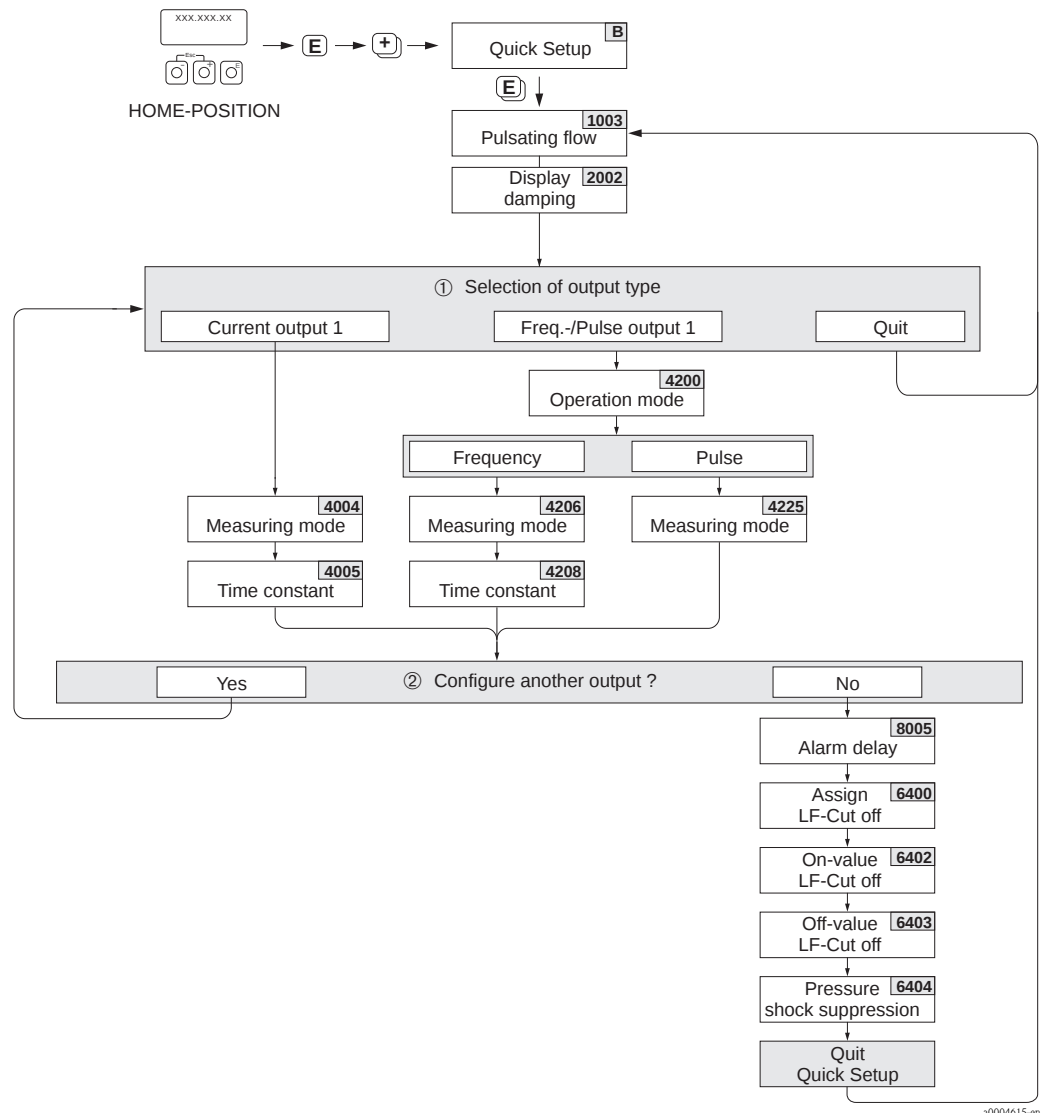


Fig. 55: Quick Setup for measuring severely pulsating flows. Recommended settings see next page

- ① Only the output not yet configured in the current Setup is offered for selection in the second cycle.
- ② The "YES" option remains visible until both outputs have been configured. "NO" is the only option displayed when no further outputs are available.



Note!

- The display returns to the cell QUICK SETUP PULSATING FLOW (1003) if you press the key combination during parameter interrogation.
- You can call up the Setup menu either directly from the "COMMISSIONING" Quick Setup menu or manually by means of the function QUICK SETUP PULSATING FLOW (1003).

Quick Setup "Pulsating Flow"		
HOME position → → MEASURAND → → QUICK SETUP → → QS PULSATING FLOW (1003)		
Function No.	Function name	Selection with To the next function with
1003	QS PULSATING FLOW	YES After is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.



Basic configuration		
2002	DISPLAY DAMPING	3 s
Signal type for "CURRENT OUTPUT 1"		
4004	MEASURING MODE	PULS. FLOW
4005	TIME CONSTANT	3 s
Signal type for "FREQ./PULSE OUTPUT 1" (for FREQUENCY operating mode)		
4206	MEASURING MODE	PULS. FLOW
4208	TIME CONSTANT	0 s
Signal type for "FREQ./PULSE OUTPUT 1" (for PULSE operating mode)		
4225	MEASURING MODE	PULS. FLOW
Other settings		
8005	ALARM DELAY	0 s
6400	ASSIGN LOW FLOW CUTOFF	VOLUME FLOW
6402	ON-VALUE LOW FLOW CUTOFF	Recommended setting: On-value $\approx \frac{\text{max. full scale (per DN)}^*}{1000}$ a0004432-en <i>*Full scale values → 18</i>
6403	OFF-VALUE LOW FLOW CUTOFF	50%
6404	PRESSURE SHOCK SUPPRESSION	0 s



Back to the HOME position:

→ Press and hold down the key for longer than three seconds or

→ Repeatedly press and release the key → Exit the function matrix step by step

6.3.3 Quick Setup "Batching"



Note!

This function is only available when the additional "batching" software is installed in the measuring device (order option). You can order this software from Endress+Hauser as an accessory at a later date → [123](#).

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be modified and configured for batching operation. These basic settings allow simple (one-step) batching processes.

Additional settings, e.g. for multistage batching procedures, must be made via the function matrix itself (see the "Description of Device Functions" manual).



Caution!

The "Batching" Quick Setup sets certain device parameters for discontinuous measurement operation.

If the measuring device is used for continuous flow measurement at a later time, we recommend at you rerun the "Commissioning" and/or "Pulsating flow" Quick Setup.

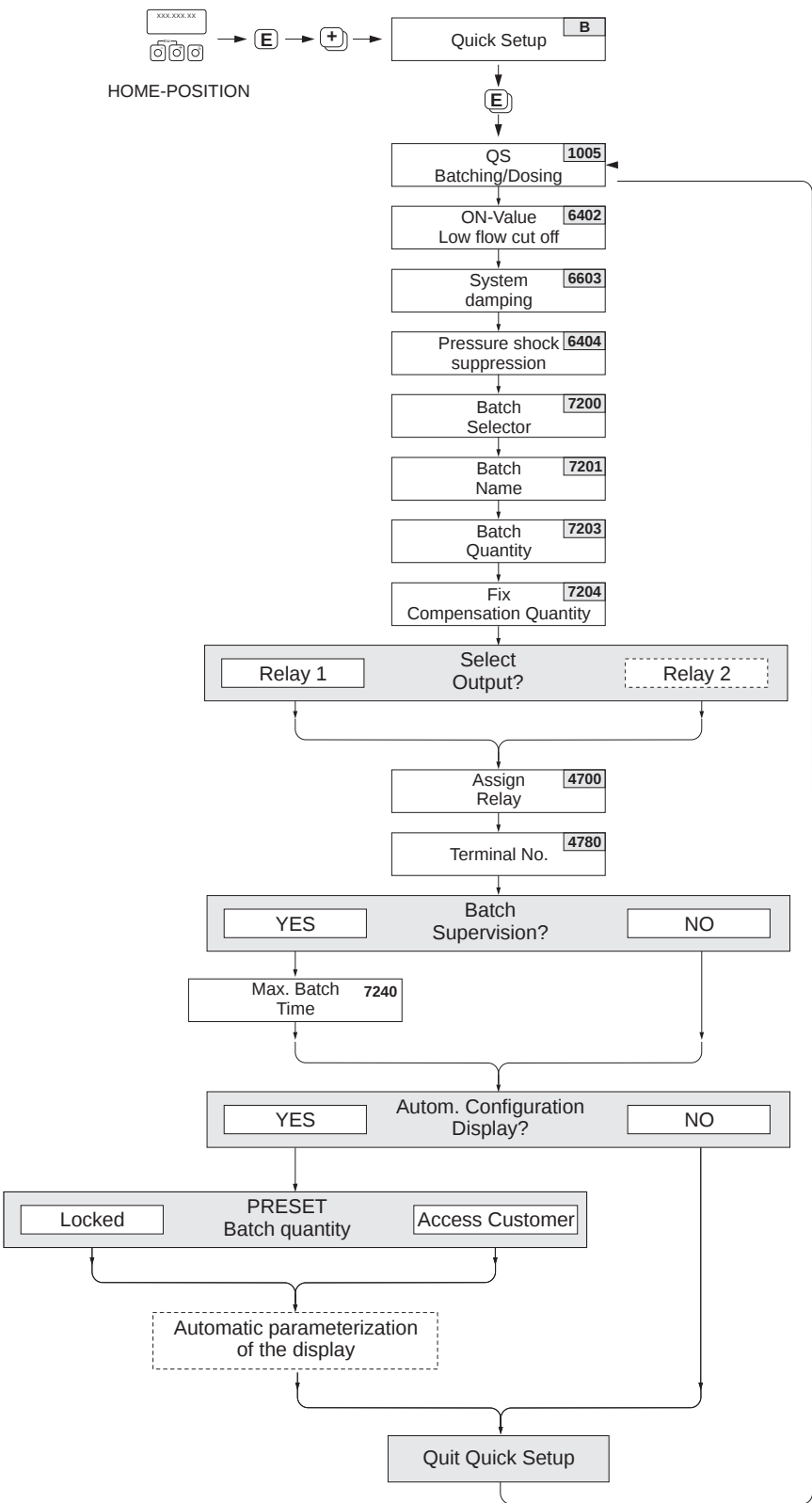


Note!

- Before carrying out the Quick Setup "Batching" the Quick Setup "Commissioning" has to be executed → [80](#).
- You can find detailed information on the batching functions in the separate "Description of Device Functions" manual.
- You can also directly control filling process using the local display. During Quick Setup, an appropriate dialog appears concerning the automatic display configuration. Acknowledge this by clicking "YES".

This assigns special batching functions (START, PRESET, etc.) to the bottom line of the display. These can be directly executed on site using the three operating keys ( /  / ). Therefore, the measuring device can be fully deployed in the field as a "batch controller" → [65](#).

- You can also directly control the filling process using the fieldbus.



a0004433-en

Fig. 56: Quick Setup "Batching". Recommended settings see next page.

Recommended settings

Quick Setup "Batching"		
HOME position →  → MEASURAND →  → QUICK SETUP →  → QUICK SETUP BATCHING (1005)		
Function No.	Function name	Setting to be selected () (to the next function with )
1005	QUICK SETUP BATCHING/DOSING	YES After  is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.



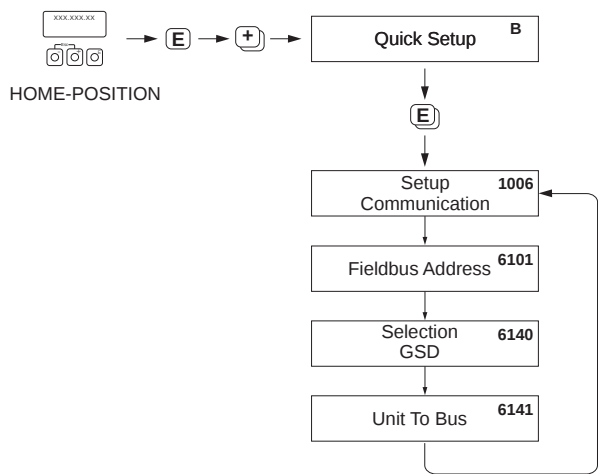
 Note! Some of the functions listed below (with a gray background) are configured automatically, i.e. by the measuring system.		
6400	ASSIGN LOW FLOW CUTOFF	VOLUME FLOW
6402	ON-VALUE LOW FLOW CUTOFF	The recommended setting is contained on →  84 in Function No. 6402.
6403	OFF-VALUE LOW FLOW CUTOFF	50%
6603	SYSTEM DAMPING	9  Note! The parameter has to be optimized for highly accurate and short filling processes: to do this, put the setting to "0".
6404	PRESSURE SHOCK SUPPRESSION	0 s
7200	BATCH SELECTOR	BATCH #1
7201	BATCH NAME	BATCH #1
7202	ASSIGN BATCH VARIABLE	Volume
7203	BATCH QUANTITY	0
7204	FIX COMPENSATION QUANTITY	0
7208	BATCH STAGES	1
7209	INPUT FORMAT	Value input
4700	ASSIGN RELAY	BATCHING VALVE 1
4780	TERMINAL NUMBER	Output (display only)
7220	OPEN VALVE 1	0% or 0 [unit]
7240	MAXIMUM BATCH TIME	0 s (= switched off)
7241	MINIMUM BATCH QUANTITY	0
7242	MAXIMUM BATCH QUANTITY	0
2200	ASSIGN (Main line)	BATCH NAME
2220	ASSIGN (Multiplex main line)	Off
2400	ASSIGN (Additional line)	BATCH DOWNWARDS
2420	ASSIGN (Multiplex additional line)	Off
2600	ASSIGN (Information line)	BATCHING KEYS
2620	ASSIGN (Multiplex information line)	Off



Back to the HOME position:
 → Press and hold down the  key for longer than three seconds or
 → Repeatedly press and release the  key → Exit the function matrix step by step

6.3.4 Quick Setup "Communication"

To establish cyclic data transfer, various arrangements between the PROFIBUS master (Class 1) and the measuring device (slave) are required which have to be taken into consideration when configuring various functions. These functions can be configured quickly and easily by means of the "Communication" Quick Setup. The following table explains the parameter configuration options in more detail.



a0002600-en

Fig. 57: Quick Setup "Communication"

Quick Setup "Communication"		
HOME position → → MEASURAND (A) → → QUICK SETUP (B) → → QUICK SETUP COMMUNICATION (1006)		
Function No.	Function name	Setting to be selected () (to the next function with)
1006	QS-COMMUNICATION	After confirmation (YES) by pressing the subsequent functions are called up in succession.
6101	FIELDBUS ADDRESS	Enter the device address (permitted address range: 1 to 126) Factory setting: 126
6140	SELECTION GSD	Select the operating mode (the GSD file) which should be used for cyclic data transmission with the PROFIBUS master. Options: MANUFACT. SPEC. → The measuring device is operated with complete device functionality. MANUFACT V2.0 → The measuring device is used as the replacement for the previous Promag 33 model (compatibility mode). PROFILE-GSD → The measuring device is operated in the PROFIBUS Profile mode. Factory setting: MANUFACT. SPEC. Note! For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 96.



Quick Setup "Communication"		
6141	UNIT TO BUS	If this function is executed, the measured variables are transmitted cyclically to the PROFIBUS master (Class 1) with the system units set in the measuring device. Options: OFF SET UNITS (Transmission is started by pressing the  key)  Caution! Activating this function can cause a sudden change of the measured variables transmitted to the PROFIBUS master (Class 1); this, in turn, can affect subsequent control routines.



Back to the HOME position: → Press and hold down the  key for longer than three seconds or → Repeatedly press and release the  key = Exit the function matrix step by step

6.3.5 Data backup/transmission

Using the T-DAT SAVE/LOAD function, you can transfer data (device parameters and settings) between the T-DAT (exchangeable memory) and the EEPROM (device storage unit).

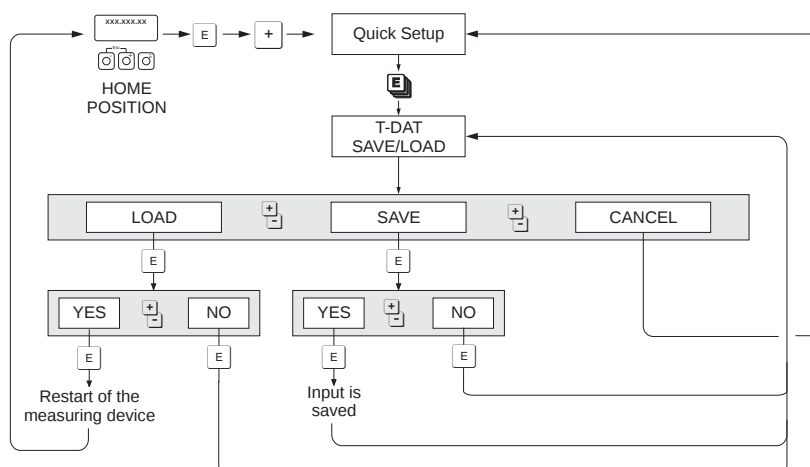
This is required in the following instances:

- Creating a backup: current data are transferred from an EEPROM to the T-DAT.
- Replacing a transmitter: current data are copied from an EEPROM to the T-DAT and then transferred to the EEPROM of the new transmitter.
- Duplicating data: current data are copied from an EEPROM to the T-DAT and then transferred to EEPROMs of identical measuring points.



Note!

For information on installing and removing the T-DAT → 143.



a0001221-en

Abb. 58: Data backup/transmission with T-DAT SAVE/LOAD function

Information on the LOAD and SAVE options available:

LOAD: Data are transferred from the T-DAT to the EEPROM.



Note!

- Any settings already saved on the EEPROM are deleted.
- This option is only available, if the T-DAT contains valid data.
- This option can only be executed if the software version of the T-DAT is the same or newer than that of the EEPROM. Otherwise, the error message "TRANSM. SW-DAT" appears after restarting and the LOAD function is then no longer available.

SAVE:

Data are transferred from the EEPROM to the T-DAT.

6.4 Commissioning the PROFIBUS interface



Note!

- All functions required for commissioning are described in detail in the "Description of Device Functions" manual which is a separate part of this Operating Manual.
- A code (factory setting: 53) must be entered to change device functions, numerical values or factory settings → 67.

6.4.1 PROFIBUS DP commissioning

The following steps must be carried out in the sequence specified:

1. **Check the hardware write protection:**

The WRITE PROTECT (6102) parameter indicates whether it is possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare).



Note!

- This check is not needed if operating via the local display.

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION (610) → WRITE PROTECT (6102) → Display of one of the following options:

- OFF (factory setting) = write access via PROFIBUS possible
- ON = write access via PROFIBUS not possible

Deactivate the write protection if necessary → 72.

2. **Enter the tag name (optional):**

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION (610) → TAG NAME (6100)

3. **Configuring the fieldbus address:**

- Software addressing using the local display:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION (610) → FIELDBUS ADDRESS (6101)

- Hardware addressing via miniature switches → 73

4. **Select the system unit:**

- a. Determine the units by means of the system units group:

MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) → UNIT MASS FLOW (0400) / UNIT MASS (0401) / UNIT VOLUME FLOW (0402) / ...

- b. In the function UNIT TO BUS (6141), select the option SET UNITS, so that the measured variables transmitted cyclically to the PROFIBUS master (Class 1) are transmitted with the system units set in the measuring device:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) → UNIT TO BUS (6141)



Note!

- The configuration of the system units for the totalizer is described separately → see step 7
- If the system unit of a measured variable is changed by means of the local operation or an operating program, this initially does not have any effect on the unit that is used to transmit the measured variable to the PROFIBUS master (Class 1). Changed system units of the measured variables are not transmitted to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the function BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) → UNIT TO BUS (6141).

5. Configuration of the Analog Input function blocks 1 to 2:

The measuring device has two Analog Input function blocks (AI modules), through which the various measured variables can be cyclically transmitted to the PROFIBUS master (Class 1). The assignment of a measured variable to the Analog Input function block is shown below using the example of Analog Input function block 1 (AI module, slot 1).

Using the CHANNEL function (6123), you can determine the measured variable (e.g. volume flow) to be cyclically transmitted to the PROFIBUS master (Class 1):

- a. Select BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTIONBLOCKS (612) → BLOCK SELECTION (6120).
- b. Select the option ANALOG INPUT 1.
- c. Select the function CHANNEL (6123).
- d. Select the option VOLUME FLOW.

Possible settings:

Measured variable	ID for "CHANNEL" function
VOLUME FLOW (factory setting AI function block 1)	273
MASS FLOW (factory setting AI function block 2)	277
The following measured variables are available when the additional "batching" software is installed (order option)	
BATCH UPWARDS	1346
BATCH DOWNWARDS	1347
BATCH COUNTER	1348
BATCH SUM	1349
BATCHING TIME	1354
 Note! If, when the PROFIBUS network configuration, the AI module was integrated in slot 1 or 5, the measured variable selected in the CHANNEL function is transmitted cyclically to the PROFIBUS master (Class 1) for the respective Analog Input function block 1 to 2. →  102	

6. Setting the measuring mode:

In the function MEASURING MODE (6601), select the flow portions to be measured by the measuring device.

BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601) → Selection of one of the following options:

- UNIDIRECTIONAL (factory setting) = only the positive flow portions
- BIDIRECTIONAL = the positive and negative flow components

7. Configuration of totalizers 1 to 3:

The measuring device has three totalizers. The following example describes the configuration of the totalizer using totalizer 1 as an example.

- Using the CHANNEL function (6133), you can determine the measured variable (e.g. volume flow) to be cyclically transmitted to the PROFIBUS master (Class 1) as a totalizer value:
 - a. Select BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) → SELECT TOTALIZER (6130).
 - b. Select the option TOTALIZER 1.
 - c. Go to the function CHANNEL (6133).

- d. Select one of the following options:
- VOLUME FLOW (CHANNEL = 273, factory setting): the volume flow is totalized.
 - MASS FLOW (CHANNEL = 277): the mass flow is totalized.
 - OFF (CHANNEL = 0): no totalizing, "0" is displayed as the totalizer value.

 Note!

If, when the PROFIBUS network configuration, the module or the function "TOTAL" was integrated in slot 2, 3 or 4, the measured variable selected in the CHANNEL function is transmitted cyclically to the PROFIBUS master (Class 1) for the respective totalizer 1 to 3 →  102.

- Enter the desired unit for the totalizer:
BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) → UNIT TOTALIZER (6134)
- Configure totalizer status (e.g. totalize):
BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) → SET TOTALIZER (6135) → Select the option TOTALIZE
- Set the totalizer mode:
BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) → TOTALIZER MODE (6137) → Selection of one of the following options:
 - BALANCE (factory setting): calculates the positive and negative flow portions
 - POSITIVE: calculates the positive flow portions
 - NEGATIVE: calculates the negative flow portions
 - HOLD VALUE: The totalizer remains at the last value

 Note!

For the calculation of the positive and negative flow portions (BALANCE) or the negative flow portions (NEGATIVE) to be carried out correctly, the selection BIDIRECTIONAL must be active in the function BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601).

8. Select the operating mode:

Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master.

- BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) → SELECTION GSD (6140) → Selection of one of the following options:
- MANUFACT. SPEC. (factory setting): the complete device functionality is available.
 - MANUFACT V2.0 The device is used as the replacement for the previous Promag 33 model (compatibility mode).
 - PROFILE-GSD: The device is operated in the PROFIBUS Profile mode.

 Note!

For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode →  96.

9. Configuration of cyclic data transmission in the PROFIBUS master:

A detailed description of the cyclic data transmission is contained →  100.

6.4.2 PROFIBUS PA commissioning

The following steps must be carried out in the sequence specified:

1. Check the hardware write protection:

The WRITE PROTECT (6102) parameter indicates whether it is possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare).



Note!

- This check is not needed if operating via the local display.

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →

WRITE PROTECT (6102) → Display of one of the following options:

- OFF (factory setting) = write access via PROFIBUS possible
- ON = write access via PROFIBUS not possible

Deactivate the write protection if necessary → 72.

2. Enter the tag name (optional):

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →
TAG NAME (6100)

3. Configuring the fieldbus address:

- Software addressing using the local display:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →
FIELDBUS ADDRESS (6101)

- Hardware addressing via miniature switches → 73

4. Select the system unit:

- a. Determine the units by means of the system units group:

MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) →
UNIT MASS FLOW (0400) / UNIT MASS (0401) / UNIT
VOLUME FLOW (0402) / ...

- b. In the function UNIT TO BUS (6141), select the option SET UNITS, so that the measured variables transmitted cyclically to the PROFIBUS master (Class 1) are transmitted with the system units set in the measuring device:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) →
UNIT TO BUS (6141)



Note!

- The configuration of the system units for the totalizer is described separately
→ see step 6
- If the system unit of a measured variable is changed by means of the local operation or an operating program, this initially does not have any effect on the unit that is used to transmit the measured variable to the PROFIBUS master (Class 1). Changed system units of the measured variables are not transmitted to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the function BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) → UNIT TO BUS (6141).

5. Setting the measuring mode:

In the function MEASURING MODE (6601), select the flow portions to be measured by the measuring device.

BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) →
MEASURING MODE (6601) → Selection of one of the following options:

- UNIDIRECTIONAL (factory setting) = only the positive flow portions
- BIDIRECTIONAL = the positive and negative flow components

6. Configuration of totalizers 1 to 3:

The measuring device has three totalizers. The following example describes the configuration of the totalizer using totalizer 1 as an example.

- Using the CHANNEL function (6133), you can determine the measured variable (e.g. volume flow) to be cyclically transmitted to the PROFIBUS master (Class 1) as a totalizer value:
 - a. Select BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → SELECT TOTALIZER (6130).
 - b. Select the option TOTALIZER 1.
 - c. Go to the function CHANNEL (6133).
 - d. Select one of the following options:
 - VOLUME FLOW (CHANNEL = 273, factory setting): the volume flow is totalized.
 - MASS FLOW (CHANNEL = 277): the mass flow is totalized.
 - OFF (CHANNEL = 0): no totalizing, "0" is displayed as the totalizer value.

 **Note!**

If, when the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 2, 3 or 4, the measured variable selected in the CHANNEL function is transmitted cyclically to the PROFIBUS master (Class 1) for the respective totalizer 1 to 3 →  102.

- Enter the desired unit for the totalizer:
BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → UNIT TOTALIZER (6134)
- Configure totalizer status (e.g. totalize):
BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → SET TOTALIZER (6135) → Select the option TOTALIZE
- Set the totalizer mode:
BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → TOTALIZER MODE (6137) → Selection of one of the following options:
 - BALANCE (factory setting): calculates the positive and negative flow portions
 - POSITIVE: calculates the positive flow portions
 - NEGATIVE: calculates the negative flow portions
 - HOLD VALUE: The totalizer remains at the last value

 **Note!**

For the calculation of the positive and negative flow portions (BALANCE) or the negative flow portions (NEGATIVE) to be carried out correctly, the selection BIDIRECTIONAL must be active in the function BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → SETTINGS (660) → MEASURING MODE (6601).

7. Select the operating mode:

Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master.

- BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) → SELECTION GSD (6140) → Selection of one of the following options:
- MANUFACT. SPEC. (factory setting): the complete device functionality is available.
 - MANUFACT V2.0 The device is used as the replacement for the previous Promag 33 model (compatibility mode).
 - PROFILE-GSD: The device is operated in the PROFIBUS Profile mode.

 **Note!**

For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode →  96.

8. Configuration of cyclic data transmission in the PROFIBUS master:

A detailed description of the cyclic data transmission is contained →  100.

6.5 PROFIBUS DP/PA system integration

6.5.1 Device master file (GSD file)

For PROFIBUS network configuration, the device master file (GSD file) is needed for every bus user (PROFIBUS slave). The GSD file contains a description of the properties of a PROFIBUS device, such as supported data transmission rate and number of input and output data. Before configuration takes place, a decision should be made as to which GSD file should be used to operate the measuring device in the PROFIBUS DP master system.

The measuring device supports the following GSD files:

- Promag 53 GSD file (manufacturer-specific GSD file, complete device functionality)
- PROFIBUS Profile GSD file:
- Promag 33 GSD file (compatibility to previous model Promag 33)

Below you will find a detailed description of the GSD files supported.

Promag 53 GSD file (manufacturer-specific GSD file, complete device functionality)

Use this GSD file to access the complete functionality of the measuring device. In this way, device-specific measured variables and functions are thus completely available in the PROFIBUS master system. An overview of the modules available (input and output data):

PROFIBUS DP → 100

PROFIBUS PA → 110

GSD file with standard or extended format:

The GSD file with either the standard or the extended format must be used depending on the configuration software used. When installing the GSD file, the GSD file with the extended format (EH3x15xx.gsd) should always be used first.

However, if the installation or the configuration of the measuring device fails with this format, then use the standard GSD (EH3_15xx.gsd). This differentiation is the result of different implementation of the GSD formats in the master systems. Note the specifications of the configuration software.

Name of the Promag 53 GSD file

	ID No.	GSD file	Type file	Bitmaps
PROFIBUS DP	1526 (Hex)	Extended Format (recommended):	EH_1526.200	EH_1526_d.bmp/.dib EH_1526_n.bmp/.dib EH_1526_s.bmp/.dib
		Standard Format:		
PROFIBUS PA	1527 (Hex)	Extended Format (recommended):	EH_1527.200	EH_1527_d.bmp/.dib EH_1527_n.bmp/.dib EH_1527_s.bmp/.dib
		Standard Format:		

How to acquire:

- Internet (Endress+Hauser) → www.endress.com (→ Download)
- CD-ROM with all GSD files for Endress+Hauser devices → Order No.: 56003894

Contents of the downloadfile from the Internet and the CD-ROM:

- All Endress+Hauser GSD files (standard and extended format)
- Endress+Hauser type files
- Endress+Hauser bitmap files
- Useful information relating to the devices

PROFIBUS Profile GSD file:

The function scope of the profile GSD file is defined by the PROFIBUS Profile Specification 3.0. The function scope is restricted compared to the manufacturer-specific GSD file (complete device functionality). However, similar devices from different manufacturers can be interchanged with the profile GSD file without the need to reconfigure (interchangeability).

The following modules are supported with the Profile GSD file:

- "AI Flow" module → Analog Input function block 1 / output variable: volume flow
- "AI Density" module → Analog Input function block 2 / output variable: mass flow
- "Totalizer" module → Totalizer function block 1 / output variable: totaled volume flow

Name of the PROFIBUS Profile GSD file

	ID No.	Profile GSD file
PROFIBUS DP	9741 (Hex)	PA039741.gsd
PROFIBUS PA	9741 (Hex)	PA139741.gsd

Source

Internet (GSD library of the PROFIBUS User Organization) → www.PROFIBUS.com

Promag 33 GSD file:

Promag 33 with Profile Version 2.0 is the precursor to the Promag 53.

If Promag 33 is already being operated in the system and the measuring device has to be replaced, Promag 53 can be used as a replacement device without having to reconfigure the PROFIBUS DP network.

Further information →  99.

6.5.2 Selection of the GSD file in the measuring device

Depending on which GSD file is used in the PROFIBUS master system, the corresponding GSD file has to be configured in the device by means of the SELECTION GSD function.

BASIC FUNCTION (G) → PROFIBUS DP/PA (GBA/GCA) → OPERATION (614) → SELECTION GSD (6140)

Promag 53 GSD file:	→	Select: MANUFACT. SPEC. (factory setting)
Profile GSD file	→	Select: PROFILE-GSD
Promag 33 GSD file:	→	Select: MANUFACT V2.0

Example

Before configuration takes place, a decision should be made as to which GSD file should be used to configure the measuring device in the PROFIBUS master system. Below, the use of the manufacturer-specific GSD file (complete device functionality) is shown using **PROFIBUS PA** as an example:

Select the manufacturer-specific GSD file in the measuring device by means of the SELECTION GSD function.

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) → SELECTION GSD (6140) → Selection: MANUFACT. SPEC. (factory setting)

1. Before configuring the network, load the corresponding GSD file into the configuration system/master system.



Note!

When installing the GSD file, always first use the GSD file with the extended format (EH3x1527.gsd). However, if the installation or the configuration of the device fails with this format, then use the standard GSD (EH3_1527.gsd).

Example for the configuration software Siemens STEP 7 of the Siemens PLC family S7-300/400:

Use the GSD file with the extended format (EH3x1527.gsd). Copy the file to the subdirectory "...siemensstep7s7datagsd". The GSD files also include bitmap files. These bitmap files are used to display the measuring points in image form. The bitmap files must be saved to the directory "...siemensstep7s7datansbmp".

If you are using configuration software other than that referred to above, ask your PROFIBUS master system manufacturer which directory you should use.

2. The measuring device is a modular PROFIBUS slave, i.e. the desired module configuration (input and output data) must be performed in the next step. This can be done directly by means of the configuration software. A detailed description of the modules supported by the measuring device as follows:
 PROFIBUS DP → 100
 PROFIBUS PA → 110

6.5.3 Compatibility to the previous model Promag 33 (Profile Version 2.0)

Promag 33 with Profile Version 2.0 is the precursor to Promag 53. If Promag 33 is already being operated in the system and if the measuring device has to be replaced, Promag 53 can be used as a replacement device without having to reconfigure the PROFIBUS network.

In the event of a device being replaced, Promag 53 completely supports the compatibility of the cyclic data with the previous Promag 33 model.

The measuring devices can be exchanged as follows:

Existing device:	GSD file used:	→	To be replaced with:
Promag 33 PROFIBUS DP (ID No. 0x1511)	Extended Format: EH3x1511.gsd or Standard Format: EH3_1511.gsd	→	Promag 53 PROFIBUS DP
Promag 33 PROFIBUS PA (ID No. 0x1505)	Extended Format: EH3x1505.gsd or Standard Format: EH3_1505.gsd	→	Promag 53 PROFIBUS PA

Promag 53 is accepted as the replacement device if the MANUFACT V2.0 option is activated in the SELECTION GSD (6140) function.

The measuring device automatically detects that a Promag 33 device was configured in the automation system and makes both suitable input and output data and measured value status information available even though the devices differ in name and ID number. You do not have to adjust the configuration of the PROFIBUS network in the automation system.

Procedure after replacing the measuring devices:

1. Set the same (old) device address → FIELDBUS ADDRESS (6101) function
2. In the SELECTION GSD (6140) function → Select MANUFACT V2.0
3. Restart the measuring device → SYSTEM RESET (8046) function



Note!

If necessary, the following settings have to be configured via an operating program:

- Configuration of the application-specific parameters
- Configuration of the system units for the measured values and totalizers.

6.5.4 Maximum number of writes

If a nonvolatile device parameter is modified via the cyclic or acyclic data transmission, this change is saved in the EEPROM of the measuring device.

The number of writes to the EEPROM is technically restricted to a maximum of 1 million.

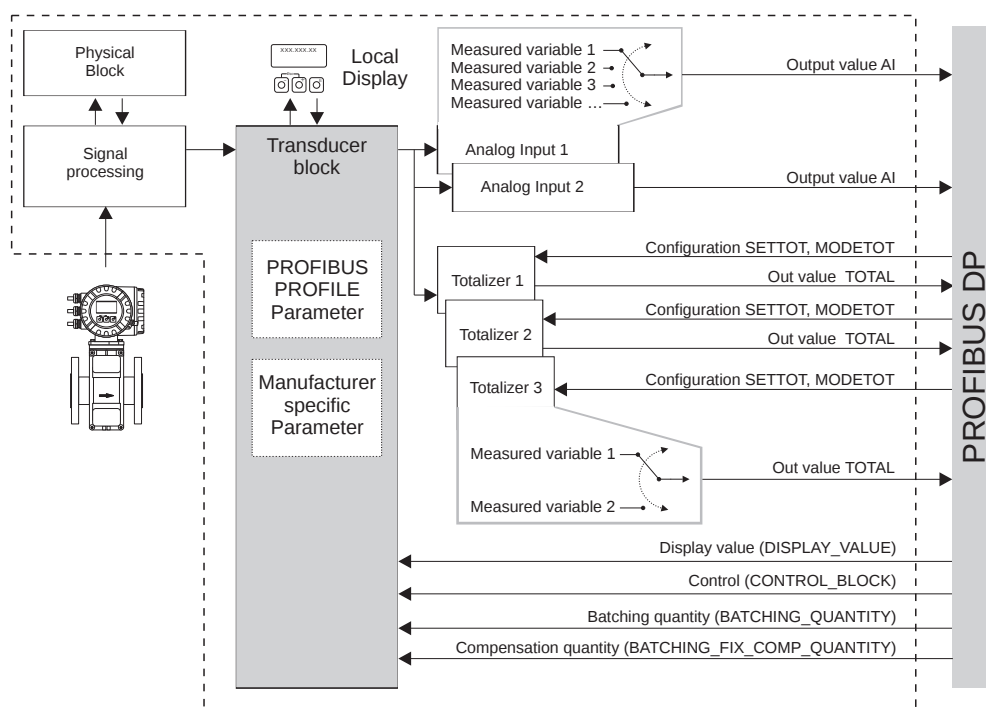
Attention must be paid to this limit since, if exceeded, it results in data loss and measuring device failure. For this reason, avoid constantly writing nonvolatile device parameters via the PROFIBUS!

6.6 PROFIBUS DP cyclic data transmission

Below is a description of the cyclic data transmission when using the Promag 53 GSD file (complete device functionality).

6.6.1 Block model

The block model illustrated shows which input and output data the measuring device provides for cyclic data transmission via PROFIBUS DP.



a0004625-en

Fig. 59: Block model for Promag 53 PROFIBUS DP Profile 3.0

6.6.2 Modules for cyclic data transmission

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the EMPTY_MODULE module.

To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

It is essential to adhere to the following sequence/assignment when configuring the modules in the PROFIBUS master system:

Slot sequence	Module	Description
1	AI	Analog Input function block 1 Output variable → volume flow (factory setting)
2	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	Totalizer function block 1 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
3	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	Totalizer function block 2 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
4	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	Totalizer function block 3 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
5	AI	Analog Input function block 2 Output variable → mass flow (factory setting)
6	DISPLAY_VALUE	Value for local display
7	CONTROL_BLOCK	Control of device functions
8	BATCHING_QUANTITY	Batching quantity
9	BATCHING_FIX_COMP_QUANTITY	Fixed correction quantity



Note!

- The assignment of the measured variables for the Analog Input function blocks (1 to 2) and the totalizer function blocks (1 to 3) can be changed by means of the CHANNEL function. A detailed description of the individual modules is contained in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system. This can be effected as follows:
 - By means of the local display
 - By means of an operating program (e.g. FieldCare)
 - By switching the supply voltage off and on again.

6.6.3 Description of the modules

AI (Analog Input) module

The AI module (slots 1, 5) cyclically transmits the corresponding measured variable, including the status, to the PROFIBUS master (Class 1). The measured variable is represented in the first four bytes in the form of floating point numbers in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the measured variable.

Further information on the device status →  127

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
measured variable (IEEE 754 floating point number)				Status

Assignment of the measured variables to the AI module

The AI module can transmit different measured variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Analog Input function blocks 1 to 2 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) →
 BLOCK SELECTION (6120): Selection of an Analog Input function block →
 CHANNEL (6123): Selection of a measured variable

Possible settings

Measured variable	ID for CHANNEL function
VOLUME FLOW	273
MASS FLOW	277
The following measured variables are available when the additional "batching" software is installed (order option)	
BATCH UPWARDS	1346
BATCH DOWNWARDS	1347
BATCH COUNTER	1348
BATCH SUM	1349
BATCHING TIME	1354

**Note!**

The measured variables for the additional "batching" software are available only when they are installed in the measuring device. If the measured variable is selected even if the additional software is not installed, the value "0" is transmitted to the PROFIBUS master (Class 1) for the measured variable.

Factory setting

Module	Analog Input function block	Measured variable	ID for CHANNEL function
AI (slot 1)	1	VOLUME FLOW	273
AI (slot 5)	2	MASS FLOW	277

TOTAL module

The measuring device has three totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS (Class 1) via the TOTAL module (slots 2 to 4). The totalizer value is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the totalizer value.

Further information on the device status → 127

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Assignment of the measured variables to the TOTAL module

The TOTAL module can transmit different totalizer variables to the PROFIBUS master (Class 1). The measured variables are assigned to the totalizer function blocks 1 to 3 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →

SELECT TOTALIZER (6130): Selection of a totalizer →

CHANNEL (6133): Selection of measured variable

Possible settings

Totalizer value/measured variable	ID for CHANNEL function
VOLUME FLOW	273
MASS FLOW	277
OFF	0

Factory setting

Module	Totalizer function block	Totalizer value/Measured variable	Unit	ID for CHANNEL function
TOTAL (slot 2)	1	VOLUME FLOW	m ³	273
TOTAL (slot 3)	2	VOLUME FLOW	m ³	273
TOTAL (slot 4)	3	VOLUME FLOW	m ³	273

SETTOT_TOTAL module

The module combination SETTOT_TOTAL (slots 2 to 4) consists of the functions SETTOT and TOTAL.

With this module combination:

- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer value, is transmitted, including the status (TOTAL)

SETTOT function

In the SETTOT function, the totalizer can be controlled via control variables.

The following control variables are supported:

- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer preset



Note!

After the totalizer value has been reset to 0 or set to the preset value, the totalizing continues automatically. The control variable does not have to be changed to 0 again to restart totalizing. Stopping totalizing is controlled in the SETTOT_MODETOT_TOTAL module via the MODETOT function. → 104

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 102

Data structure of the SETTOT_TOTAL module combination

Output data		Input data				
SETTOT		TOTAL				
Byte 1		Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Control		Totalizer value (IEEE 754 floating point number)				Status

SETTOT_MODETOT_TOTAL module

The module combination SETTOT_MODETOT_TOTAL (slots 2 to 4) consists of the functions SETTOT, MODETOT and TOTAL.

With this module combination:

- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer can be configured via the automation system (MODETOT).
- The totalizer value, is transmitted, including the status (TOTAL)

SETTOT function

For a description of the SETTOT function, refer to SETTOT_TOTAL module → 103

MODETOT function

In the MODETOT function, the totalizer can be configured via control variables.

The following settings are possible:

- 0 = Balance (factory setting), calculates the positive and negative flow portions
- 1 = calculates the positive flow portions
- 2 = calculates the negative flow portions
- 3 = Totalizing is stopped



Note!

For the calculation of the positive and negative flow portions (control variable 0) or the negative flow portions only (control variable 2) to be carried out correctly, the option BIDIRECTIONAL must be active in the MEASURING MODE (6601) function.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 102

Data structure of the SETTOT_MODETOT_TOTAL module combination

Output data		Input data				
SETTOT	MODETOT	TOTAL				
Byte 1	Byte 2	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Control	Configuration	Totalizer value (IEEE 754 floating point number)				Status

Example of using the SETTOT_MODETOT_TOTAL module

If the SETTOT function is set to 1 (= reset the totalizer), the value for the aggregated total is reset to 0.

If the aggregated total of the totalizer should constantly retain the value 0, the MODETOT function must first be set to 3 (= totalizing is stopped) and then the SETTOT function must be set to 1 (= reset the totalizer).

DISPLAY_VALUE module

Any value (IEEE 754 floating point number), including status, can be cyclically transmitted via the PROFIBUS master (Class 1) directly to the local display using the DISPLAY_VALUE module (slot 6). Display value assignment to the main line, additional line or information line can be configured via the local display itself or an operating program (e.g. FieldCare).

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Display value (IEEE 754 floating point number)				Status

Status

The measuring device interprets the status in accordance with PROFIBUS Profile Specification Version 3.0. The statuses OK, BAD and UNCERTAIN are indicated on the local display by a corresponding symbol. →  63

CONTROL_BLOCK module

By means of the CONTROL_BLOCK module (slot 7), the measuring device is able to process device-specific control variables from the PROFIBUS master (Class 1) in cyclic data transmission (e.g. switching on positive zero return).

Supported control variables of the CONTROL_BLOCK module

The following device-specific control variables can be activated by changing the output byte from 0 → x:

Module	Control variables
CONTROL_BLOCK	0 → 2: Positive zero return ON 0 → 3: Positive zero return OFF 0 → 8: UNIDIRECTIONAL measuring mode 0 → 9: BIDIRECTIONAL measuring mode 0 → 24: Run UNIT TO BUS function
	Control variables that are executed only if the measuring device is equipped with the optional Electrode Cleaning Circuit (ECC)
	0 → 5: ECC OFF 0 → 6: ECC ON
	The following control variables are only executed if the measuring device has a relay output.
	0 → 50: Relay output 1 OFF 0 → 51: Relay output 1 ON 0 → 55: Relay output 2 OFF 0 → 56: Relay output 2 ON
	Control variables that are executed only if the "Batching" software plug-in is installed in the measuring device
	0 → 30: Select batching specification 1 0 → 31: Select batching specification 2 0 → 32: Select batching specification 3 0 → 33: Select batching specification 4 0 → 34: Select batching specification 5 0 → 35: Select batching specification 6 0 → 40: Stop batching 0 → 41: Start batching 0 → 42: Interrupt (pause) batching 0 → 43: Continue batching 0 → 44: Reset the fault message (affects the batching fault messages: # 471...474) 0 → 46: Reset batching counter and total batching quantity to 0



Note!
The control (e.g. switching on positive zero return) is executed by cyclic data transmission if the output byte switches from "0" to the bit pattern in question. The output byte must always switch from "0". A switchback to "0" does not have any effect.

Example (change the output byte)

From	→	To	Result
0	→	2	Positive zero return is switched on.
2	→	0	No effect
0	→	3	Positive zero return is switched off.
3	→	2	No effect

Output data

Byte 1
Control

BATCHING_QUANTITY module

The value of the quantity to be batched (IEEE 754 floating point number), including status, can be cyclically transmitted by the PROFIBUS master (Class 1) to the measuring device using the BATCHING_QUANTITY module (slot 8). If the batch quantity specified here is achieved, the closing contact for valve 1 is activated. The unit selected in the measuring device is used as the unit.



Caution!
The batching quantity is a nonvolatile device parameter. For this reason, avoid constantly writing this device parameter via PROFIBUS → 99.



Note!

- This module is only evaluated by the measuring device if the additional "batching" software is installed in the measuring device (order option).
- Further explanation of the parameter BATCH QUANTITY (7203) is contained in the "Description of Device Functions" manual, which is a separate part of this Operating Manual.

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Batch quantity (IEEE 754 floating point number)				Status



Note!
The status is not evaluated by the device.

BATCHING_FIX_COMP_QUANTITY module

A positive or negative correction value (IEEE 754 floating point number), including status, can be cyclically transmitted by the PROFIBUS master (Class 1) to the measuring device using the BATCHING_FIX_COMP_QUANTITY module (slot 9). The correction quantity balances out a constant, system-related incorrect quantity. This can be caused, for example, by a pump over-running or by the closing time of a valve. The correction quantity is determined by the system operator. A negative compensation quantity must be specified for overbatching and a positive correction quantity for underbatching. The permitted input range is $\pm 10\%$ of the batch quantity. The unit selected in the measuring device is used as the unit.

**Caution!**

The batching quantity is a nonvolatile device parameter. For this reason, avoid constantly writing this device parameter via PROFIBUS → 99.

**Note!**

- This module is only evaluated by the measuring device if the additional "batching" software is installed in the measuring device (order option).
- If the input range is not sufficient for the correction quantity, the batching quantity may have to be adjusted.
- Further explanation of the parameter FIX COMPENSATION QUANTITY (7204) is contained in the "Description of Device Functions" manual, which is a separate part of this Operating Manual.

Output data:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Fixed correction quantity (IEEE 754 floating point number)				Status

**Note!**

The status is not evaluated by the device.

EMPTY_MODULE module

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules. Gaps between configured modules have to be assigned the EMPTY_MODULE module.

For a more detailed description, see → 101.

6.6.4 Configuration examples with Simatic S7 HW-Konfig

Example 1

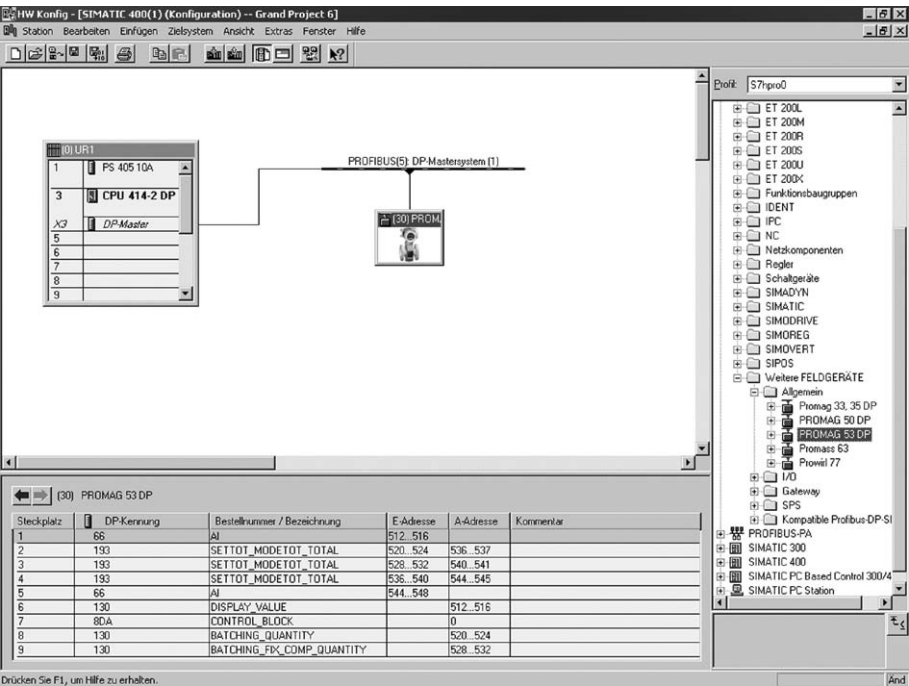


Fig. 60: Complete configuration using the Promag 53 GSD file (complete device functionality)

It is essential to adhere to the following sequence when configuring the modules in the PROFIBUS master (Class 1):

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	-	Analog Input function block 1 Output variable → volume flow (factory setting)
2	SETTOT_MODETOT_TOTAL	5	2	Totalizer function block 1 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
3	SETTOT_MODETOT_TOTAL	5	2	Totalizer function block 2 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
4	SETTOT_MODETOT_TOTAL	5	2	Totalizer function block 3 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
5	AI	5	-	Analog Input function block 2 Output variable → mass flow (factory setting)
6	DISPLAY_VALUE	-	5	Value for local display
7	CONTROL_BLOCK	-	1	Control of device functions
8	BATCHING_QUANTITY	-	5	Batching quantity
9	BATCHING_FIX_COMP_QUANTITY	-	5	Fixed correction quantity

Example 2

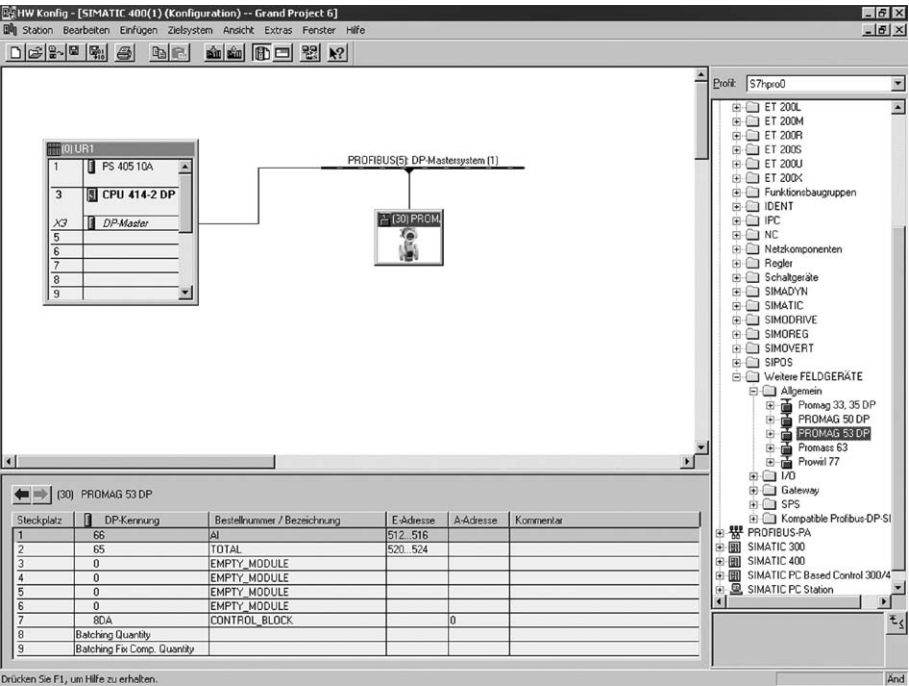


Fig. 61: In this example, modules that are not needed are replaced by the module EMPTY_MODULE. The Promag 53 GSD file is used (manufacturer-specific GSD file, complete device functionality)

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 2) and the cyclic control of device functions CONTROL_BLOCK (slot 7) are activated. The volume flow (factory setting) is read out cyclically by the measuring device by means of Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the volume flow by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

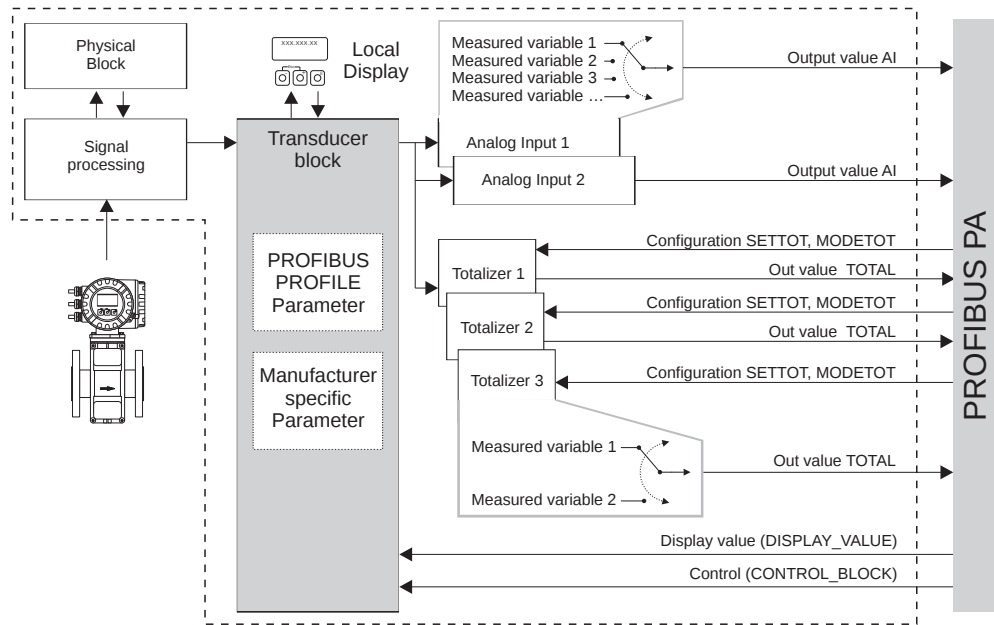
Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	-	Analog Input function block 1 Output variable → volume flow (factory setting)
2	TOTAL	5	-	Totalizer function block 1 TOTAL → output variable = volume flow (factory setting)
3	EMPTY_MODULE	-	-	Empty
4	EMPTY_MODULE	-	-	Empty
5	EMPTY_MODULE	-	-	Empty
6	EMPTY_MODULE	-	-	Empty
7	CONTROL_BLOCK	-	1	Control of device functions

6.7 PROFIBUS PA cyclic data transmission

Below is a description of the cyclic data transmission when using the Promag 53 GSD file (complete device functionality).

6.7.1 Block model

The block model illustrated shows which input and output data the measuring device provides for cyclic data transmission via PROFIBUS PA.



a0004625-en

Fig. 62: Block model for Promag 53 PROFIBUS PA Profile 3.0

6.7.2 Modules for cyclic data transmission

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the EMPTY_MODULE module.

To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

It is essential to adhere to the following sequence/assignment when configuring the modules in the PROFIBUS master system:

Slot sequence	Module	Description
1	AI	Analog Input function block 1 Output variable → volume flow (factory setting)
2	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	Totalizer function block 1 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
3	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	Totalizer function block 2 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
4	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	Totalizer function block 3 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
5	AI	Analog Input function block 2 Output variable → mass flow (factory setting)
6	DISPLAY_VALUE	Value for local display
7	CONTROL_BLOCK	Control of device functions



Note!

- The assignment of the measured variables for the Analog Input function blocks (1 to 2) and the totalizer function blocks (1 to 3) can be changed by means of the CHANNEL function. A detailed description of the individual modules is contained in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system. This can be effected as follows:
 - By means of the local display
 - By means of an operating program (e.g. FieldCare)
 - By switching the supply voltage off and on again.

6.7.3 Description of the modules

AI (Analog Input) module

The AI module (slots 1, 5) cyclically transmits the corresponding measured variable, including the status, to the PROFIBUS master (Class 1). The measured variable is represented in the first four bytes in the form of floating point numbers in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the measured variable. Further information on the device status → [127](#)

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
measured variable (IEEE 754 floating point number)				Status

Assignment of the measured variables to the AI module

The AI module can transmit different measured variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Analog Input function blocks 1 to 2 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) →
 BLOCK SELECTION (6120): Selection of an Analog Input function block →
 CHANNEL (6123): Selection of a measured variable

Possible settings

Measured variable	ID for CHANNEL function
VOLUME FLOW	273
MASS FLOW	277



Note!

The measured variables for the additional "batching" software are available only when they are installed in the measuring device. If the measured variable is selected even if the additional software is not installed, the value "0" is transmitted to the PROFIBUS master (Class 1) for the measured variable.

Factory setting

Module	Analog Input function block	Measured variable	ID for CHANNEL function
AI (slot 1)	1	VOLUME FLOW	273
AI (slot 5)	2	MASS FLOW	277

TOTAL module

The measuring device has three totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS (Class 1) via the TOTAL module (slots 2 to 4). The totalizer value is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the totalizer value.

Further information on the device status → 127

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Assignment of the measured variables to the TOTAL module

The TOTAL module can transmit different totalizer variables to the PROFIBUS master (Class 1). The measured variables are assigned to the totalizer function blocks 1 to 3 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
 SELECT TOTALIZER (6130): Selection of a totalizer →
 CHANNEL (6133): Selection of measured variable

Possible settings

Totalizer value/measured variable	ID for CHANNEL function
VOLUME FLOW	273
MASS FLOW	277
OFF	0

Factory setting

Module	Totalizer function block	Totalizer value/ Measured variable	Unit	ID for CHANNEL function
TOTAL (slot 2)	1	VOLUME FLOW	m ³	273
TOTAL (slot 3)	2	VOLUME FLOW	m ³	273
TOTAL (slot 4)	3	VOLUME FLOW	m ³	273

Example:

You want to cyclically transmit the totalized volume flow as totalizer value 1 to the PROFIBUS master (Class 1) by means of the TOTAL module (slot 7):

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → select TOTALIZER (6130): Select TOTALIZER 1, then select CHANNEL (6133) = VOLUME FLOW

SETTOT_TOTAL module

The module combination SETTOT_TOTAL (slots 2 to 4) consists of the functions SETTOT and TOTAL.

With this module combination:

- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer value, is transmitted, including the status (TOTAL)

SETTOT function

In the SETTOT function, the totalizer can be controlled via control variables.

The following control variables are supported:

- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer preset

**Note!**

After the totalizer value has been reset to 0 or set to the preset value, the totalizing continues automatically. The control variable does not have to be changed to 0 again to restart totalizing. Stopping totalizing is controlled in the SETTOT_MODETOT_TOTAL module via the MODETOT function → 104.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 102

Data structure of the SETTOT_TOTAL module combination

Output data		Input data				
SETTOT		TOTAL				
Byte 1		Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Control		Totalizer value (IEEE 754 floating point number)				Status

SETTOT_MODETOT_TOTAL module

The module combination SETTOT_MODETOT_TOTAL (slots 2 to 4) consists of the functions SETTOT, MODETOT and TOTAL.

With this module combination:

- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer can be configured via the automation system (MODETOT).
- The totalizer value, is transmitted, including the status (TOTAL)

SETTOT function

For a description of the SETTOT function, refer to SETTOT_TOTAL module →  103

MODETOT function

In the MODETOT function, the totalizer can be configured via control variables.

The following settings are possible:

- 0 = Balance (factory setting), calculates the positive and negative flow portions
- 1 = calculates the positive flow portions
- 2 = calculates the negative flow portions
- 3 = Totalizing is stopped



Note!

For the calculation of the positive and negative flow portions (control variable 0) or the negative flow portions only (control variable 2) to be carried out correctly, the option BIDIRECTIONAL must be active in the MEASURING MODE (6601) function.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module →  102

Data structure of the SETTOT_MODETOT_TOTAL module combination

Output data		Input data				
SETTOT	MODETOT	TOTAL				
Byte 1	Byte 2	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Control	Configuration	Totalizer value (IEEE 754 floating point number)				Status

Example of using the SETTOT_MODETOT_TOTAL module

If the SETTOT function is set to 1 (= reset the totalizer), the value for the aggregated total is reset to 0.

If the aggregated total of the totalizer should constantly retain the value 0, the MODETOT function must first be set to 3 (= totalizing is stopped) and then the SETTOT function must be set to 1 (= reset the totalizer).

DISPLAY_VALUE module

Any value (IEEE 754 floating point number), including status, can be cyclically transmitted via the PROFIBUS master (Class 1) directly to the local display using the DISPLAY_VALUE module (slot 6). Display value assignment to the main line, additional line or information line can be configured via the local display itself or an operating program (e.g. FieldCare).

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Display value (IEEE 754 floating point number)				Status

Status

The measuring device interprets the status in accordance with PROFIBUS Profile Specification Version 3.0. The statuses OK, BAD and UNCERTAIN are indicated on the local display by a corresponding symbol. →  63

CONTROL_BLOCK module

By means of the CONTROL_BLOCK module (slot 7), the measuring device is able to process device-specific control variables from the PROFIBUS master (Class 1) in cyclic data transmission (e.g. switching on positive zero return).

Supported control variables of the CONTROL_BLOCK module

The following device-specific control variables can be activated by changing the output byte from 0 → x:

Module	Control variables
CONTROL_BLOCK	0 → 2: Positive zero return ON 0 → 3: Positive zero return OFF 0 → 8: UNIDIRECTIONAL measuring mode 0 → 9: BIDIRECTIONAL measuring mode 0 → 24: Run UNIT TO BUS function
	Control variables that are executed only if the measuring device is equipped with the optional Electrode Cleaning Circuit (ECC)
	0 → 5: ECC OFF 0 → 6: ECC ON



Note!
The control (e.g. switching on positive zero return) is executed by cyclic data transmission if the output byte switches from "0" to the bit pattern in question. The output byte must always switch from "0". A switchback to "0" does not have any effect.

Example (change the output byte)

From	→	To	Result
0	→	2	Positive zero return is switched on.
2	→	0	No effect
0	→	3	Positive zero return is switched off.
3	→	2	No effect

Output data

Byte 1
Control

EMPTY_MODULE module

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable - it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules. Gaps between configured modules have to be assigned the EMPTY_MODULE module.

For a more detailed description, see →  101

6.7.4 Configuration examples with Simatic S7 HW-Konfig

Example 1

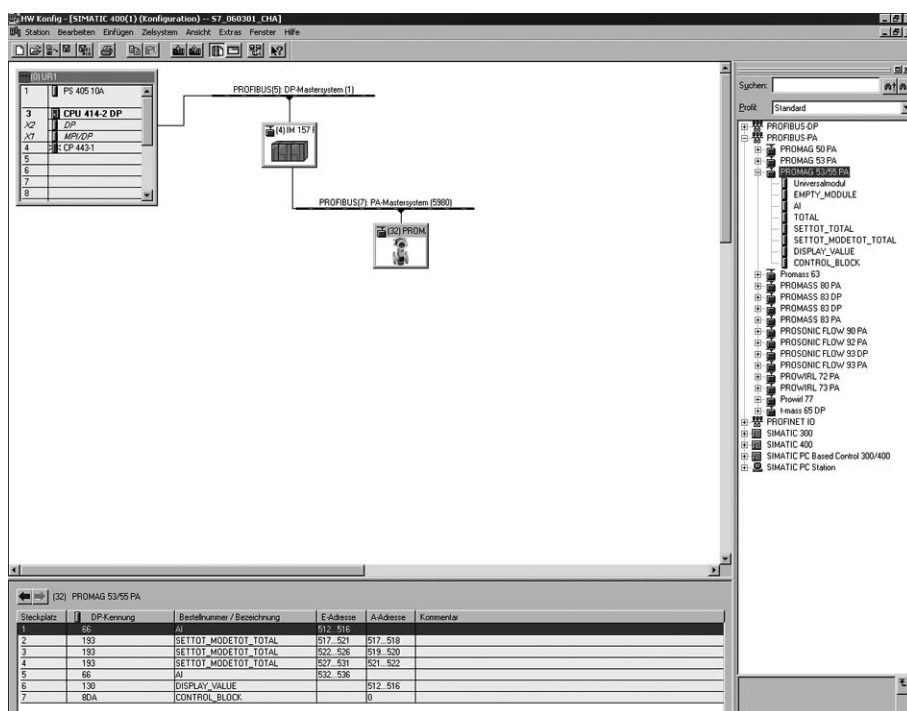


Fig. 63: Complete configuration using the Promag 53 GSD file (complete device functionality)

It is essential to adhere to the following sequence when configuring the modules in the PROFIBUS master (Class 1):

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	-	Analog Input function block 1 Output variable → volume flow (factory setting)
2	SETTOT_MODETOT_TOTAL	5	2	Totalizer function block 1 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
3	SETTOT_MODETOT_TOTAL	5	2	Totalizer function block 2 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
4	SETTOT_MODETOT_TOTAL	5	2	Totalizer function block 3 TOTAL → output variable = volume flow (factory setting) SETTOT → totalizer control MODETOT → totalizer configuration
5	AI	5	-	Analog Input function block 2 Output variable → mass flow (factory setting)
6	DISPLAY_VALUE	-	5	Value for local display
7	CONTROL_BLOCK	-	1	Control of device functions

Example 2

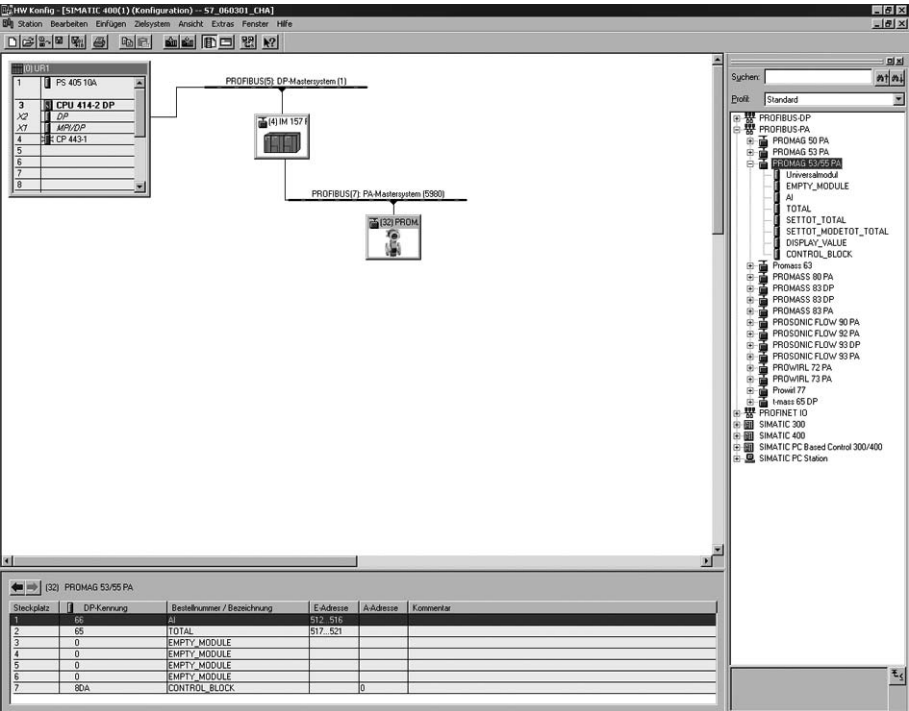


Fig. 64: In this example, modules that are not needed are replaced by the module EMPTY_MODULE. The Promag 53 GSD file is used (manufacturer-specific GSD file, complete device functionality)

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 2) and the cyclic control of device functions CONTROL_BLOCK (slot 7) are activated. The volume flow (factory setting) is read out cyclically by the measuring device by means of Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the volume flow by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	-	Analog Input function block 1 Output variable → volume flow (factory setting)
2	TOTAL	5	-	Totalizer function block 1 TOTAL → output variable = volume flow (factory setting)
3	EMPTY_MODULE	-	-	Empty
4	EMPTY_MODULE	-	-	Empty
5	EMPTY_MODULE	-	-	Empty
6	EMPTY_MODULE	-	-	Empty
7	CONTROL_BLOCK	-	1	Control of device functions

6.8 PROFIBUS DP/PA acyclic data transmission

Acyclic data transmission is used to transmit parameters during commissioning or maintenance, or to display additional measured variables that are not included in cyclic data traffic. Thus parameters for identification, control or adjustment in the various blocks (physical block, transducer block, function block) can be changed while the device is in the process of cyclic data transmission with a PLC.

The measuring device supports the two basic types of acyclic data transmission:

- MS2AC communication with 2 available SAP's
- MS1AC communication

6.8.1 Master class 2 acyclic (MS2AC)

MS2AC is acyclic data transmission between a field device and a Class 2 master (z.B. FieldCare, Siemens PDM etc. →  69). During this process, the master opens a communication channel via an SAP (Service Access Point) to access the device.

All parameters to be exchanged with a device via PROFIBUS must be made known to a Class 2 master. This assignment to each individual parameter takes place either in a device description (DD), a DTM (Device Type Manager), or inside a software component in the master via slot and index addressing.

When using MS2AC communication, note the following:

- As described above, a Class 2 master accesses a device via special SAP's.
Therefore, the number of Class 2 masters that can communicate with a device simultaneously is limited to the number of SAPs available for this data transmission.
- The use of a Class 2 master increases the cycle time of the bus system. This must be taken into account when programming the control system used.

6.8.2 Master class 1 acyclic (MS1AC)

In MS1AC, a cyclic master, that is already reading the cyclic data from the device or writing to the device opens the communication channel via the SAP 0x33 (special Service Access Point for MS1AC) and can then read or write a parameter acyclically like a Class 2 master via the slot and the index (if supported).

When using MS1AC communication, note the following:

- Currently, few PROFIBUS masters on the market support this data transmission.
- MS1AC is not supported by all PROFIBUS devices.
- In the user program, note that constant writing of parameters (for example, at every cycle of the program) can drastically reduce the service life of a device. Acyclically written parameters are written to voltage-resistant memory modules (EEPROM, Flash etc.). These memory modules are designed for a limited number of write operations. In normal operation without MS1AC (during parameter configuration), the number of write operations does not even come close to this number. If programming is incorrect, this maximum number can be reached quickly, drastically reducing a device's service life.



Note!

The memory module of the measuring device is designed for one million write operations.

6.9 Adjustment

6.9.1 Empty-pipe/Full-pipe adjustment

Flow cannot be measured correctly unless the measuring pipe is completely full.

This status can be monitored at all times with the Empty Pipe Detection function:

- 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!

A **detailed** description and other helpful hints for the empty-pipe/full-pipe adjustment procedure are contained in the separate "Description of Device Functions" manual:

- EPD/OED ADJUSTMENT (6481) → Carrying out the adjustment.
- EPD (6420) → Switching on and off EPD/OED.
- EPD RESPONSE TIME (6425) → 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 liquid conductivity differs from this reference, empty-pipe/full-pipe adjustment has to be performed again on site.
- The default setting for EPD/OED when the devices are delivered is OFF; the function has to be activated if required.
- The EPD/OED process error can be output by means of the configurable relay outputs.

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

1. Select the corresponding function in the function matrix:
HOME → → → BASIC FUNCTIONS → → → PROCESSPARAMETERS → → → ADJUSTMENT → → EPD/OED ADJUSTMENT
2. Empty the piping. In case of an EPD adjustment, the wall of the measuring tube should be wetted with fluid for the adjustment procedure but this is not the case with an OED adjustment!
3. Start empty-pipe adjustment: Select "EMPTY PIPE ADJUST" or "OED EMPTY ADJUST" and press 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 to confirm.
6. Having completed the adjustment, select the setting "OFF" and exit the function by pressing .
7. Now select the "EPD" function (6420). Switch on Empty Pipe Detection by selecting the following settings:
 - EPD → Select ON STANDARD or ON SPECIAL and press to confirm.
 - OED → Select OED and confirm with .



Caution!

The adjustment coefficients must be valid before you can activate the EPD/OED function. If adjustment is incorrect the following messages might appear on the display:

- ADJUSTMENT FULL = EMPTY
The adjustment values for empty pipe and full pipe are identical. In such cases, the empty-pipe/full-pipe adjustment **must** be repeated!
- ADJUSTMENT NOT OK
Adjustment is not possible because the fluid's conductivity is out of range.

6.10 Data storage device

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data is stored. By plugging and unplugging such modules, device configurations can be duplicated onto other measuring devices to cite just one example.

6.10.1 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.

6.10.2 HistoROM/T-DAT (Transmitter DAT)

The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.

Storing of specific parameter settings from the device memory (EEPROM) to the T-DAT module and vice versa has to be carried out by the user (= manual save function). Detailed information about the procedure →  90

6.10.3 F-CHIP (Function Chip)

The F-Chip is a microprocessor chip that contains additional software packages that extend the functionality and application possibilities of the transmitter.

In the case of a later upgrade, the F-CHIP can be ordered as an accessory and can simply be plugged on to the I/O board. After start up, the software is immediately made available to the transmitter.

Accessories →  123

Plugging on to the I/O board →  141



Caution!

To ensure an unambiguous assignment, the F-CHIP is coded with the transmitter serial number once it is plugged in. Thus, it can not be reused with other measuring devices.

7 Maintenance

No special maintenance work is required.

7.1 Exterior cleaning

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

7.2 Seals

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

Replacement seals (accessories) →  123

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 code of your choice.

8.1 Device-specific accessories

Accessory	Description	Order code
Promag 53 transmitter	Transmitter for replacement or for stock. Use the order code to define the following specifications: – Approvals – Degree of protection / version – Cable type for the remote version – Cable entries – Display / power supply / operation – Software – Outputs / inputs	53XXX - XXXXX * * * * *
Conversion kit for inputs/outputs (PROFIBUS DP only)	Conversion kit with appropriate slot modules for converting the present input/output configuration to a new version.	DKUI - * *
Software packages for Promag 53 (PROFIBUS DP only)	Software add-ons on F-CHIP, can be ordered individually: – Electrode Cleaning Circuitry (ECC) – Batching	DK5SO - *

8.2 Measuring principle-specific accessories

Accessory	Description	Order code
Mounting kit for Promag 53 transmitter	Mounting kit for wall-mounted housing (remote version). Suitable for: ■ Wall mounting ■ Pipe mounting ■ Panel mounting Mounting set for aluminum housings. Suitable for: ■ Pipe mounting	DK5WM - *
Cable for remote version	Coil and signal cables, various lengths. Reinforced cable on request.	DK5CA - * *
Ground cable for Promag W/P	A set consists of two ground cables.	DK5GC - * * *
Ground disk for Promag W/P	Ground disk for potential matching	DK5GD * * *
Mounting kit for Promag H	Mounting kit for Promag H, comprising: – 2 process connections – Screws – Seals	DKH * * - * * * *
Adapter connection for Promag A, H	Adapter connections for installing Promag 53 H instead of Promag 30/33 A or Promag 30/33 H DN 25.	DK5HA - * * * * *
Ground rings for Promag H	If the process connections are made of PVC or PVDF, ground rings are necessary to ensure that potential is matched. A set comprises 2 ground rings.	DK5HR - * * * *
Set of seals for Promag H	For regular replacement of the seals of the Promag H sensor.	DK5HS - * * *
Wall-mounting kit for Promag H	Wall-mounting kit for the Promag H sensor.	DK5HM - * *
Welding jig for Promag H	Weld nipples as process connection: Welding jig for installation in pipes.	DK5HW - * * *

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.	DKA80 – *
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 units in your system and helps you manage these units. By providing status information, it is also a simple but effective method of controlling the units' status.	See the product page on the Endress+Hauser website: www.endress.com
FXA193	The FXA193 service interface connects the device to the PC for configuration via FieldCare.	FXA193 – *
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-*****

9 Troubleshooting

9.1 Troubleshooting instructions

Always start troubleshooting with the following checklist if faults occur after commissioning 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 supply voltage → Terminals 1, 2 2. Check device fuse → 147 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V 3. Measuring electronics defective → order spare parts → 141
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 → 141 2. Display module defective → order spare parts → 141 3. Measuring electronics defective → order spare parts → 141
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
Measured value indicated, but no signal at the current or pulse output	Measuring electronics defective → order spare parts → 141



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: = fault message, = notice message – EMPTY TUBE = Type of error, e.g. measuring tube is only partly filled or completely empty – 03:00:05 = duration of error occurrence (in hours, minutes and seconds) – #401 = error number Caution! ■ Also refer to the information on → 68 ■ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.
System error (device error) has occurred → 127
Process error (application error) has occurred → 136



Faulty connection to control system	
No connection can be made between the control system and the device. Check the following points:	
Supply voltage Transmitter	Check the Supply voltage → Terminals 1/2
Device fuse	Check device fuse →  147 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V
Fieldbus connection	PROFIBUS PA: Check data line Terminal 26 = PA + Terminal 27 = PA - PROFIBUS DP: Check data line Terminal 26 = B (Rx/D/TxD-P) Terminal 27 = A (Rx/D/TxD-N)



Faulty connection to control system (continued)	
Fieldbus connector (only for PROFIBUS PA)	■ Check pin assignment/wiring ■ Check connection between connector/fieldbus port. Is the coupling ring tightened correctly?
Fieldbus voltage (only for PROFIBUS PA)	Check that a min. bus voltage of 9 V DC is present at terminals 26/27. Permissible range: 9 to 32 V DC
Network structure	Check permissible fieldbus length and number of spurs.
Basic current (only for PROFIBUS PA)	Is there a basic current of min. 11 mA?
Bus address	Check bus address: make sure there are no double assignments
Bus termination	Has the PROFIBUS network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in communication.
Power consumption, permitted feed current (only for PROFIBUS PA)	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply.



System or process error messages
System or process errors which occur during commissioning or operation can also be displayed in the manufacturer-specific device controls using the FieldCare operating program.



Other error (without error message)	
Other errors are present	Diagnosis and rectification →  139

9.2 System error messages

Serious system errors are **always** recognized by the measuring device as a "fault message" and shown as a lightning flash symbol (⚡) on the display! Fault messages immediately affect the inputs and outputs. Simulations and positive zero return, on the other hand, are classed and displayed as "Notice messages".



Caution!

In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. Important procedures must be carried out before you return a flowmeter to Endress+Hauser → [150](#).

Always enclose a duly completed "Declaration of contamination" form. You will find a preprinted blank of this form at the back of this manual.



Note!

- The error types listed in the following correspond to the factory settings.
- See the information on → [68](#)

9.2.1 Displaying the device status on PROFIBUS DP/PA

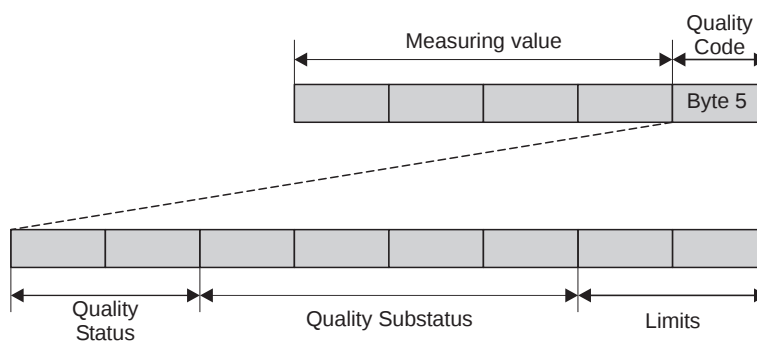
Display in the operating program (acyclic data transmission)

The device status can be queried using an operating program (e.g. FieldCare):

Function block SUPERVISION → SYSTEM → OPERATION → ACTUAL SYSTEM CONDITION

Display in the PROFIBUS master system (cyclic data transmission)

If the AI or TOTAL modules are configured for cyclic data transmission, the device status is coded in accordance with PROFIBUS Profile Specification 3.0 and transmitted with the measured value to the PROFIBUS master by means of the quality byte (byte 5). The quality byte is split into the "quality status", "quality substatus" and "limits" segments.



a0002707-en

Fig. 65: Structure of the quality byte

The content of the quality byte depends on the failsafe mode error behavior configured in the corresponding Analog Input function block. Depending on which failsafe mode has been set in the FAILSAFE_TYPE function, the following status information is transmitted to the PROFIBUS master via the quality byte:

- For the selection FAILSAFE_TYPE → FSAFE VALUE :

Quality code (HEX)	Quality status	Quality substatus	Limits
0x48 0x49 0x4A	UNCERTAIN	Substitute set	OK Low High

- For the selection FAILSAFE_TYPE → LAST GOOD VALUE (factory setting):

If a valid output value was available before the failure:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x44 0x45 0x46	UNCERTAIN	Last usable value	OK Low High

If no valid output value was available before the failure:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x4C 0x4D 0x4E	UNCERTAIN	Initial Value	OK Low High

- For FAILSAFE_TYPE → WRONG VALUE:
For status information, see the table in the following section.

9.2.2 List of system error messages

No.	Device status message (local display)	Quality code (HEX) Measured value status	PROFIBUS measured value status			Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts → 📄 141)
			Quality status	Quality substatus	Limits		
Depicted on the local display: S = System error ⚡ = Fault message (with an effect on the inputs and outputs) ! = Notice message (without any effect on the inputs and outputs)							
No. # 0xx → Hardware error							
001	S: CRITICAL FAILURE ⚡: # 001	0x0F	BAD	Device Failure	Constant	ROM/RAM failure	<i>Cause:</i> ROM/RAM error. Error when accessing the program memory (ROM) or random access memory (RAM) of the processor. <i>Remedy:</i> Replace the amplifier board.
011	S: AMP HW EEPROM ⚡: # 011	0x0F	BAD	Device Failure	Constant	Amplifier EEPROM failure	<i>Cause:</i> Amplifier with faulty EEPROM <i>Remedy:</i> Replace the amplifier board.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts → 141)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
012	S: AMP SW EEPROM #: # 012	0x0F	BAD	Device Failure	Constant	Amplifier EEPROM data inconsistent	Cause: Error when accessing data of the measuring amplifier EEPROM Remedy: The EEPROM data blocks in which an error has occurred are displayed in the TROUBLESHOOTING function (No. 8047). 1. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the faulty parameter values. 2. The measuring device must be restarted after fault elimination. Access: SUPERVISION → SYSTEM → OPERATION → SYSTEM RESET (→ RESTART)
031	S: SENSOR HW DAT #: # 031	0x10 0x11 0x12	BAD	Sensor Failure	O.K. Low High	S-DAT failure / S-DAT not inserted	Cause: 1. S-DAT is not correctly plugged into the amplifier board (or is missing). 2. S-DAT is defective. Remedy: 1. Check whether the S-DAT is correctly plugged into the amplifier board. 2. Replace the S-DAT if it is defective. Check whether the new replacement DAT is compatible with the existing electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the S-DAT into the amplifier board.
032	S: SENSOR SW DAT #: # 032	0x10 0x11 0x12	BAD	Sensor Failure	O.K. Low High	S-DAT data inconsistent	2. Replace the S-DAT if it is defective. Check whether the new replacement DAT is compatible with the existing 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.
041	S: TRANSM. HW-DAT #: # 041	0x0F	BAD	Device Failure	Constant	T-DAT failure	Cause: 1. T-DAT is not correctly plugged into the amplifier board (or is missing). 2. T-DAT is defective. Remedy: 1. Check whether the T-DAT is correctly plugged into the amplifier board. 2. Replace the T-DAT if it is defective. Check whether the new replacement DAT is compatible with the existing electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the T-DAT into the amplifier board.
042	S: TRANSM. SW-DAT #: # 042	0x0F	BAD	Device Failure	Constant	T-DAT data inconsistent	2. Replace the T-DAT if it is defective. Check whether the new replacement DAT is compatible with the existing electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the T-DAT into the amplifier board.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts →  141)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
061	S: HW F-CHIP ?: # 061	0x0F	BAD	Device Failure	Constant	F-CHIP defect/not plugged	<i>Cause:</i> Transmitter F-Chip: – F-Chip is defective – F-Chip is not plugged into the I/O board or is missing. <i>Remedy:</i> 1. Replace the F-CHIP. 2. Plug the F-CHIP into the I/O board.
No. # 1xx → Software error							
101	S: GAIN ERROR AMP ?: # 101	0x0F	BAD	Device Failure	Constant	Gain Error Amplifier	<i>Cause:</i> Gain deviation compared to reference gain is greater than 2%. <i>Remedy:</i> Replace the amplifier board.
121	S: A/C COMPATIB. !: # 121	0x0F	BAD	Device Failure	Constant	Amplifier and I/O board only partially compatible	<i>Cause:</i> Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality).  Note! – The indication on the display as notice message appears only for 30 seconds (with listing in "Previous system condition" function). – This condition can occur if only one electronics board has been exchanged; the extended software functionality is not available. The previously existing software functionality is still working and the measurement possible. <i>Remedy:</i> Module with lower software version has either to be updated by "FieldCare" with the required software version or the module has to be replaced.

No.	Device status message (local display)	Quality code (HEX) Measured value status	PROFIBUS measured value status			Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts →  141)
			Quality status	Quality substatus	Limits		
No. # 2xx → Error in DAT/no communication							
205	S: LOAD T-DAT !: # 205	0x0F	BAD	Device Failure	Constant	Save to T-DAT failed	<i>Cause:</i> Data backup (downloading) to T-DAT failed, or error when accessing (uploading) the calibration values stored in the T-DAT. <i>Remedy:</i> 1. Check whether the T-DAT is correctly plugged into the amplifier board. 2. Replace the T-DAT if it is defective. Before replacing the DAT, 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
206	S: SAVE T-DAT !: # 206	0x0F	BAD	Device Failure	Constant	Restore from T- DAT failed	
261	S: COMMUNICAT. I/O f: # 261	0x18 0x19 0x1A	BAD	No Communicati on	O.K. Low High	Communication failure	<i>Cause:</i> Communication error. No data reception between amplifier and I/O board or faulty internal data transfer. <i>Remedy:</i> Check whether the electronics boards are correctly inserted in their holders
No. # 3xx → System limits exceeded							
321	S: TOL. COIL CURR. f: # 321	0x0F	BAD	Device Failure	Constant	Coil current out of tolerance	<i>Cause:</i> The coil current of the sensor is out of tolerance. <i>Remedy:</i>  Warning! Switch off power supply before manipulating the coil current cable, coil current cable connector or measuring electronics boards! Remote version: 1. Check wiring of terminals 41/42 →  44 2. Check coil current cable connector. Compact and remote version: If the error can not be resolved, please contact your local Endress+Hauser service organization.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts →  141)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
339 to 342	S: STACK CUR OUT n #: # 339 to 342	0x0F	BAD	Device Failure	Constant	Temp. Buf. not cleared	<i>Cause:</i> The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds. <i>Remedy:</i> 1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
343 to 346	S: STACK FREQ. OUT n #: # 343 to 346	0x0F	BAD	Device Failure	Constant	Temp. Buf. not cleared	<i>Recommendation:</i> – Configure the fault response of the output to ACTUAL VALUE, so that the temporary buffer can be cleared. – Clear the temporary buffer by the measures described under Item 1.
347 to 350	S: STACK PULSE OUT n !: # 347 to 350	0x0F	BAD	Device Failure	Constant	Temp. Buf. not cleared	<i>Cause:</i> The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds. <i>Remedy:</i> 1. Increase the setting for pulse weighting. 2. Increase the max. pulse frequency, if the totalizer can handle a higher number of pulses. 3. Increase or reduce flow, as applicable. <i>Recommendation:</i> – Configure the fault response of the output to ACTUAL VALUE, so that the temporary buffer can be cleared. – Clear the temporary buffer by the measures described under Item 1.
351 to 354	S: CURRENT RANGE n !: # 351 to 354	0x54 0x55 0x56	UNCERTAIN	Engineering Unit Range Violation	O.K. Low High	Flow is Out of Range	<i>Cause:</i> Current output: The actual value for the flow lies outside the set limits. <i>Remedy:</i> 1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
355 to 358	S: FREQ. RANGE n !: # 355 to 358	0x54 0x55 0x56	UNCERTAIN	Engineering Unit Range Violation	O.K. Low High	Flow is Out of Range	<i>Cause:</i> Frequency output: The actual value for the flow lies outside the set limits. <i>Remedy:</i> 1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts → 141)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
359 to 362	S: PULSE RANGE !: # 359 to 362	0x54 0x55 0x56	UNCERTAIN	Engineering Unit Range Violation	O.K. Low High	Flow is Out of Range	Cause: Pulse output: The pulse output frequency is out of range. Remedy: 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: – Version 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: $\frac{1}{2 \cdot 10 \text{ Hz}} = 50 \text{ ms}$ 3. Reduce flow
No. # 5xx → Application error							
501	S: SW.-UPDATE ACT. !: # 501	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	New amplifier software loaded	Cause: New amplifier or communication software version is loaded. Currently no other functions are possible. Remedy: Wait until process is finished. The device will restart automatically.
502	S: UP-/DOWNLO. ACT. !: # 502	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	Upload/download of device data active	Cause: Up- or downloading the device data via configuration program. Currently no other functions are possible. Remedy: Wait until process is finished.

a0004437

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts →  141)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
571	P: RUN BATCHING !: # 571	0x80	GOOD	O.K.	O.K.	Batch running	<i>Cause:</i> Batching is started and active (valves are open) <i>Remedy:</i> No measures needed (during the batching process some other functions may not be activated).
572	P: HOLD BATCHING !: # 572	0x80	GOOD	O.K.	O.K.	Batch hold	<i>Cause:</i> Batching has been interrupted (valves are closed) <i>Remedy:</i> Using either: ■ PROFIBUS DP/PA ■ Local display: – Continue batching with "GO ON". – Interrupt batching with "STOP".
No. # 6xx → Simulation mode active							
601	S: POS. ZERO-RETURN !: # 601	0x53	UNCERTAIN	Sensor conversion not accurate (measured value from sensor not accurate)	Constant	Positive zero return active	<i>Cause:</i> Positive zero return is active.  Note! This message has the highest display priority! <i>Remedy:</i> Switch off positive zero return. <i>Access:</i> BASIC FUNCTION → SYSTEM PARAMETER → CONFIGURATION → POS. ZERO RETURN (→ OFF)
611 to 614	S: SIM. CURR. OUT. n !: # 611 to 614	0x80	GOOD	O.K.	O.K.	Simulation IO active	<i>Cause:</i> Simulation current output is active. <i>Remedy:</i> Switch off simulation.
621 to 624	S: SIM. FREQ. OUT. n !: # 621 to 624	0x80	GOOD	O.K.	O.K.	Simulation IO active	<i>Cause:</i> Simulation frequency output is active. <i>Remedy:</i> Switch off simulation.
631 to 634	S: SIM. PULSE n !: # 631 to 634	0x80	GOOD	O.K.	O.K.	Simulation IO active	<i>Cause:</i> Simulation pulse output is active. <i>Remedy:</i> Switch off simulation.
641 to 644	S: SIM. STAT. OUT n !: # 641 to 644	0x80	GOOD	O.K.	O.K.	Simulation IO active	<i>Cause:</i> Simulation status output is active. <i>Remedy:</i> Switch off simulation.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (Spare parts → 141)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
651 to 654	S: SIM. RELAY n !: # 651 to 654	0x80	GOOD	O.K.	O.K.	Simulation IO active	<i>Cause:</i> Simulation relay output is active. <i>Remedy:</i> Switch off simulation.
671 to 674	S: SIM. STATUS IN n !: # 671 to 674	0x80	GOOD	O.K.	O.K.	Simulation IO active	<i>Cause:</i> Simulation status output is active. <i>Remedy:</i> Switch off simulation.
691	S: SIM. FAILSAFE !: # 691	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	Simulation failsafe active	<i>Cause:</i> Simulation of failsafe mode (outputs) is active. <i>Remedy:</i> Switch off simulation. <i>Access:</i> SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
692	S: SIM. MEASURAND !: # 692	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Simulation measured value active	<i>Cause:</i> Simulation of the measured value is active. <i>Remedy:</i> Switch off simulation. <i>Access:</i> SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)
698	S: DEV. TEST ACT. !: # 698	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Device test via Fieldcheck active	<i>Cause:</i> The measuring device is being checked on site via the test and simulation device.

9.3 Process error messages



Note!

Also note the versions on → [68](#) and → [140](#).

9.3.1 Displaying the device status on PROFIBUS DP/PA

For more information, refer to → [127](#)

9.3.2 List of process error messages

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
P = Process error ⚡ = Fault message (with an effect on the inputs and outputs) ! = Notice message (without any effect on the inputs and outputs)							
401	P: EMPTY PIPE ⚡: # 401	0x03	BAD	Non specific (uncertain status)	Constant	Empty Pipe detected	<i>Cause:</i> Measuring tube partially filled or empty. <i>Remedy:</i> 1. Check the process conditions of the plant. 2. Fill the measuring tube.
461	P: ADJ N. OK !: # 461	0x40 0x41 0x42	UNCERT AIN	Non specific (uncertain status)	O.K. Low High	EPD adjustment not possible	<i>Cause:</i> EPD/OED adjustment not possible because the fluid's conductivity is either too low or too high. <i>Remedy:</i> The EPD/OED function cannot be used with fluids of this nature.
463	P: FULL = EMPTY ⚡: # 463	0x40 0x41 0x42	UNCERT AIN	Non specific (uncertain status)	O.K. Low High	EPD adjustment wrong	<i>Cause:</i> The EPD/OED adjustment values for empty pipe and full pipe are identical, therefore incorrect. <i>Remedy:</i> Repeat adjustment, making sure procedure is correct. → 📖 120

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
471	P: > BATCH TIME t: # 471	0x00 0x01 0x02	BAD	Non specific (uncertain status)	O.K. Low High	Batch Time	<i>Cause:</i> The maximum permitted batching time was exceeded. <i>Remedy:</i> 1. Increase flow rate. 2. Check valve (opening). 3. Adjust time setting to changed batch quantity.  Note! If the errors listed above occur, these are displayed in the Home position flashing continuously. ■ General: These error messages can be reset by configuring any batching parameter. It is sufficient to confirm with the  key and then the  key. ■ Batching via status input: The error message can be reset by means of a pulse. Another pulse then restarts the batching. ■ Batching via operating keys (soft keys) The error message is reset by pressing the START key. Pressing the START key a second time starts the batching process. ■ Batching via the BATCHING PROCESS function (7260): The error message can be reset by pressing the STOP, START, HOLD or GO ON keys. Pressing the START key a second time starts the batching process.
472	P: >< BATCH QUANTITY t: # 472	0x00 0x01 0x02	BAD	Non specific (uncertain status)	O.K. Low High	Batch Quantity	<i>Cause:</i> EPD calibration not possible as the fluid conductivity is either too low or too high. – Underbatching: The minimum quantity was not reached. – Overbatching: The maximum permitted batching quantity was exceeded. <i>Remedy:</i> Underbatching: 1. Increase fixed correction quantity. 2. If the batching quantity changes, the minimum batching quantity must be adjusted. Overbatching: 1. Reduce fixed correction quantity. 2. If the batching quantity changes, the maximum batching quantity must be adjusted.  Note! Please observe Note in error message No. 471

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
473	P: PROGRESS NOTE ! # 473	0x80	GOOD	O.K.	O.K.	Progress Note	<i>Cause:</i> End of filling process approaching. The running filling process has exceeded the predefined batch quantity point for the display warning message. <i>Remedy:</i> No measures required (if necessary prepare to replace container).
474	P: MAX. FLOW RATE ! # 474	0x00 0x01 0x02	BAD	Non specific (uncertain status)	O.K. Low High	Flow Rate	<i>Cause:</i> Maximum flow value entered is exceeded. <i>Remedy:</i> Reduce the flow value.  Note! Please observe Note in error message No. 471

9.4 Process errors without messages

Symptoms	Rectification
 Note! You may have to change or correct certain settings of the function matrix in order to rectify faults. The functions outlined below, such as DISPLAY DAMPING, for example, are described in detail in the "Description of Device Functions" manual.	
Flow values are negative, even though the fluid is flowing forwards through the pipe.	- Remote version: - Switch off the power supply and check the wiring → 14 40 - If necessary, reverse the connections at terminals 41 and 42 - Change the setting in the INSTALLATION DIRECTION SENSOR function accordingly
Measured value reading fluctuates even though flow is steady.	- Check grounding and potential matching. → 14 56 - The medium is too inhomogeneous. Check the following medium characteristics: - Gas bubble percentage too high? - Solids percentage too high? - Conductivity fluctuations too high? - SYSTEM DAMPING function → increase value (→ BASIC FUNCTION/SYSTEMPARAMETER/CONFIGURATION) - TIME CONSTANT function → increase the value (→ OUTPUTS/CURRENT OUTPUT/CONFIGURATION) - DISPLAY DAMPING function → increase the value (→ USER INTERFACE/CONTROL/BASIC CONFIGURATION)
Measured-value reading or measured-value output pulsates or fluctuates, e.g. because of reciprocating pump, peristaltic pump, diaphragm pump or pump with similar delivery characteristic.	Perform the "Pulsating Flow" Quick Setup (only possible if a pulse/frequency output is available). → 14 82 If the problem persists despite these measures, a pulsation damper will have to be installed between pump and measuring device.
There are differences between the flowmeter's internal totalizer and the external metering device.	This symptom is due primarily to backflow in the piping because the pulse output cannot subtract in the STANDARD or SYMMETRY measuring modes. The problem can be solved as follows: Allow for flow in both directions. Set the MEASURING MODE function to PULSATING FLOW for the pulse output in question.
Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	- Check grounding and potential matching → 14 56 - Check the fluid for presence of gas bubbles. - Activate the ON-VALUE LOW FLOW CUT OFF function, i.e. enter or increase the value for the low flow cut off (→ BASIC FUNCTIONS / PROCESS PARAMETERS / CONFIGURATION).
Measured-value reading on display, even though measuring tube is empty.	- Perform empty-pipe/full-pipe adjustment and then switch on Empty Pipe Detection → 14 120 - Remote version: Check the terminals of the EPD cable → 14 44 - Fill the measuring tube.
The current output signal is always 4 mA, irrespective of the flow signal at any given time.	Value for creepage too high: Reduce the corresponding value in the ON-VALUE LOW FLOW CUT OFF function.
The fault cannot be rectified or some other fault not described above has occurred. 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: order code, serial number → 14 7 Returning devices to Endress+Hauser The required procedures must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. → 14 150 Always enclose a duly completed "Declaration of contamination" form with the flowmeter. You will find a preprinted form at the back of this Operating Manual. Replace transmitter electronics Components in the measuring electronics defective → order spare parts → 14 141

9.5 Failsafe mode of outputs



Note!

The failsafe mode of the 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 reset the signals of the current, pulse and frequency outputs to their fallback value, or reset measured value transmission via fieldbus to "0", 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		
	System/process error is present	Positive zero return is activated
 Caution! System or process errors defined as "Notice messages" have no effect whatsoever on the inputs and outputs. See the information on →  68		
Current output	MINIMUM VALUE 0–20 mA → 0 mA 4–20 mA → 2 mA 4–20 mA NAMUR → 3.5 mA 4–20 mA US → 3.75 mA 0–20 mA (25 mA) → 0 mA 4–20 mA (25 mA) → 2 mA MAXIMUM VALUE 0–20 mA → 22 mA 4–20 mA → 22 mA 4–20 mA NAMUR → 22.6 mA 4–20 mA US → 22.6 mA 0–20 mA (25 mA) → 25 mA 4–20 mA (25 mA) → 25 mA HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Fault is ignored, i.e. normal measured-value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"
Pulse output	FALLBACK VALUE Signal output → no pulses HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Fault is ignored, i.e. normal measured-value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"
Frequency output	FALLBACK VALUE Signal output → 0 Hz FAILSAFE LEVEL Output of the frequency specified in the FAILSAFE VALUE function. HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Fault is ignored, i.e. normal measured-value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"
Relay output	In the event of a fault or power supply failure: Relay → deenergized The "Description of Device Functions" manual contains detailed information on relay switching response for various configurations such as error message, flow direction, EPD, limit value, etc.	No effect on relay output
PROFIBUS	→  127	-

9.6 Spare parts

The previous sections contain a detailed troubleshooting guide → 125.

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 (screws etc.)
- Mounting instructions
- Packaging

9.6.1 PROFIBUS DP

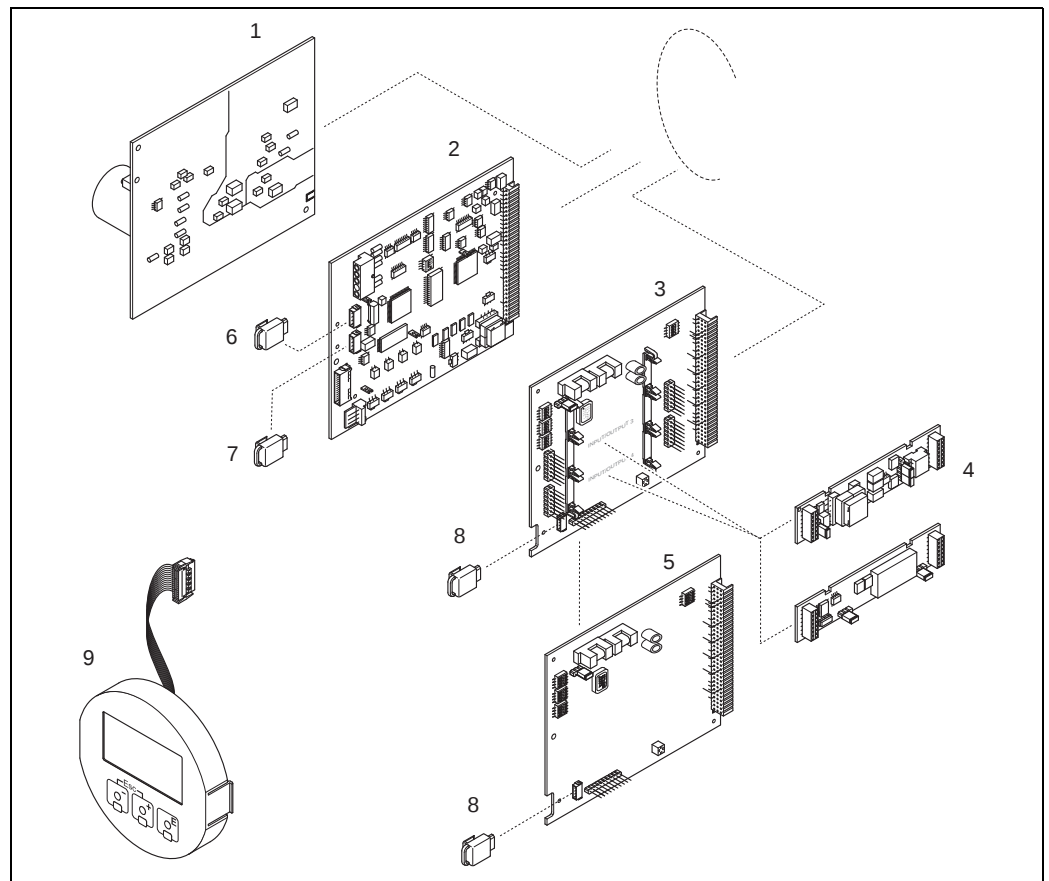


Fig. 66: Spare parts for PROFIBUS DP transmitters (field and wall-mount housing)

- 1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
- 2 Amplifier board
- 3 I/O board (COM module), flexible
- 4 Pluggable input/output submodules; ordering structure → 123
- 5 I/O board (COM module), permanent assignment
- 6 S-DAT (sensor data storage device)
- 7 T-DAT (transmitter data storage device)
- 8 F-CHIP (function chip for optional software)
- 9 Display module

9.6.2 PROFIBUS PA

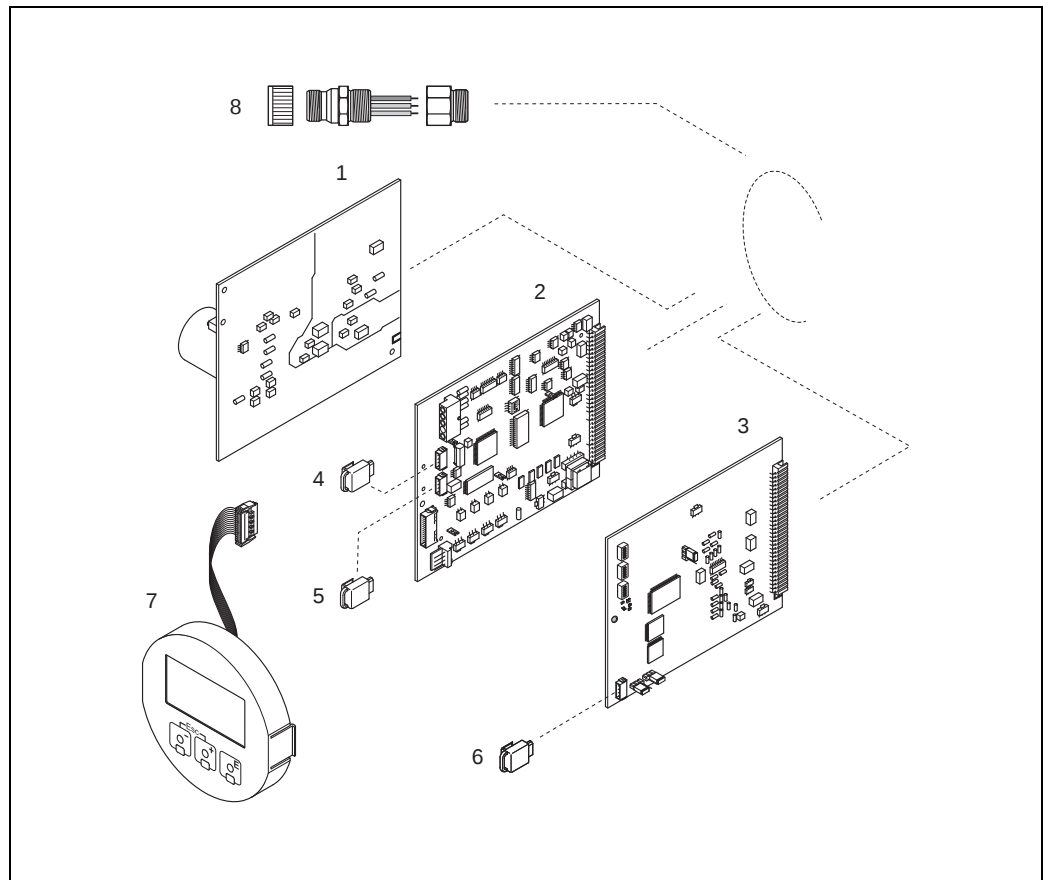


Fig. 67: Spare parts for PROFIBUS PA transmitters (field and wall-mount housing)

- 1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
- 2 Amplifier board
- 3 I/O board (COM module), permanent assignment
- 4 S-DAT (sensor data storage device)
- 5 T-DAT (transmitter data storage device)
- 6 F-CHIP (function chip for optional software)
- 7 Display module
- 8 Fieldbus connector consisting of protection cap, connector, adapter PG 13.5/M20.5 (only for PROFIBUS-PA, order No. 50098037)

9.6.3 Removing and installing printed circuit boards

Field housing



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 this Operating Manual.

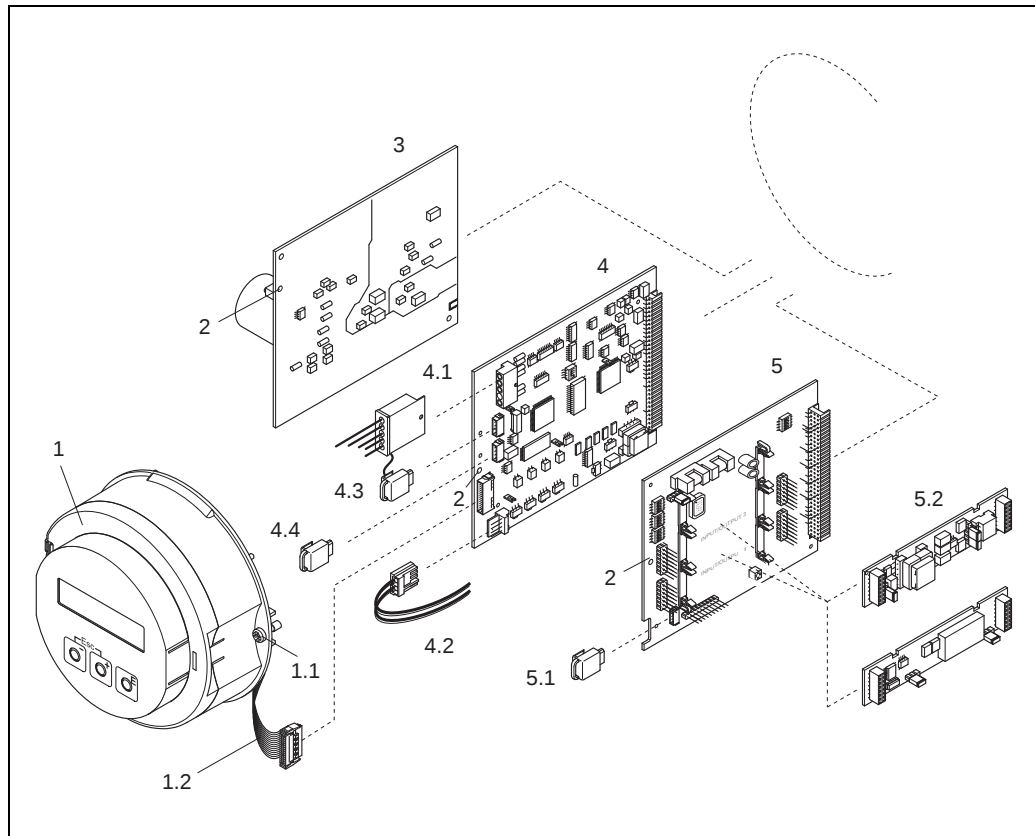


Caution!

Use only original Endress+Hauser parts.

Installing and removing the circuit boards →  68:

1. Unscrew cover of the electronics compartment from the transmitter housing.
 2. 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.
 3. Remove the screws and remove the cover (2) from the electronics compartment.
 4. Remove power unit board (4) and I/O board (6):
Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
 5. Removing sub-modules (6.2, only for measuring devices with convertible I/O board):
No tools are required for removing the submodules (inputs/outputs) from the I/O board.
Installation is also a no-tools operation.
-  **Caution!**
Only certain combinations of submodules on the I/O board are permissible →  49.
The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:
- "INPUT / OUTPUT 3" slot = terminals 22/23
 - "INPUT / OUTPUT 4" slot = terminals 20/21
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 back and forward.
 - Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
 7. Installation is the reverse of the removal procedure.



#0008241

Fig. 68: Field housing: removing and installing printed circuit boards

- 1 Local display
- 1.1 Screws of electronics compartment cover
- 1.2 Ribbon cable (display module)
- 2 Aperture for installing/removing boards
- 3 Power unit board
- 4 Amplifier board
- 4.1 Electrode signal cable (sensor)
- 4.2 Coil current cable (sensor)
- 4.3 S-DAT (sensor data storage device)
- 4.4 T-DAT (transmitter data storage device)
- 5 I/O board (flexible assignment)
- 5.1 F-CHIP (function chip for optional software)
- 5.2 Pluggable sub-modules (current, pulse/frequency and relay output)

Wall-mounted housing**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 purposely 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 this Operating Manual.

**Caution!**

Use only original Endress+Hauser parts.

Installing and removing the circuit boards →  69: Wall-mount housing

1. Remove the screws and open the hinged cover (1) of the housing.
2. Remove the screws securing the electronics module (2). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. 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):
Loosen the plug locking and gently disconnect the plug from the board, i.e. without moving it back and forward.
 - Ribbon cable plug (3) of the display module
4. Remove the cover (4) from the electronics compartment by loosening the screws.
5. Remove the boards (6, 7, 8):
(5) Insert a thin pin into the hole provided for the purpose and pull the board clear of its holder.
6. Removing sub-modules (8.2, only for measuring devices with convertible I/O board):
No tools are required for removing the submodules (inputs/outputs) from the I/O board.
Installation is also a no-tools operation.

**Caution!**

Only certain combinations of submodules on the I/O board are permissible →  49.

The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:

"INPUT / OUTPUT 3" slot = terminals 22/23

"INPUT / OUTPUT 4" slot = terminals 20/21

7. Installation is the reverse of the removal procedure.

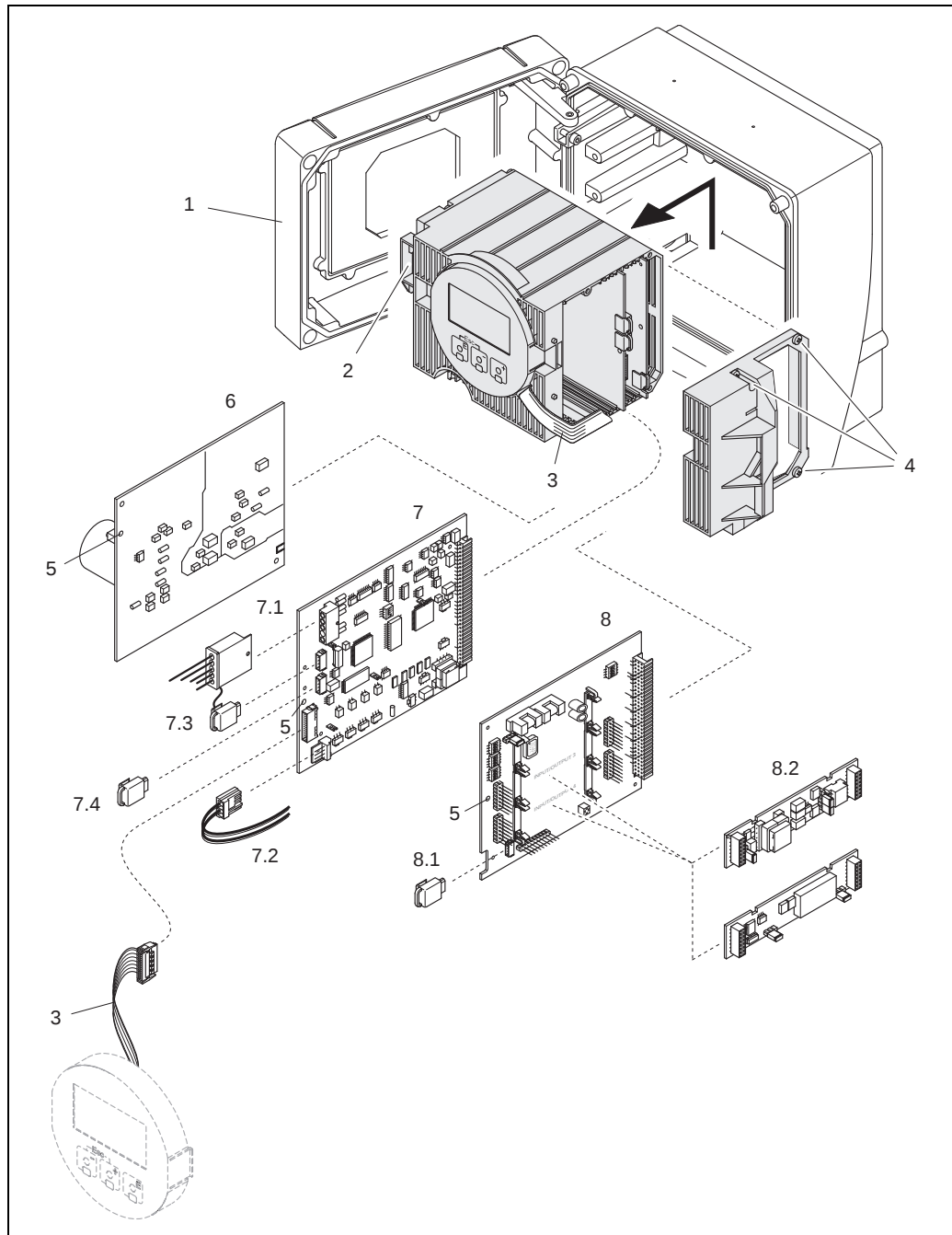


Fig. 69: Wall-mount housing: removing and installing printed circuit boards

- 1 Housing cover
- 2 Electronics module
- 3 Ribbon cable (display module)
- 4 Screws of electronics compartment cover
- 5 Aperture for installing/removing boards
- 6 Power unit board
- 7 Amplifier board
- 7.1 Electrode signal cable (sensor)
- 7.2 Coil current cable (sensor)
- 7.3 S-DAT (sensor data storage device)
- 7.4 T-DAT (transmitter data storage device)
- 8 I/O board (flexible assignment)
- 8.1 F-CHIP (function chip for optional software)
- 8.2 Pluggable sub-modules (current, pulse/frequency and relay output)

9.6.4 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 unit board →  70.

The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power unit board. →  143
3. Remove the protection cap (1) and replace the device fuse (2).
Use only fuses of the following type:
 - 20 to 55 V AC / 16 to 62 V DC → 2.0 A slow-blow / 250 V; 5.2 x 20 mm
 - Power supply 85 to 260 V AC → 0.8 A slow-blow / 250 V; 5.2 x 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.

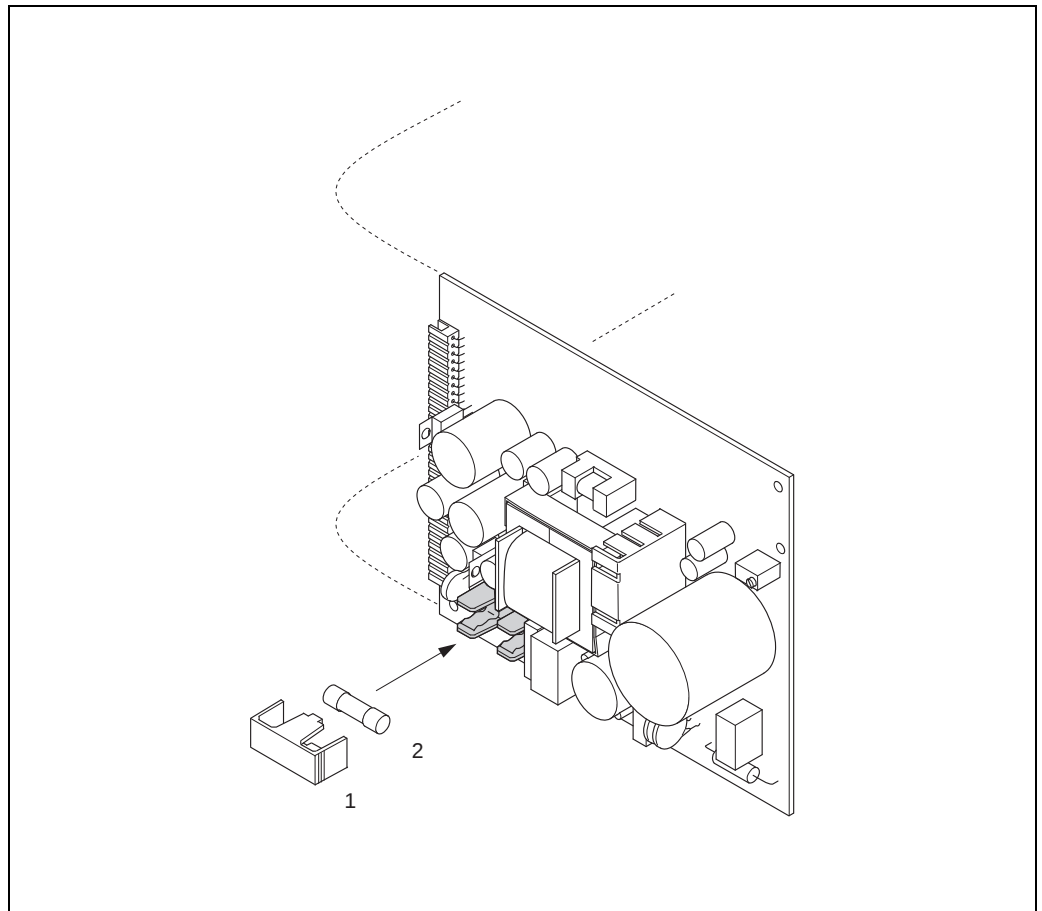


Fig. 70: Replacing the device fuse on the power unit board

- 1 Protective cap
2 Device fuse

9.6.5 Replacing exchangeable measuring electrodes

The Promag W sensor (DN 350 to 2000; 14" to 78") is available with exchangeable measuring electrodes as an option. This design permits the measuring electrodes to be replaced or cleaned under process conditions → 149.

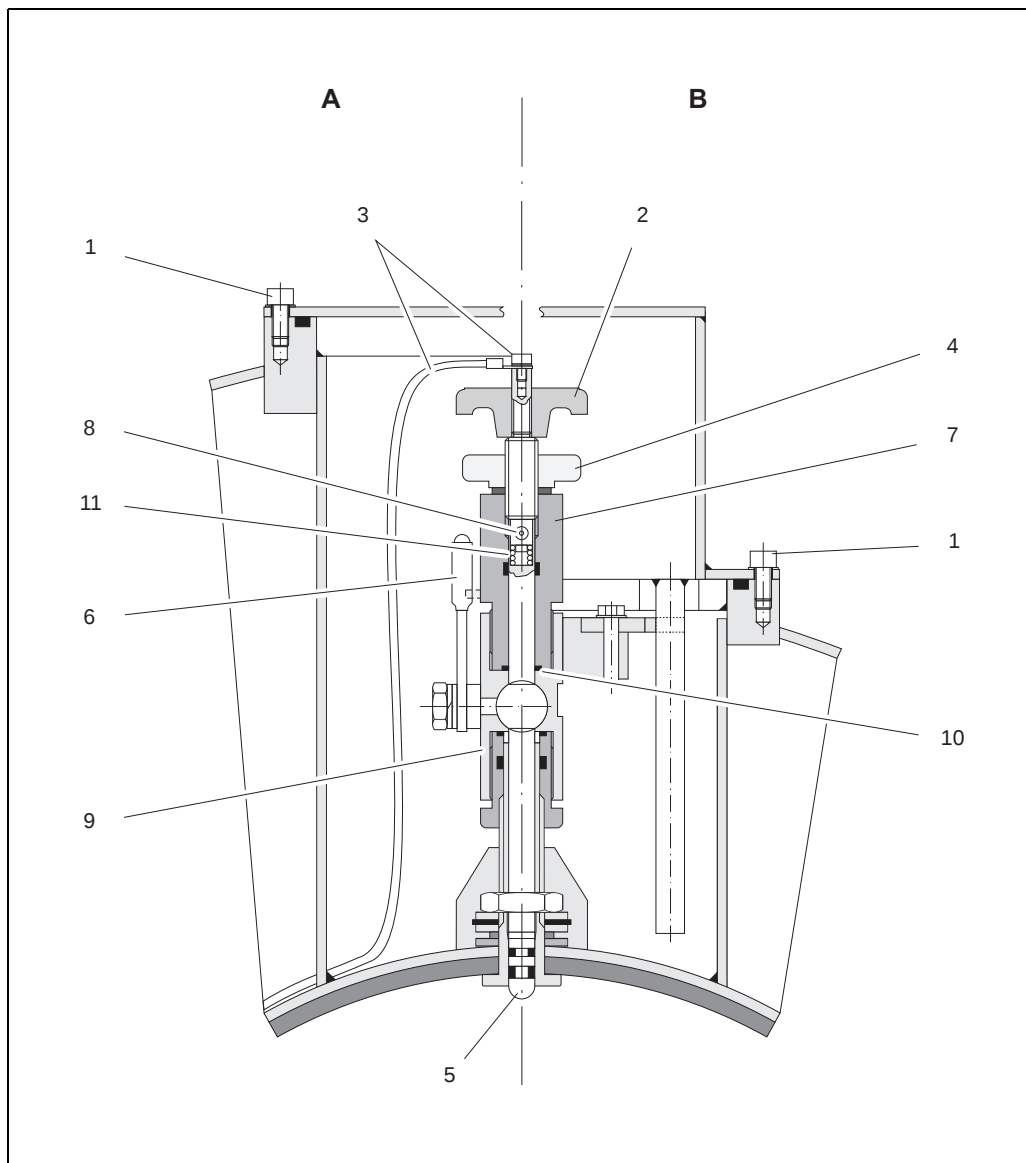


Fig. 71: Apparatus for replacing exchangeable measuring electrodes

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

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

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

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

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

Observe the regulations applicable in your country!

9.9 SoftwareHistory

Date	Software version	Changes to software	Operating Manual
06.2010	PROFIBUS DP/PA 3.06.XX	Software adjustmen	71116500/06.10
08.2007	PROFIBUS PA 3.04.XX	Introduction of a new PROFIBUS PA I/O board	71060107/08.07
07.2007	PROFIBUS DP 3.04.XX	Software adjustment	
10.2006	PROFIBUS DP 3.04.00	Software adjustment	
12.2005			
10.2005	PROFIBUS DP 3.01.XX	Introduction of a new PROFIBUS DP I/O-board: – Support of additional output signals (current, frequency etc.) Software expansion: – Batching	50099246/10.05

Date	Software version	Changes to software	Operating Manual
03.2005	PROFIBUS PA 2.03.XX	Software expansion: – New, improved functions New functions: – DEVICE SOFTWARE → Display of the device software (NAMUR recommendation 53) – US unit Kgal	50099246/10.03
10.2003	Amplifier: 1.06.XX Communication module: 2.03.XX	Software expansion: – Language groups – New error messages – SIL 2 – The totalizer values are also updated without integration into the cyclic data transmission – Support of compatibility with previous PROFIBUS model Promag 33 with Profile Version 2.0 New functions: – Operation hours counter – Intensity of background illumination adjustable – Counter for access code – Upload/download via ToF Tool - Fieldtool Package Compatible with service protocol: – ToF-Tool FieldTool Package (the latest SW version can be downloaded under: www.tof-fieldtool.endress.com)	
12.2002	Communication module: 2.02.XX	Software adjustment	
09.2002	Amplifier: 1.04.XX Communication module: 2.01.XX	Software expansion: – Data length of advanced diagnosis adjusted in the cyclic data transmission  Note! As of this software version, a new device master file (GSD) must be used when replacing the device!	
03.2002	Amplifier: 1.03.XX Communication module: 2.00.01	Software expansion: – Communication software can be updated via service protocol	50099246/10.03
07.2001	Com. module: 1.01.00	Software adjustment	
06.2001	Amplifier: 1.02.00	Software adjustment	
04.2001	Com. module: 1.00.00	Original software	50099246/04.01
09.2000	Amplifier: 1.01.01	Software adjustment	
08.2000	Amplifier: 1.01.00	Software enhancement (functional adaptations)	
04.2000	Amplifier: 1.00.00	Original software	

10 Technical data

10.1 Technical data at a glance

10.1.1 Applications

→ 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 variables

Measured variable	Flow rate (proportional to induced voltage)
-------------------	---

Measuring range	Typically $v = 0.01$ to 10 m/s (0.03 to 0.33 ft/s) with the specified measuring accuracy
-----------------	---

Operable flow range	Over $1000 : 1$
---------------------	-----------------

Input signal	<i>Status input (auxiliary input):</i> $U = 3$ to 30 V DC, $R_i = 3$ k Ω , galvanically isolated. Switch level: ± 3 to ± 30 VDC, independent of polarity
--------------	---

10.1.4 Output variables

Output signal	<i>Current output</i> Active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s), Full scale value adjustable, temperature coefficient: typically 0.005% o.r./ $^{\circ}\text{C}$, resolution: 0.5 μA ■ Active: $0/4$ to 20 mA, R_L max. 700 Ω ■ Passive: 4 to 20 mA; supply voltage V_s 18 to 30 V DC; $R_i \geq 150$ Ω <i>Pulse/frequency output:</i> Active/passive selectable, galvanically isolated ■ Active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100$ Ω ■ Passive: open collector, 30 V DC, 250 mA ■ Frequency output: full scale frequency 2 to 10000 Hz ($f_{\text{max}} = 12500$ Hz), on/off ratio $1:1$, pulse width max. 2 s ■ Pulse output: pulse value and pulse polarity selectable, pulse width configur. (0.05 to 2000 ms) <i>PROFIBUS DP interface:</i> ■ PROFIBUS DP in accordance with IEC 61158, galvanically isolated ■ Profile Version 3.0 ■ Data transmission rate: 9.6 kBaud to 12 MBaud ■ Automatic identification of data transmission rate ■ Signal coding: NRZ code ■ Bus address can be configured via miniature switches or via the local display (optional)
---------------	--

PROFIBUS PA interface:

- PROFIBUS PA in accordance with IEC 61158 (MBP), galvanically isolated
- Profile Version 3.0
- Data transmission rate: 31.25 kBaud
- Current consumption: 11 mA
- Permitted supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Signal coding: Manchester II
- Bus address can be configured via miniature switches or via the local display (optional)

Signal on alarm	<i>Current output:</i> Failsafe mode selectable (e.g. in accordance with NAMUR recommendation NE 43) <i>Pulse/frequency output:</i> Failsafe mode selectable <i>Relay output:</i> De-energized by fault or power supply failure <i>PROFIBUS DP/PA</i> Status and alarm messages in accordance with PROFIBUS Profile Version 3.0
Load	See "Output signal"
Switching output	<i>Relay output:</i> Normally closed (NC or break) or normally open (NO or make) contacts available (default: relay 1 = NO, relay 2 = NC), max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated.
Low flow cut off	Switch points for low flow are selectable.
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

10.1.5 Power supply

Electrical connections	→  40
Supply voltage	85 to 260 V AC, 45 to 65 Hz 20 to 55 V AC, 45 to 65 Hz 16 to 62 V DC
Cable entries	Power supply and signal cables (inputs/outputs): ■ Cable entry M20 x 1.5 (8 to 12 mm; 0.31 to 0.47 in) ■ Sensor cable entry for armored cables M20 x 1.5 (9.5 to 16 mm; 0.37 to 0.63 in) ■ Threads for cable entries, 1/2" NPT, G 1/2" Connecting cable for remote version: ■ Cable entry M20 x 1.5 (8 to 12 mm; 0.31 to 0.47 in) ■ Sensor cable entry for armored cables M20 x 1.5 (9.5 to 16 mm; 0.37 to 0.63 in) ■ Threads for cable entries, 1/2" NPT, G 1/2"
Cable specifications (remote version)	→  48

Power consumption	AC: <15 VA (including sensor) DC: <15 W (including sensor) Switch-on current: ■ max. 13.5 A (< 50 ms) at 24 V DC ■ max. 3 A (< 5 ms) at 260 V AC
Power supply failure	Lasting min. 1 power cycle ■ EEPROM or T-DAT saves measuring system data if power supply fails ■ S-DAT: exchangeable data storage device which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point, etc.)
Potential matching	→ 56

10.1.6 Performance characteristics

Reference operating conditions	To DIN EN 29104 and VDI/VDE 2641: ■ Fluid temperature: +28 °C ± 2 K ■ Ambient temperature: +22 °C ± 2 K ■ Warm-up time: 30 minutes Installation: ■ Inlet run >10 × DN ■ Outlet run > 5 × DN ■ Sensor and transmitter grounded. ■ Sensor centered relative to the pipe.
Maximum measured error	Standard: ±0.2% o.r. ± 2 mm/s (o.r. = of reading)  Note! Supply-voltage fluctuations have no effect within the specified range.

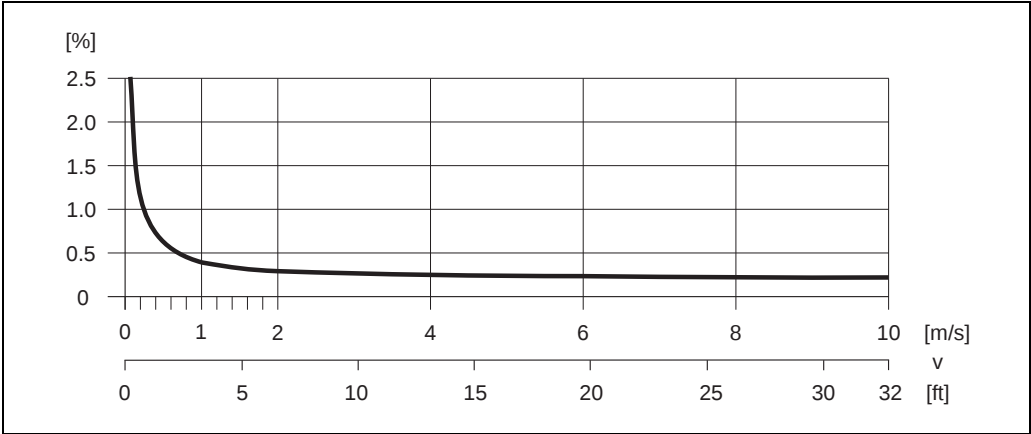


Fig. 72: Max. measured error in % of reading

Repeatability	Standard: max. ±0.1% o.r. ± 0.5 mm/s (o.r. = of reading)
---------------	--

10.1.7 Operating conditions: Installation

Installation instructions →  13

Inlet and outlet runs
Inlet run: typically $\geq 5 \times \text{DN}$
Outlet run: typically $\geq 2 \times \text{DN}$

Length of connecting cable

- The permissible cable length L_{max} for the remote version depends on the conductivity of the medium →  20.
- A minimum conductivity of 20 $\mu\text{S}/\text{cm}$ is required to measure demineralized water.

10.1.8 Operating conditions: Environment

Ambient temperature range

Transmitter:

- Standard: -20 to $+60$ °C (-4 to $+140$ °F)
- Optional: -40 to $+60$ °C (-40 to $+140$ °F)

 Note!

At ambient temperatures below -20 °C (-4 °F), the readability of the display may be impaired.

Sensor:

- Flange material carbon steel: -10 to $+60$ °C ($+14$ to $+140$ °F)
- Flange material stainless steel: -40 to $+60$ °C (-40 to $+140$ °F)

 Caution!

Do not exceed the min. and max. temperatures for the lining of the measuring tube (→ "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 (→ "Medium temperature range").

Storage temperature

The storage temperature corresponds to the operating temperature range of the transmitter and sensor.

 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 and bacteria infestation which can damage the lining.

Degree of protection

- Standard: IP 67 (NEMA 4X) for transmitter and sensor
- Optional: IP 68 (NEMA 6P) for remote version of Promag W and Promag P sensors

Shock and vibration resistance

Acceleration up to 2 g in accordance with IEC 600 68-2-6
(High-temperature version: no data available)

CIP cleaning

 Caution!

The maximum fluid temperature permitted for the measuring device must not be exceeded.

CIP cleaning possible:
Promag P, Promag H

CIP cleaning not possible:
Promag W

SIP cleaning



Caution!

The maximum fluid temperature permitted for the measuring device must not be exceeded.

SIP cleaning possible:

Promag P (with PFA lining), Promag H

SIP cleaning not possible:

Promag W

Electromagnetic compatibility (EMC)

■ As per IEC/EN 61326 and NAMUR Recommendation NE 21

■ Emission: to limit value for industry EN 55011

10.1.9 Operating conditions: Process

Medium temperature range

The permitted temperature depends on the lining of the measuring tube:

Promag W

■ 0 to +80 °C (+32 to +176 °F) for hard rubber (DN 50 to 2000 / 2½ to 80")

■ -20 to +50 °C (-4 to +122 °F) for polyurethane (DN 25 to 1200 / 1 to 48")

Promag P

Standard

■ -40 to +130 °C (-40 to +266 °F) for PTFE (DN 15 to 600 / ½ to 24"),
restrictions → see diagrams below

■ -20 to +130 °C (-4 to +266 °F) for PFA/HE (DN 25 to 200 / 1" to 8"),
restrictions → see diagrams below

■ -20 to +150 °C (-4 to +302 °F) for PFA (DN 25 to 200 / 1" to 8"),
restrictions → see diagrams below

Optional

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

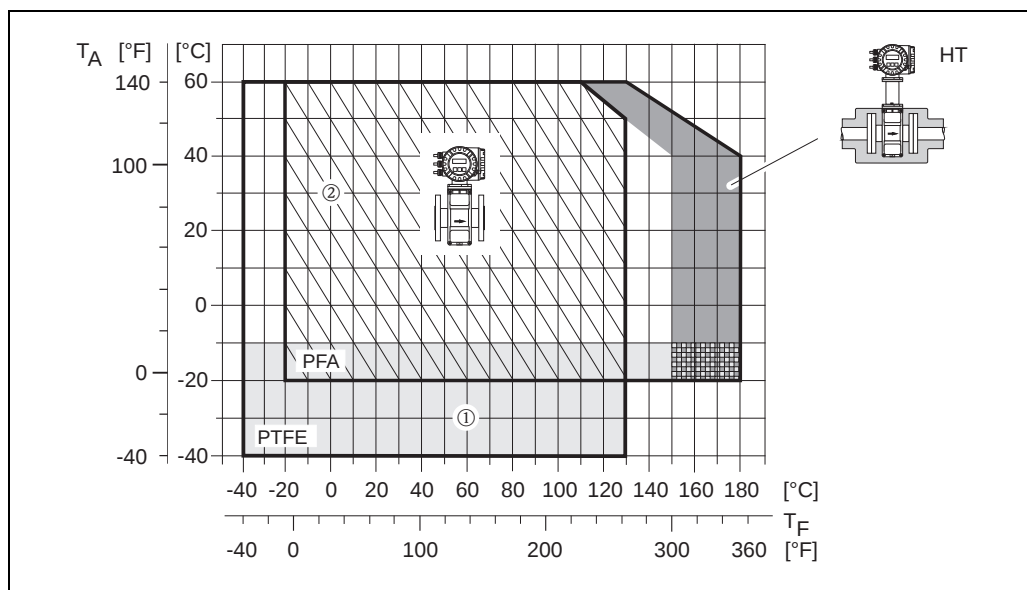


Fig. 73: Promag P compact version (with PFA or PTFE lining)

T_A = ambient temperature; T_F = fluid temperature; HT = high-temperature version with insulation

① = Light gray area → temperature range from -10 to -40 °C (-14 to -40 °F) applies only to stainless steel flanges

② = Diagonally hatched area → foam lining (HE) + degree of protection IP68 = fluid temperature max. 130 °C / 266 °F

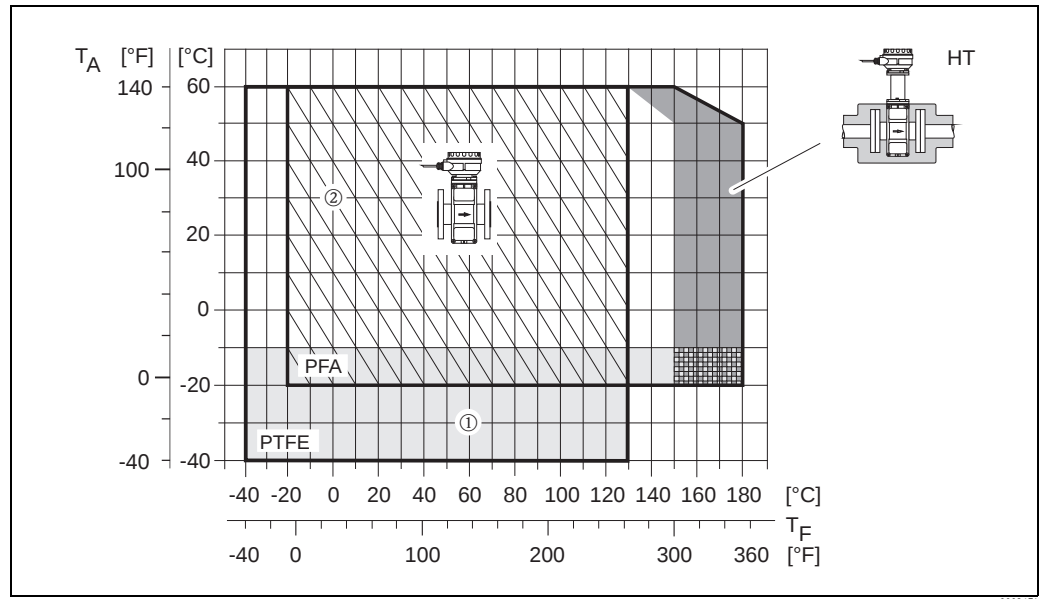


Fig. 74: Remote versions (with PFA or PTFE lining)

T_A = ambient temperature; T_F = fluid temperature; HT = high-temperature version with insulation

① = Light gray area → temperature range from -10 to -40 °C (-14 to -40 °F) applies only to stainless steel flanges

② = Diagonally hatched area → foam lining (HE) + degree of protection IP68 = fluid temperature max. 130 °C / 266 °F

Promag H

Sensor:

- DN 2 to 25: -20 to $+150$ °C (-4 to $+302$ °F)
- DN 40 to 100: -20 to $+150$ °C (-4 to $+302$ °F)

Seals:

- EPDM: -20 to $+150$ °C (-4 to $+302$ °F)
- Silicone: -20 to $+150$ °C (-4 to $+302$ °F)
- Viton: -20 to $+150$ °C (-4 to $+302$ °F)
- Kalrez: -20 to $+150$ °C (-4 to $+302$ °F)

Conductivity of the fluid



The minimum conductivity is ≥ 5 $\mu\text{S}/\text{cm}$ (for demineralized water ≥ 20 $\mu\text{S}/\text{cm}$)

Note!

In the remote version, the required minimum conductivity is also influenced by the length of the connecting cable → 20.

Limiting medium pressure
range (nominal pressure)

Promag W

- EN 1092-1 (DIN 2501)
 - PN 6 (DN 350 to 2000)
 - PN 10 (DN 200 to 2000)
 - PN 16 (DN 65 to 2000)
 - PN 25 (DN 200 to 1000)
 - PN 40 (DN 25 to 150)
- ANSI B 16.5
 - Class 150 (1" to 24")
 - Class 300 (1" to 6")
- AWWA
 - Class D (28" to 78")
- JIS B2220
 - 10 K (DN 50 to 300)
 - 20 K (DN 25 to 300)
- AS 2129
 - Table E (DN 80, 100, 150 to 1200)
- AS 4087
 - PN 16 (DN 80, 100, 150 to 1200)

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)
- ANSI B 16.5
 - Class 150 (½" to 24")
 - Class 300 (½" to 6")
- JIS B2220
 - 10 K (DN 50 to 300)
 - 20 K (DN 15 to 300)
- AS 2129
 - Table E (DN 25, 50)
- AS 4087
 - PN 16 (DN 50)

Promag H

The permitted nominal pressure depends on the process connection and the seal:

- 40 bar → flange, weld nipple (with O-ring seal)
- 16 bar → all other process connections

Pressure tightness (measuring
tube lining)

Promag W

Promag W nominal diameter		Measuring tube lining	Resistance of measuring tube lining to partial vacuum: limit values for absolute pressure [mbar] ([psi]) at various fluid temperatures						
[mm]	[inch]		25 °C 77 °F	50 °C 122 °F	80 °C 176 °F	100 °C 212 °F	130 °C 266 °F	150 °C 302 °F	180 °C 356 °F
25 to 1200	1 to 48"	Polyurethane	0	0	–	–	–	–	–
50 to 2000	3 to 78"	Hard rubber	0	0	0	–	–	–	–

Promag P
Measuring tube lining: PFA

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

Promag P
Measuring tube lining: PTFE

Promag P nominal diameter		Resistance of measuring tube lining to partial vacuum: limit values for absolute pressure [mbar] ([psi]) at various fluid temperatures								
[mm]	[inch]	25 °C		80° C	100 °C		130 °C		150 °C	180 °C
		77 °F		176° F	212 °F		266 °F		302 °F	356 °F
		[mbar]	[psi]		[mbar]	[psi]	[mbar]	[psi]		
15	½"	0	0	0	0	0	100	1,45	–	–
25	1"	0	0	0	0	0	100	1,45	–	–
32	–	0	0	0	0	0	100	1,45	–	–
40	1 ½"	0	0	0	0	0	100	1,45	–	–
50	2"	0	0	0	0	0	100	1,45	–	–
65	–	0	0	*	40	0,58	130	1,89	–	–
80	3"	0	0	*	40	0,58	130	1,89	–	–
100	4"	0	0	*	135	1,96	170	2,47	–	–
125	–	135	1,96	*	240	3,48	385	5,58	–	–
150	6"	135	1,96	*	240	3,48	385	5,58	–	–
200	8"	200	2,90	*	290	4,21	410	5,95	–	–
250	10"	330	4,79	*	400	5,80	530	7,69	–	–
300	12"	400	5,80	*	500	7,25	630	9,14	–	–
350	14"	470	6,82	*	600	8,70	730	10,59	–	–
400	16"	540	7,83	*	670	9,72	800	11,60	–	–
450	18"	Partial vacuum is impermissible								
500	20"									
600	24"									
* No value can be quoted.										

Promag H (measuring tube lining: PFA)

Promag H nominal diameter		Pressure tightness, measuring tube lining: limit values for absolute pressure [mbar] ([psi]) at various fluid temperature					
[mm]	[inch]	25 °C	80° C	100 °C	130 °C	150 °C	180 °C
		77 °F	176° F	212 °F	266 °F	302 °F	356 °F
2 to 100	1/12 to 4"	0	0	0	0	0	0

Limiting flow Further information can be found in the "Nominal diameter and flow rate" → 18 section

- Pressure loss
- No pressure loss if the sensor is installed in piping with the same nominal diameter (for Promag H only from DN8).
 - Pressure losses for configurations incorporating adapters according to DIN EN 545 → 17.

10.1.10 Mechanical construction

Design / dimensions

The dimensions and face-to-face length of the sensor and transmitter can be found in the separate "Technical Information" documentation for each device which can be downloaded in PDF format from www.endress.com. A list of available "Technical Information" documentation can be found in the "Documentation" →  170 section.

Weight (SI units)

Promag W



Note!

The following weights apply to standard pressure ratings and without packaging material.

Nominal diameter	Weights in [kg] for the Promag W								
	Compact version				Remote version (without cable)				
	[mm]	EN (DIN) / AS*	JIS		Sensor		Transmitter		
EN (DIN) / AS*					JIS				
25	PN 40	7,3		7,3	PN 40	5,3		6,0	
32		8,0		7,3		6,0		5,3	6,0
40		9,4		8,3		7,4		6,3	6,0
50		10,6		9,3		8,6		7,3	6,0
65	PN 16	12,0	10K	11,1	PN 16	10,0	10K	9,1	6,0
80		14,0		12,5		12,0		10,5	6,0
100		16,0		14,7		14,0		12,7	6,0
125		21,5		21,0		19,5		19,0	6,0
150		25,5		24,5	PN 10	23,5		22,5	6,0
200		45		41,9		43		39,9	6,0
250		65		69,4		63		67,4	6,0
300		70		72,3		68		70,3	6,0
350	PN 10	115			PN 6	103		6,0	
375		134				133		6,0	
400		135				118		6,0	
450		175				159		6,0	
500		175				154		6,0	
600		235				206		6,0	
700		355				302		6,0	
800		435				355		6,0	
900		575				483		6,0	
1000		700				587		6,0	
1200	PN 6	850				848	6,0		
1400		1300				1298	6,0		
1600		1700				1698	6,0		
1800		2200				2198	6,0		
2000		2800				2798	6,0		
Promag transmitter (compact version): 3.4 kg									
*Only DN 80, 100, 150 to 400, 500 and 600 are available for flanges as per AS									

Promag P

Note!

The following weights apply to standard pressure ratings and without packaging material.

Nominal diameter	Weights in [kg] for the Promag P						
	Compact version				Remote version (without cable)		
	EN (DIN) / AS*		JIS	Sensor		Transmitter	
[mm]				EN (DIN) / AS*		JIS	
15	PN 40	6.5	10K	PN 40	4.5	4.5	6.0
25		7.3			5.3	5.3	6.0
32		8.0			6.0	5.3	6.0
40		9.4			7.4	6.3	6.0
50		10.6			8.6	7.3	6.0
65	PN 16	12.0	10K	PN 16	10.0	9.1	6.0
80		14.0			12.0	10.5	6.0
100		14.4			14.0	12.7	6.0
125		16.0			19.5	19.0	6.0
150		21.5			23.5	22.5	6.0
200	PN 10	45	10K	PN 10	43	39.9	6.0
250		65			63	67.4	6.0
300		70			68	70.3	6.0
350		115			113		6.0
400		135			133		6.0
450	PN 10	175	10K	PN 10	173		6.0
500		175			173		6.0
600		235			233		6.0

Promag transmitter (compact version): 3.4 kg
 High-temperature version: +1.5 kg
 * Only DN 25 and 50 are available for flanges as per AS

Promag H

Note!

The following weights apply to standard pressure ratings and without packaging material.

Nominal diameter	Weights in [kg] for the Promag H		
	Compact version		Remote version (without cable)
			Sensor Transmitter
DIN			
[mm]			
2	5.2		2.0 6.0
4	5.2		2.0 6.0
8	5.3		2.0 6.0
15	5.4		1.9 6.0
25	5.5		2.8 6.0
40	6.5		4.5 6.0
50	9.0		7.0 6.0
65	9.5		7.5 6.0
80	19.0		17.0 6.0
100	18.5		16.5 6.0

Promag transmitter (compact version): 3.4 kg

Weight (US units)

Promag W

Note!

The following weights apply to standard pressure ratings and without packaging material.

Nominal diameter	Weights in [lbs] for the Promag W				
	Compact version		Remote version (without cable)		
			Sensor	Transmitter	
[inch]	ANSI / AWWA		ANSI / AWWA		
1"	Class 150	16	Class 150	12	13
1 ½"		21		16	13
2"		23		19	13
3"		31		26	13
4"		35		31	13
6"		56		52	13
8"		99		95	13
10"		143		161	13
12"		243		238	13
14"		386		381	13
16"		452		448	13
18"		562		558	13
20"		628		624	13
24"		893		889	13
28"	Class D	882	Class D	878	13
30"		1014		1010	13
32"		1213		1208	13
36"		1764		1760	13
40"		1985		1980	13
42"		2426		2421	13
48"		3087		3083	13
54"		4851		4847	13
60"		5954		5949	13
66"		8159		8154	13
72"		9041		9036	13
78"		10143		10139	13
Promag transmitter (compact version): 7.5 lbs					

Promag P

Note!

The following weights apply to standard pressure ratings and without packaging material.

Nominal diameter	Weights in [lbs] for the Promag P				
	Compact version		Remote version (without cable)		
			Sensor	Transmitter	
[inch]	ANSI / AWWA		ANSI / AWWA		
½"	Class 150	14	Class 150	10	13
1 "		16		12	13
1 ½"		21		16	13
2"		23		19	13
3"		31		26	13
4"		35		31	13
6"		56		52	13
8"		99		95	13
10"		165		161	13
12"		243		238	13
14"		386		381	13
16"		452		448	13
18"		562		558	13
20"		628		624	13
24"		893		889	13
Promag transmitter (compact version): 7.5 lbs High-temperature version: + 3.3 lbs					

Promag H

Note!

The following weights apply to standard pressure ratings and without packaging material.

Nominal diameter [inch]	Weights in [lbs] for the Promag H		
	Compact version	Remote version (without cable)	
		Sensor	Transmitter
1/12"	11.5	4.4	13.5
5/32"	11.5	4.4	13.5
5/16"	11.7	4.4	13.5
½"	11.9	4.2	13.5
1"	12.1	6.2	13.5
1 ½"	14.3	9.9	13.2
2"	19.8	15.5	13.2
3"	41.9	37.5	13.2
4"	40.8	36.5	13.2
Promag transmitter (compact version): 7.5 lbs			

Material

Promag W

- Transmitter housing:
 - Housing for compact version: powder-coated die-cast aluminum
 - Wall-mount housing: powder-coated die-cast aluminum
- Sensor housing
 - DN 25 to 300: powder-coated die-cast aluminum
 - DN 350 to 2000: with protective coating
- 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 coating
- Electrodes: 1.4435, 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 varnish)
 - ANSI: A105; F316L
(DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective varnish)
 - AWWA: 1.0425
 - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L
(DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective varnish)
 - AS 2129
 - (DN 100, 150, 200, 250, 300, 450, 600...1200) A105 or RSt37-2 (S235JRG2)
 - (DN 80, 350, 400, 500) A105 or St44-2 (S275JR)
 - AS 4087: A105 or St44-2 (S275JR)
- Seals: as per DIN EN 1514-1
- Ground disks: 1.4435/316L, Alloy C-22, titanium, tantalum

Promag P

- Transmitter housing:
 - Compact housing: powder-coated die-cast aluminum
 - Wall-mount housing: powder-coated die-cast aluminum
- Sensor housing
 - DN 15 to 300: powder-coated die-cast aluminum
 - DN 350 to 2000: with protective coating
- Measuring tube
 - DN ≤ 300: stainless steel 1.4301 or 1.4306/304L
for flanges made of carbon steel with protective coating
 - DN ≥ 350: stainless steel 1.4301 or 1.4306/304
for flanges made of carbon steel with 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 varnish)
 - ANSI: A105; F316L
(DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective varnish)
 - AWWA: 1.0425
 - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L
(DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective varnish)
 - AS 2129
 - (DN 25) A105 or RSt37-2 (S235JRG2)
 - (DN 40) A105 or St44-2 (S275JR)
 - AS 4087: A105 or St44-2 (S275JR)

- Seals: as per DIN EN 1514-1
- Ground disks: 1.4435/316L, Alloy C-22, titanium, tantalum

Promag H

- Transmitter housing:
 - Compact housing: powder-coated die-cast aluminum or stainless steel field housing (1.4301/316L)
 - Wall-mount housing: powder-coated die-cast aluminum
 - Window material: glass or polycarbonate
- Sensor housing: stainless steel 1.4301
- Wall mounting kit (holder panel): stainless steel 1.4301
- Measuring tube: stainless steel 1.4301
- Lining material: PFA (USP Class VI; FDA 21 CFR 177.1550; 3A)
- Electrodes:
 - Standard: 1.4435
 - Optional: Alloy C-22, tantalum, platinum (only up to DN 25 (1"))
- Flanges:
 - All connections stainless-steel 1.4404/316L
 - EN (DIN), ANSI, JIS made of PVDF
 - Adhesive fitting made of PVC
- Seals:
 - DN 2 to 25: O-ring (EPDM, Viton, Kalrez) or molded seal (EPDM*, silicone*, Viton)
 - DN 40 to 100: molded seal (EPDM*, silicone*)
- Grounding rings:
 - Standard: 1.4435/316L,
 - Optional: Alloy C-22, tantalum

* = USP Class VI; FDA 21 CFR 177.2600; 3A

Material load diagrams

The material load diagrams (pressure-temperature diagrams) for the process connections can be found in the separate "Technical Information" documentation, which you can download in PDF format from www.endress.com.
A list of available "Technical Information" documentation can be found in the "Documentation" →  170 section.

Fitted electrodes

Promag W

Available as standard:

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

Optionally available:

- Exchangeable measuring electrodes for DN 350 to 2000 (14" to 78")

Promag P

Available as standard:

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

Optionally available:

- Platinum measuring electrodes only

Promag H

- 2 measuring electrodes for signal detection
- 1 EPD electrode for empty pipe detection, not for DN 2 to 15 (1/12" to 1/2")

Process connection

Promag W and Promag P

Flange connections:

- EN 1092-1 (DIN 2501)
 - DN ≤ 300 = form A
 - DN ≥ 350 = form B
 - DN 65 PN 16 and DN 600 PN 16 exclusively according to EN 1092-1
- ANSI
- AWWA (Promag W only)
- JIS
- AS

Promag H

With O-ring:

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

With molded seal:

- Weld nipple DIN 11850, ODT/SMS
- Clamp ISO 2852, DIN 32676, L14 AM7
- Coupling DIN 11851, DIN 11864-1, ISO 2853, SMS 1145
- Flange DIN 11864-2

Surface roughness

All data relate to parts in contact with fluid.

- Liner → PFA: ≤ 0.4 µm (15 µin)
- Electrodes: 0.3 to 0.5 µm (12 to 20 µin)
- Process connection made of stainless-steel (Promag H): ≤ 0.8 µm (31 µin)

10.1.11 Human interface

Display elements	■ Liquid crystal display: illuminated, four lines with 16 characters per line ■ Selectable display of different measured values and status variables ■ 3 totalizers ■ At ambient temperatures below -20 °C (-15 °F) the readability of the display may be impaired.
Operating elements	■ Local operation with three optical keys ($\square/\square/\square$) ■ Application-specific Quick Setup menus for straightforward commissioning
Language groups	Language groups available for operation in different countries: ■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese ■ Eastern Europe and Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech. ■ South and east Asia (SEA): English, Japanese, Indonesian ■ China (CN): English, Chinese  Note! You can change the language group via the operating program "FieldCare".

10.1.12 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 symbol	The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA, TIIS, IECEx, NEPSI etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.
Sanitary compatibility	<i>Promag W and Promag P</i> No applicable approvals or certification <i>Promag H</i> ■ 3A-approval and EHEDG-tested ■ Seals: FDA-compliant (except for Kalrez seals)
Drinking water approval	<i>Promag W</i> ■ WRAS BS 6920 ■ ACS ■ NSF 61 ■ KTW/W270 <i>Promag P</i> ■ ACS

PROFIBUS DP/PA certification	The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the following specifications: ■ Certified in accordance with PROFIBUS Profile Version 3.0 (device certification number: available on request) ■ The measuring device can also be operated with certified devices of other manufacturers (interoperability).
Pressure 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.
Other standards and guidelines	■ EN 60529: Degrees of protection by housing (IP code) ■ EN 61010-1 Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures ■ 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. ■ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics.

10.1.13 Ordering information

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

10.1.14 Accessories

Various accessories are available for the transmitter and the sensor. These can be ordered separately from Endress+Hauser →  123.



Note!

For detailed information on specific order codes, please contact the Endress+Hauser service organization.

10.1.15 Documentation

- Flow Measurement (FA005D/06)
- Promag 53W Technical Information (TI046D/06)
- Promag 53P Technical Information (TI047D/06)
- Promag 53H Technical Information (TI048D/06)
- Description of device functions Promag 53, PROFIBUS DP/PA (BA064D/06)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA

Index

A

Accessories	123
Acyclic data transmission	119
Adapters (installation of sensors)	17
Ambient temperature range	155
Applicator (selection and configuration software)	124
Approvals	10

B

Batching	65
Quick Setup	85
Block model	
PROFIBUS DP	100
PROFIBUS PA	110
Blocks	66
Bus structure	
PROFIBUS DP	40

C

Cable entries	
Degree of protection	58
Technical data	153
Cable length (remote version)	20
Cable specification	
PROFIBUS DP	40
PROFIBUS PA	41
Cable specifications (remote version)	
Cable length, conductivity	20
Cable type	
PROFIBUS DP	40
PROFIBUS PA	41
Calibration factor	8
CE mark (declaration of conformity)	10
Certificates	10
CIP cleaning	155
Cleaning	
Exterior cleaning	122
Cleaning using pigs, Promag H	34
Code entry (function matrix)	67
Commissioning	
Current output	75
Quick Setup	80
Relay output	76
Communication	
Quick Setup	88
Conductivity of fluid	157
Conductivity of the fluid	
Length of connecting cable (remote version)	20
Connection	
see Electrical connection	
Control	
FieldCare	69
C-Tick symbol	10
Current output	
Configuration active/passive	75
Technical data	152

Cyclic data transmission

PROFIBUS DP	100
PROFIBUS PA	110
Cyclic data transmission PROFIBUS DP	
Block model	100
SETTOT_MODETOT_TOTAL module	104
Cyclic data transmission PROFIBUS PA	
Block model	110
SETTOT_MODETOT_TOTAL module	114

D

Data back-up (of device data with T-DAT)	90
Data transmission	
Acyclic	119
Declaration of conformity (CE mark)	10
Degree of protection	58, 155
Device address, configuring	
PROFIBUS DP	73
PROFIBUS PA	78
Device description files	
PROFIBUS DP	70
PROFIBUS PA	71
Device designation	7
Device status, display	127
Display	
Local display	61
Turning the display	36
Disposal	150
Documentation, supplementary	170
Down pipes	14
Drinking water approval	168

E

Electrical connection	
Degree of protection	58
Potential equalization	56
Electrode cleaning circuitry	
See the "Description of Device Functions" manual	15
Electrodes	
Electrode Cleaning Circuitry (ECC)	15
EPD electrode	15
Exchangeable measuring electrodes (replacement) ...	148
Measuring electrode plane	15
Reference electrode (potential equalization)	15
Electronics boards (installing/removing)	145
Field housing	143
EMC (Electromagnetic compatibility)	48
EMC (electromagnetic compatibility)	156
Empty pipe detection (EPD)	
EPD electrode	15
Empty-pipe/Full-pipe adjustment	120
Environment	155
Error limits	
See Performance characteristics	

Error messages	
Process errors (application errors)	136
System error (device error)	127
Error types (system and process errors)	68
Europäische Druckgeräterichtlinie	169
Ex approval	168
Exchangeable measuring electrodes, Replacement	148
Exterior cleaning	122

F	
Fault message	68
F-Chip	121
FieldCare	69
Fieldcheck (tester and simulator)	124
Fitted electrodes	166
Flow rate/limits	18
Frequency output	
Technical data	152
Function check	79
Function descriptions	
see the "Description of Device Functions" manual	
Function groups	66
Functions	66
Fuse, replacement	147

G	
Galvanic isolation	153
Ground cable	
Promag P	27
Promag W	21
Grounding	43
Grounding rings	
Promag H	33
Groups	66

H	
Hardware write protection	
PROFIBUS DP	72
PROFIBUS PA	77
Hazardous substances	150
High-temperature version	
Installation	28
Temperature ranges	28
HOME position (display operating mode)	61

I	
Icons	63
Incoming acceptance	11
Inlet run	16
Input signal	152
Installation Wall-mount housing	37
Installation conditions	
Down pipes	14
Foundations, supports	17
Inlet and outlet runs	16
Installing pumps	13
Mounting location	13
Orientation (vertical, horizontal)	15
Partially filled pipes	14
Vibrations	16

Installing the sensor	
Adapters	17
Foundations (DN > 300)	17
High-temperature version	28
Promag H	32
Promag P	27
Promag W	21
Insulation of pipes (installing Promag P)	28

L	
Language groups	168
Length of connecting cable (remote version)	155
Load	153
Local display	
see Display	
Low flow cut off	153

M	
Maintenance	122
Material	165
Material load diagrams	166
Measured value status, display	127
Measured variable	152
Measuring electrodes	
See Electrodes	
Measuring principle	152
Measuring range	152
Measuring system	7
Measuring tube	
Lining, temperature range	156
Medium pressure range	158
Medium temperature range	156
Module	
AI (Analog Input)	
PROFIBUS DP	101
PROFIBUS PA	111
BATCHING_FIX_COMP_QUANTITY	
PROFIBUS DP	107
BATCHING_QUANTITY	
PROFIBUS DP	106
CONTROL_BLOCK	
PROFIBUS DP	105
PROFIBUS PA	115
DISPLAY_VALUE	
PROFIBUS DP	105
PROFIBUS PA	115
EMPTY_MODULE	
PROFIBUS DP	107
PROFIBUS PA	116
SETTOT_MODETOT_TOTAL	
PROFIBUS DP	104
PROFIBUS PA	114
SETTOT_TOTAL	
PROFIBUS DP	103
PROFIBUS PA	113
TOTAL	
PROFIBUS DP	102
PROFIBUS PA	112

N

Nameplate	
Connections	9
Sensor	8
Transmitter	7
Nominal diameter and flow rate	18
Notice message	68

O

Operable flow range	152
Operating conditions	155
Operation	
Function matrix	66
Operational safety	6
Order code	
Accessories	123
Sensor	8
Transmitter	7
Ordering information	170
Outlet runs	16
Output signal	152
PROFIBUS DP	152
PROFIBUS PA	153

P

Performance characteristics	
Maximum measured error	154
Reference operating conditions	154
Pigs (cleaning)	34
Post-installation check (checklist)	39
Power consumption	154
Power supply (supply voltage)	153
Power supply failure	154
Pressure loss	
Adapters (reducers, expanders)	17
General information	160
Pressure tightness	158
Process connection	167
Process error	
Definition	68
Process error messages	136
PROFIBUS DP	
Bus structure	40
Cable specification	40
Cable type	40
Configuration examples	108
Cyclic data transmission	100
Device address, configuring	73
Device description files	70
Hardware write protection	72
Output signal	152
Spur	41
Terminal assignment	49

PROFIBUS DP cyclic data transmission	
AI (Analog Input) module	101
BATCHING_FIX_COMP_QUANTITY module	107
BATCHING_QUANTITY module	106
CONTROL_BLOCK module	105
DISPLAY_VALUE module	105
EMPTY_MODULE module	107
SETTOT_TOTAL module	103
TOTAL module	102
PROFIBUS PA	
Cable specification	41
Cable type	41
Configuration examples	117
Cyclic data transmission	110
Device address, configuring	78
Device description files	71
Hardware write protection	77
Output signal	153
Spur	42
Terminal assignment	49
PROFIBUS PA cyclic data transmission	
AI (Analog Input) module	111
CONTROL_BLOCK module	115
DISPLAY_VALUE module	115
EMPTY_MODULE module	116
SETTOT_TOTAL module	113
TOTAL module	112
Programming mode	
Disabling	67
Enabling	67
Promag H	
Cleaning using pigs	34
Grounding rings	33
Installation	32
Seals	32
Weld nipple	34
Promag P	
Ground cable	27
High-temperature version	28
Installation	27
Seals	27
Tightening torques	28
Promag W	
Ground cable	21
Installation	21
Seals	21
Tightening torques	22
Pulsating flow	
Quick Setup	82
Pulse output	
see Frequency output	
Pumps	
Mounting location	13

Q

Quick Setup	
Batching	85
Commissioning	80
Communication	88
Data back-up (of device data with T-DAT)	90
Pulsating flow	82
Transfer data	90

R

Registered trademarks	10
Relay output	76, 153
Repair	150
Replacement	
Electronics boards (installing/removing)	143
Exchangeable measuring electrodes	148
Seals	122
Returning devices	150

S

Safety icons	6
Safety instructions	6
Sanitary compatibility	168
S-DAT (HistoROM)	121
Seals	
Promag H	32
Promag P	27
Promag W	21
Replacement, replacement seals	122
Seals (sensor process connection)	21, 27
Sensor installation	
See Installing sensor	
Serial number	7–9
Shielding	43
Shielding of the supply line/T-box	55
Shock resistance	155
Signal on alarm	153
SIP cleaning	156
Software	
Amplifier display	79
Spare parts	141
Spur	
PROFIBUS DP	41
PROFIBUS PA	42
Standards, guidelines	168–169
Status input	
Technical data	152
Storage	12
Storage temperature	155
Supplementary Ex documentation	6
Supply voltage (power supply)	153
Surface roughness	167
Switching output	
see Relay output	
System error	
Definition	68
System error messages	127

T

T-DAT (HistoROM)	121
Save/load (data back-up, e.g. for replacing devices)	90
Temperature	
Storage	155
Temperature ranges	
Ambient temperature range	155
Fluid temperature	156
Terminal assignment	
PROFIBUS DP	49
PROFIBUS PA	49
Terminating resistors	74
Tightening torques	
Promag P	28
Promag W	22
Transmitter	
Electrical connection	50
Installing the wall-mount housing	37
Length of connecting cable (remote version)	20
Turning the field housing (aluminum)	35
Turning the field housing (stainless steel)	35
Transporting the sensor	11
Troubleshooting and remedy	125

V

Vibration resistance	155
Vibrations	16
Measures to prevent vibrations	16
Shock and vibration resistance	155

W

Wall-mount housing, installing	37
Weight	
(SI units)	161
(US units)	163
Weld nipple, Promag H	34
Wiring	
see Electrical connection	
Writes (max.)	99

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]

Pressure / Druck _____ [psi] _____ [Pa]

Conductivity / Leitfähigkeit _____ [µS/cm]

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	Phone number of contact person / Telefon-Nr. Ansprechpartner:
Address / Adresse	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 gefährlichen Mengen sind."

(place, date / Ort, Datum)

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

Signature / Unterschrift

www.endress.com/worldwide

Endress+Hauser 
People for Process Automation
