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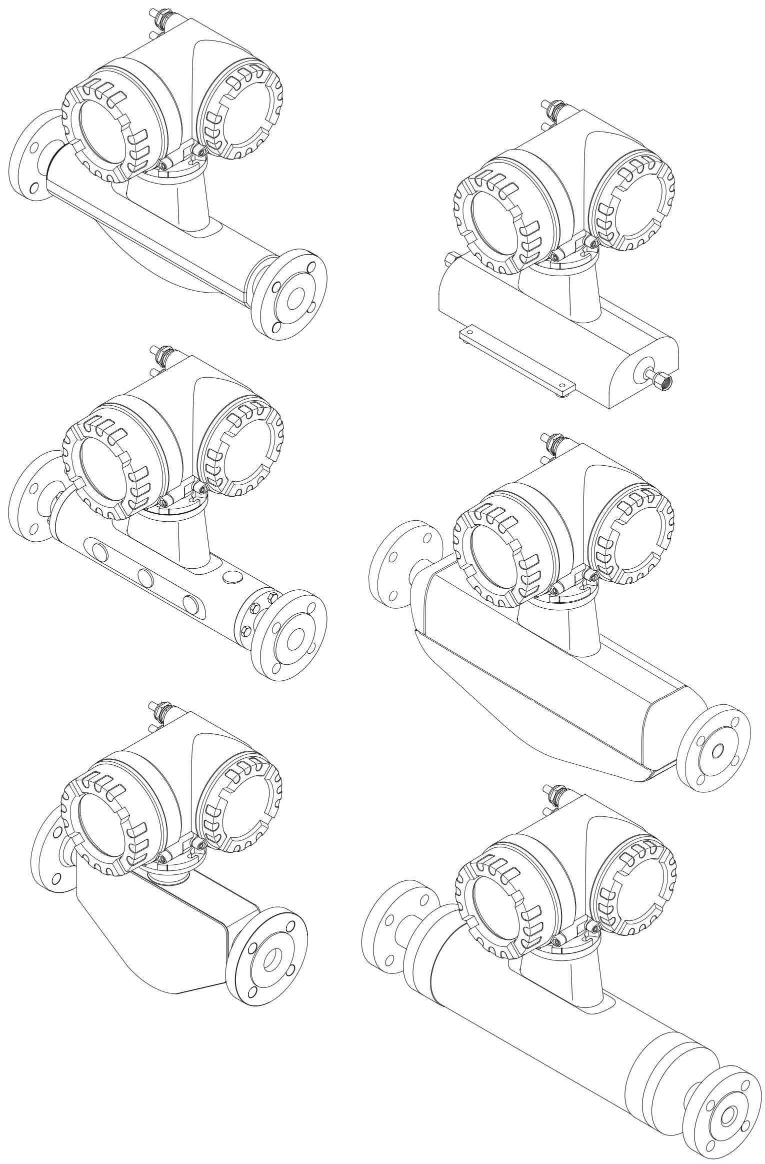
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Promass 80

Coriolis Mass Flow Measuring System



BA057D/06/en/12.05
71008475
Valid as of version
V 2.01.XX (device software)

Endress+Hauser

People for Process Automation

Brief operating instructions

These brief operating instructions show you how to configure your measuring device quickly and easily:

Safety instructions	Page 7
▼	
Installation	Page 13
▼	
Wiring	Page 24
▼	
Display and operating elements	Page 31
▼	
Commissioning with "QUICK SETUP"	Page 46 ff.
You can commission your measuring device quickly and easily, using the special "Quick Setup" menu. It enables you to configure important basic functions using the local display, for example display language, measured variables, units of measures, type of signal etc. The following adjustments and configurations can be made separately as necessary: – Zero point adjustment – Density adjustment – Configuration of the current output (active/passive)	
▼	
Customer specific configuration	Page 49 ff.
Complex measuring operations necessitate additional functions that you can configure as necessary with the aid of the function matrix, and customize to suit your process parameters. ✎ Note! 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 these Operating Instructions.	

✎ Note!
Always start troubleshooting with the checklist on Page 58, if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

QUICK SETUP "Commissioning"

Note!
More detailed information on running Quick Setup menus, especially for devices without a local display, can be found in the "Commissioning" section. → Page 47

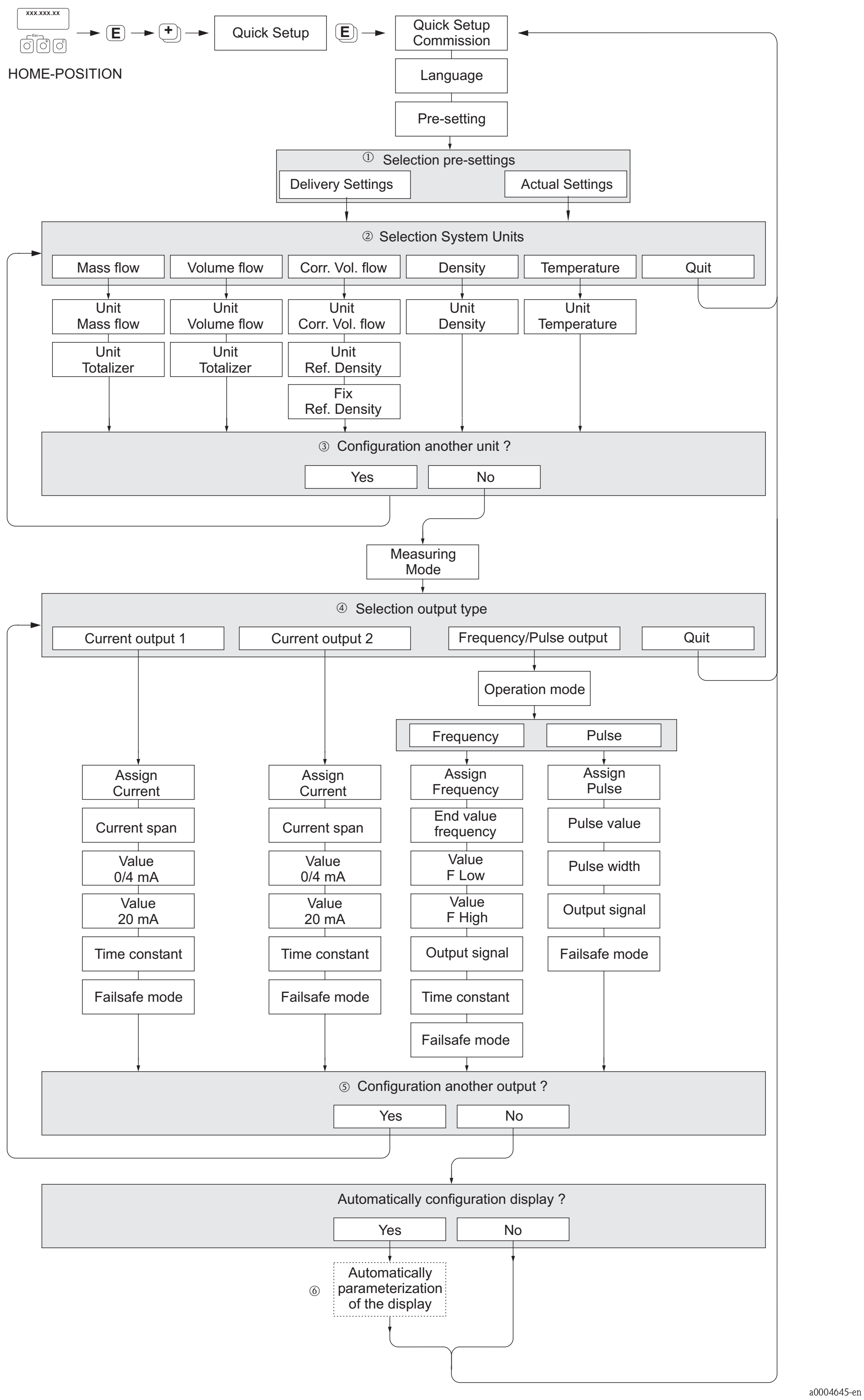


Fig. 1: "Commissioning" Quick Setup

① Selecting DELIVERY SETTINGS returns each selected unit to the factory setting.
Selecting ACTUAL SETTINGS applies the units you have set previously.

② Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.

③ The YES option remains visible until all the units have been configured. NO is the only option displayed when no further units are available.

④ Only the outputs not yet configured in the current Setup are offered for selection in each cycle.

⑤ The YES option remains visible until all the outputs have been configured. NO is the only option displayed when no further outputs are available.

⑥ The “automatic parameterization of the display” option contains the following basic settings/factory settings:
YES: line 1= mass flow; line 2 = totalizer 1;
information line = operating/system conditions
NO: The existing (selected) settings remain.

Note!

- The display returns to the cell SETUP COMMISSIONING if you press the Esc (- +) key combination during an interrogation. The stored parameters remain valid.

Table of contents

1 Safety instructions

1.1 Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the mass flow rate of liquids and gases. At the same time, the system also measures fluid density and fluid temperature. These parameters are then used to calculate other variables such as volume flow. Fluids with widely differing properties can be measured.

Examples:
- Chocolate, condensed milk, liquid sugar
- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases etc.

The operational safety of the measuring devices cannot be guaranteed if the system is used incorrectly or used for purposes other than those intended. 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. Qualified personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- The device may be operated only by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in the Operating Instructions is mandatory.
- Endress+Hauser will be happy to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning. However, the user is responsible for the choice of fluid wetted materials as regards to their in-process resistance to corrosion. The manufacturer refuses to accept liability.
- If carrying out welding work on the piping, never ground the welding unit 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, unless the power supply is galvanically isolated.
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Note the following points:
- Measuring systems for use in hazardous environments are accompanied by separate “Ex documentation”, which is an integral part of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.
  The symbol on the front of this supplementary Ex documentation indicates the approval and the certification body (Ex Europe, FM USA, CSA Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR recommendation NE 21, NE 43 and NE 53.
- For measuring systems used in SIL 2 applications, the separate manual on functional safety must be observed.

- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- 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, such as a safety data sheet as per EN 91/155/EEC.
- 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, i.e. if it is flammable, toxic, caustic, carcinogenic etc.
  With Promass A and Promass M, the threaded process connections must be removed from the sensor first and then cleaned.

Note!
You will find a preprinted "Declaration of contamination" form at the back of this manual.

Warning!

- 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.

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". However, the devices can be a source of danger if used incorrectly or for other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following icons:

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

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

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

2 Identification

2.1 Device designation

The “Promass 80/83” flow measuring system consists of the following components:
- Promass 80 or 83 transmitter
- Promass F, Promass M, Promass E, Promass A, Promass H or Promass I 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

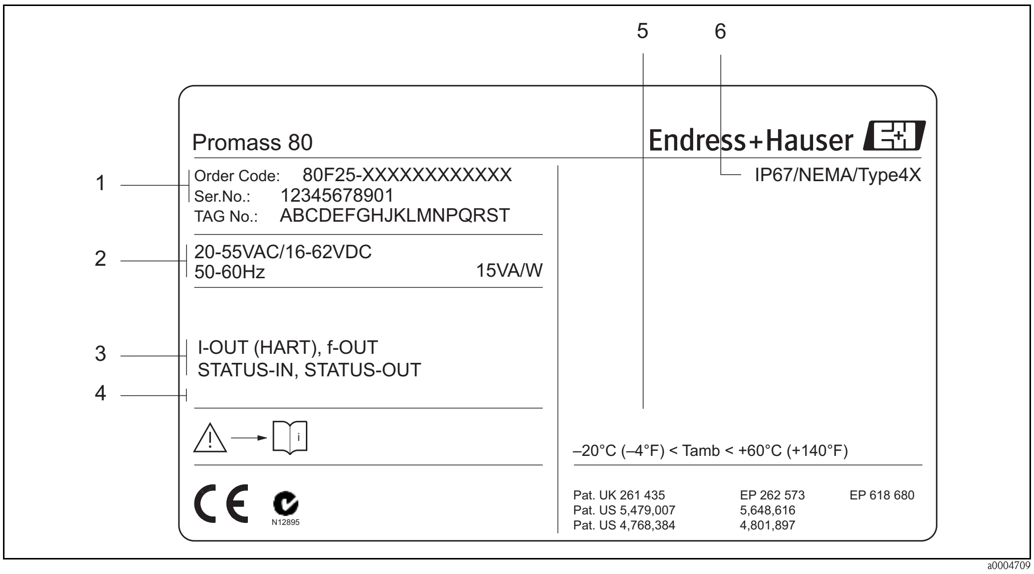


Fig. 2: Nameplate specifications for the “Promass 80” transmitter (example)

1 *Order code / Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits*
2 *Power supply / frequency: 20 to 55 V AC /16 to 62 V DC / 50 to 60 Hz*
Power consumption: 15 VA / 15 W
3 *Available inputs / outputs:*
I–OUT (HART): with current output (HART)
f–OUT: with pulse/frequency output
STATUS–IN: with status input (auxiliary input)
STATUS–OUT: with status output (switch output)
4 *Reserved for information on special products*
5 *Ambient temperature range*
6 *Degree of protection*

2.1.2 Nameplate of the sensor

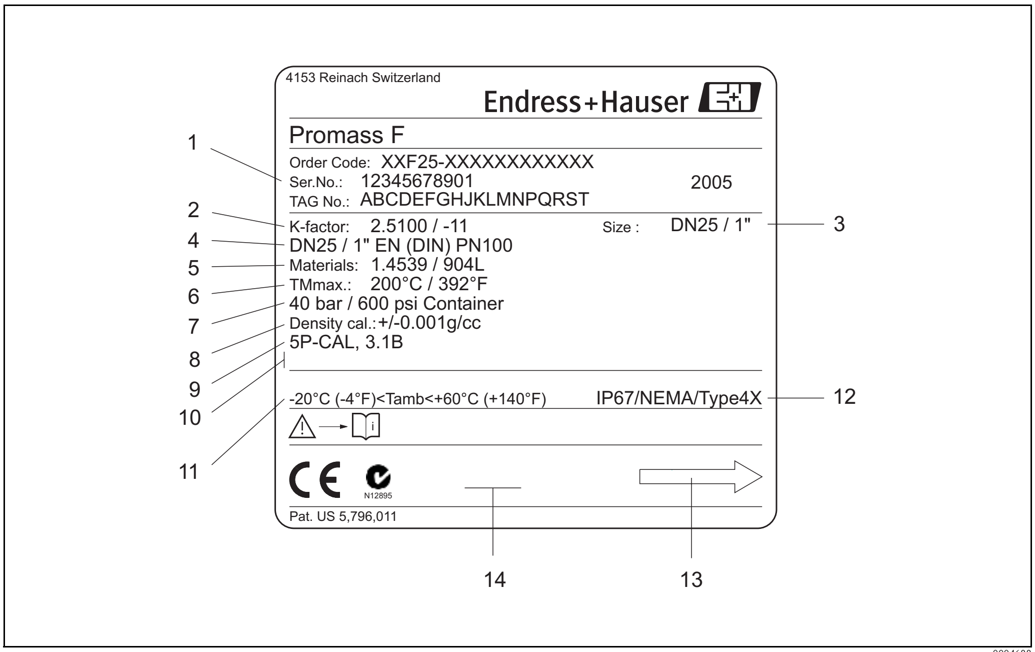
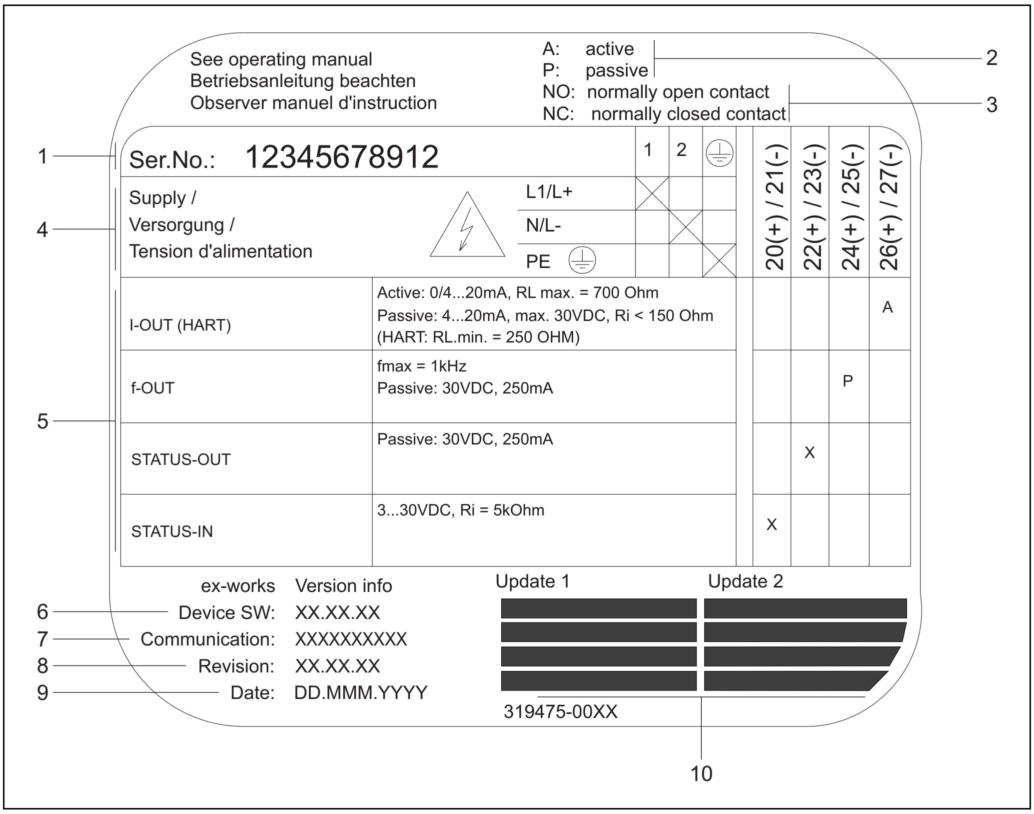


Fig. 3: Nameplate specifications for the "Promass F" sensor (example)

1 Order code / Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits
2 Calibration factor: 2.5100 / zero point: –11
3 Nominal diameter device: DN 25 / 1"
4 Flange nominal diameter: DN 25 / 1"
Nominal pressure: EN (DIN) PN 100 bar
5 Material of measuring tubes: Stainless steel 1.4539/904L
6 TMmax +200 °C / +392 °F (max. fluid temperature)
7 Pressure range of secondary containment: max. 40 bar (600 psi)
8 Accuracy of density measurement: ±0.001 g/cc
9 Additional information (examples):
– With 5-point calibration
– With 3.1 B certificate for wetted materials
10 Reserved for information on special products
11 Ambient temperature range
12 Degree of protection
13 Flow direction
14 Reserved for additional information on device version (approvals, certificates)

2.1.3 Nameplate, connections



a0000963

Fig. 4: Nameplate specifications for Proline transmitter (example)

1 Serial number
2 Possible configuration of current output
3 Possible configuration of relay contacts
4 Terminal assignment, cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: *L1 for AC, L+ for DC*
Terminal No. 2: *N for AC, L- for DC*
5 Signals present at inputs and outputs, possible configuration and terminal assignment (20 to 27), see also "Electrical values of inputs/outputs"→ Page 75
6 Version of device software currently installed
7 Installed communication type, e.g.: HART, PROFIBUS PA etc.
8 Information on current communication software (Device Revision and Device Description), e.g.: Dev. 01 / DD 01 for HART
9 Date of installation
10 Current updates to data specified in points 6 to 9

2.2 Certificates and approvals

The devices are designed 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 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of EN 61326/A1.
The measuring system described in these Operating Instructions thus complies 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 complies with the EMC requirements of the "Australian Communications Authority (ACA)".

2.3 Registered trademarks

KALREZ® and VITON®
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HistoROM™, S-DAT®, ToF Tool - Fieldtool® Package, 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 that nothing is missing from the shipment 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.
- The covers or caps fitted to the process connections prevent mechanical damage to the sealing faces and the ingress of foreign matter to the measuring tube during transportation and storage. Consequently, do not remove these covers or caps until immediately before installation.
- Do not lift measuring devices of nominal diameters DN 40 to 250 by the transmitter housing or the connection housing in the case of the remote version (Fig. 5). Use webbing slings slung round the two process connections. Do not use chains, as they could damage the housing.
- In the case of the Promass M / DN 80 sensor, use only the lifting eyes on the flanges to lift the assembly.

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

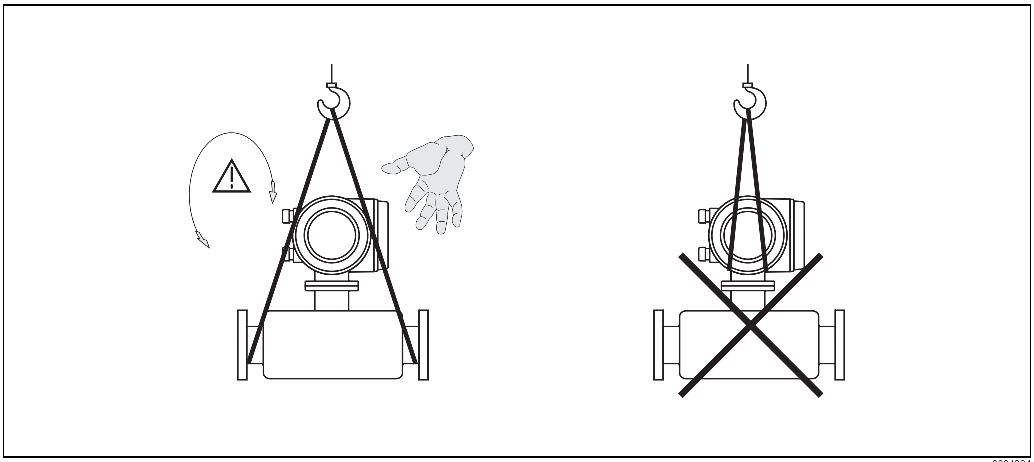


Fig. 5: Instructions for transporting sensors with DN 40 to 250

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 permissible storage temperature is –40 to +80 °C (preferably +20 °C).
- Do not remove the protective covers or caps on the process connections until you are ready to install the device.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 Installation conditions

Note the following points:
- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces etc.), as long as no cavitation occurs.
- For mechanical reasons and in order to protect the pipe, it is advisable to support heavy sensors.

3.2.1 Dimensions

All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation entitled, "Technical Information".

3.2.2 Mounting location

Accumulated air or gas bubbles in the measuring tube can result in an increase in measuring errors. **Avoid** the following mounting locations in the pipe installation:
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.

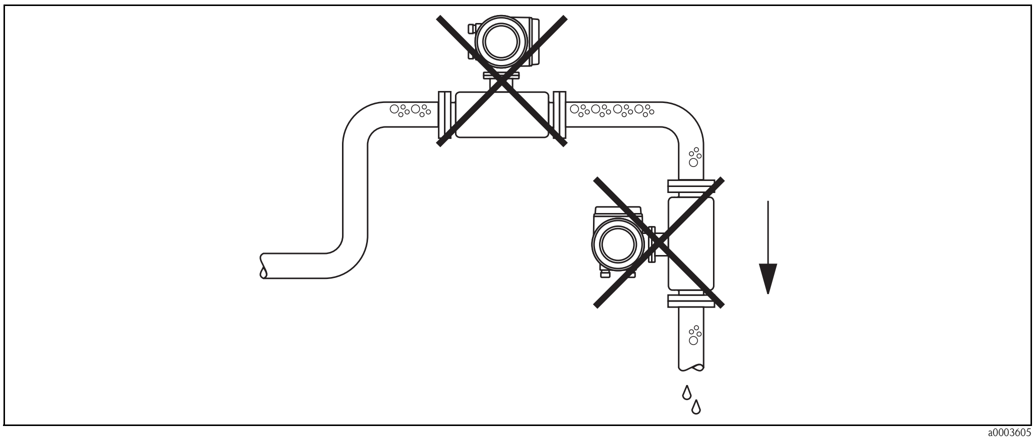


Fig. 6: Mounting location

The proposed configuration in the following diagram, however, permits installation in a vertical pipeline. Pipe restrictors or the use of an orifice plate with a smaller cross-section than the nominal diameter prevent the sensor from running empty during measurement.

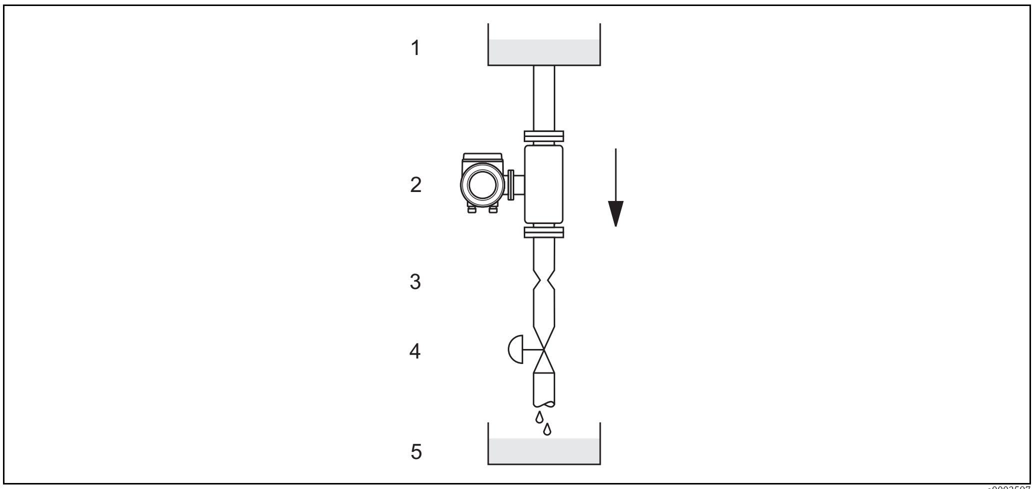


Fig. 7: Installation in a vertical pipe (e.g. for batching applications)

1 Supply tank
2 Sensor
3 Orifice plate, pipe restrictions (see Table)
4 Valve
5 Batching tank

Promass F, M, E / DN	8	15	25	40	50	80 1)	100 2)	150 2)	250 2)
∅ Orifice plate, pipe restriction [mm]	6	10	14	22	28	50	65	90	150
1) Promass F, M only 2) Promass F only									

Promass A / DN	1	2	4
∅ Orifice plate, pipe restriction [mm]	0.8	1.5	3.0

Promass H, I / DN	8	15	15 1)	25	25 1)	40	40 1)	50	50 1)	80 2)
∅ Orifice plate, pipe restriction [mm]	6	10	15	14	24	22	35	28	54	50
1) DN 15, 25, 40, 50 “FB” = Full bore versions of Promass I 2) Promass I only										

System pressure

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.
In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapor pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.

Therefore, the following locations should be preferred for installation:
- Downstream from pumps (no danger of vacuum)
- At the lowest point in a vertical pipe

3.2.3 Orientation

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe.

Orientation Promass A

Vertical:

Recommended orientation with upward direction of flow. When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids buildup.

Horizontal:

When installation is correct the transmitter housing is above or below the pipe. This arrangement means that no gas or solid deposits can accumulate in the curved measuring tube (single-tube system).
Do not install the sensor in such a way that it is suspended in the pipe, in other words without support or attachment. This is to avoid excessive strain at the process connection. The base plate of the sensor housing is designed for mounting on a tabletop, wall or post.

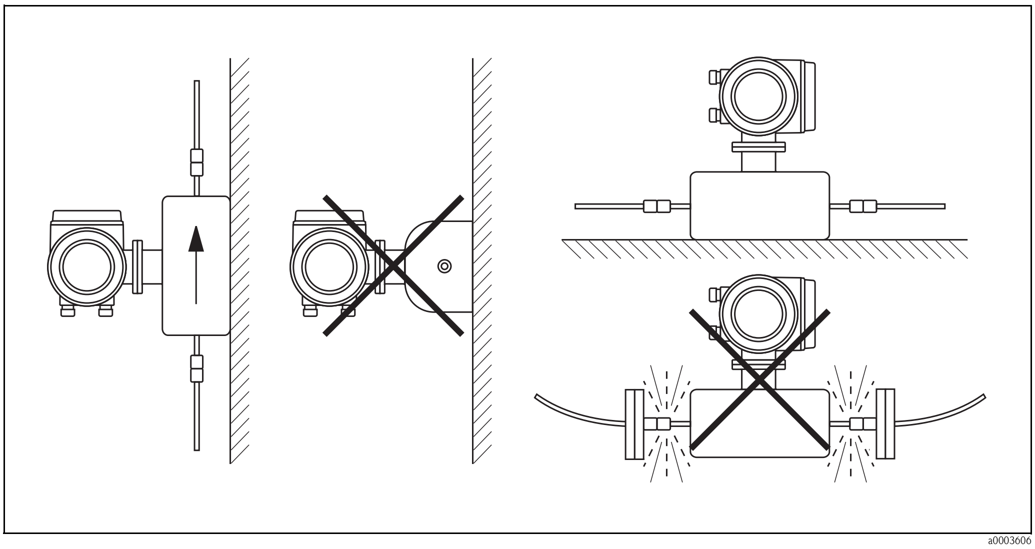


Fig. 8: Vertical and horizontal orientation (Promass A)

Orientation Promass F, M, E, H, I

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

Vertical:

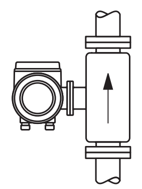
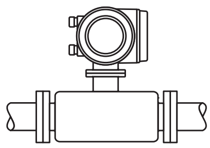
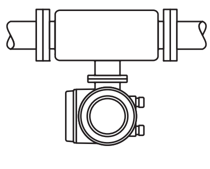
Recommended orientation with upward direction of flow (View V). When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids buildup.

Horizontal (Promass F, M, E):

The measuring tubes of Promass F, M and E must be horizontal and beside each other. When installation is correct the transmitter housing is above or below the pipe (View H1/H2). Always avoid having the transmitter housing in the same horizontal plane as the pipe.

Horizontal (Promass H, I):

Promass H and Promass I can be installed in any orientation in a horizontal pipe run.

	Promass F, M, E, H, I Standard, compact	**Promass F, M, E, H, I Standard, remote**	**Promass F High-temperature, compact**	**Promass F High-temperature, remote**
Fig. V: Vertical orientation  a0004572	✔✔	✔✔	✔✔	✔✔
Fig. H1: Horizontal orientation Transmitter head up  a0004576	✔✔	✔✔	✘ (TM = >200 °C) ①	✔ (TM = >200 °C) ①
Fig. H2: Horizontal orientation Transmitter head down  a0004580	✔✔ ②	✔✔ ②	✔✔ ②	✔✔ ②

✔✔ = Recommended orientation
✔ = Orientation recommended in certain situations
✘ = Impermissible orientation

In order to ensure that the maximum permissible ambient temperature for the transmitter (–20 to +60 °C, optional –40 to +60 °C) is not exceeded, we recommend the following orientations:

①= For fluids with very high temperatures (> 200 °C), we recommend the horizontal orientation with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V).

② = For fluids with low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

Special installation instructions for Promass F, E and H

Caution!
The two measuring tubes of Promass F and Promass E and the one of Promass H are slightly curved. The position of the sensor, therefore, has to be matched to the fluid properties when the sensor is installed horizontally .

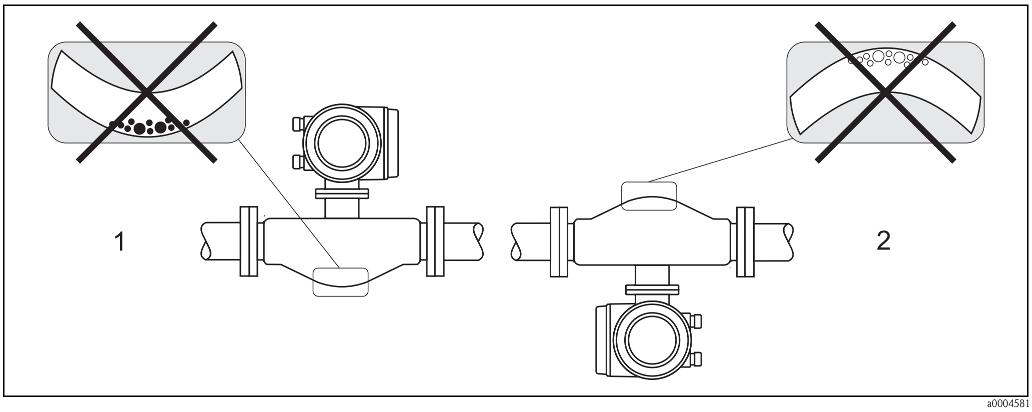


Fig. 9: Promass F, E, H installed horizontally

1 Not suitable for fluids with entrained solids. Risk of solids accumulating.
2 Not suitable for outgassing fluids. Risk of air accumulating.

3.2.4 Heating

Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper.

Caution!
- Risk of electronics overheating! Consequently, make sure that the adapter between sensor and transmitter and the connection housing of the remote version always remain free of insulating material. Note that a certain orientation might be required, depending on the fluid temperature. → Page 16
- With a fluid temperature between 200 to 350 °C, heating is not permitted for the compact version of the high-temperature version.
  When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, (i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such cases, the sensor must be magnetically shielded (except for Promass M).
  The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:
  – Relative magnetic permeability $\mu_r \geq 300$
  – Plate thickness $d \geq 0.35$ mm
- Information on permissible temperature ranges → Page 83

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for the sensors.

3.2.5 Thermal insulation

Some fluids require suitable measures to avoid loss of heat at the sensor. A wide range of materials can be used to provide the required thermal insulation.

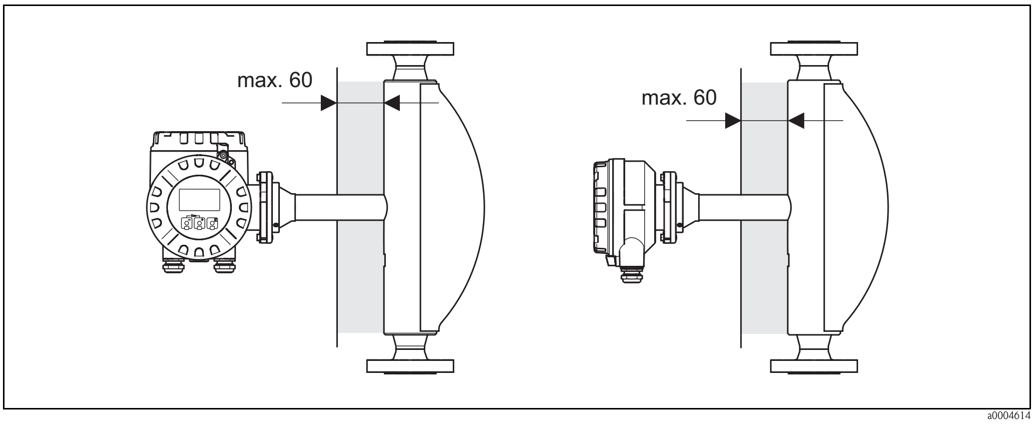


Fig. 10: In the case of the Promass F high-temperature version, a maximum insulation thickness of 60 mm must be observed in the area of the electronics/neck.

If the Promass F high-temperature version is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm is recommended to reduce convection. The maximum insulation thickness of 60 mm must be observed.

3.2.6 Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs. If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows etc.

3.2.7 Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations. Consequently, the sensors require no special measures for attachment.

3.2.8 Limiting flow

Relevant information can be found in the "Technical Data" section under Measuring range → Page 73 or Limiting flow → Page 84.

3.3 Installation

3.3.1 Turning the transmitter housing

Turning the aluminum field housing

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

1. Loosen the two securing screws.
2. Turn the bayonet catch as far as it will go.
3. Carefully lift the transmitter housing as far as it will go.
4. Turn the transmitter housing to the desired position (max. 2 x 90° in either direction).
5. Lower the housing into position and reengage the bayonet catch.
6. Retighten the two securing screws.

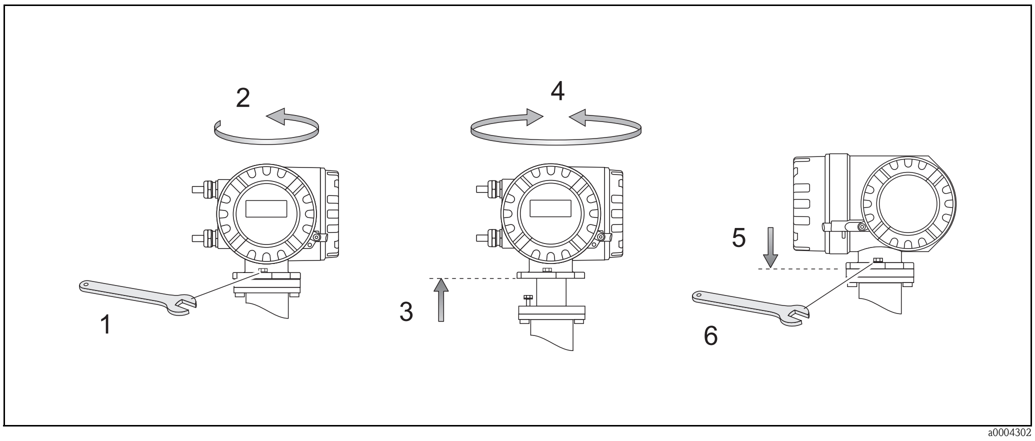


Fig. 11: Turning the transmitter housing (aluminum field housing)

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 x 90° in either direction).
4. Lower the housing into position.
5. Retighten the two securing screws.

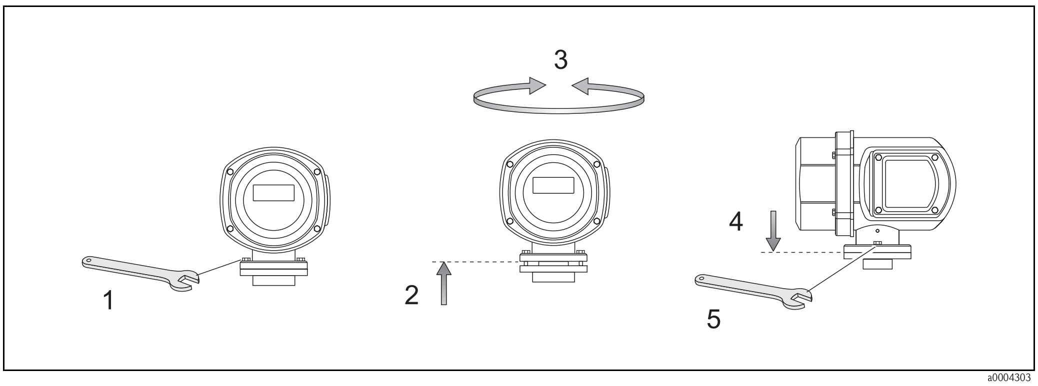


Fig. 12: Turning the transmitter housing (stainless steel field housing)

3.3.2 Installing the wall-mount transmitter housing

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

- Mounted directly on the wall
- Installation in control panel (separate mounting set, accessories) → Page 22
- Pipe mounting (separate mounting set, accessories) → Page 22

Caution!
- Make sure that ambient temperature does not go beyond the permissible range (– 20 to +60 °C, optional – 40 to +60 °C). 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 in the diagram.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   – Securing screws (M6): max. Ø 6.5 mm (0.26")
   – Screw head: max. Ø 10.5 mm (0.41")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

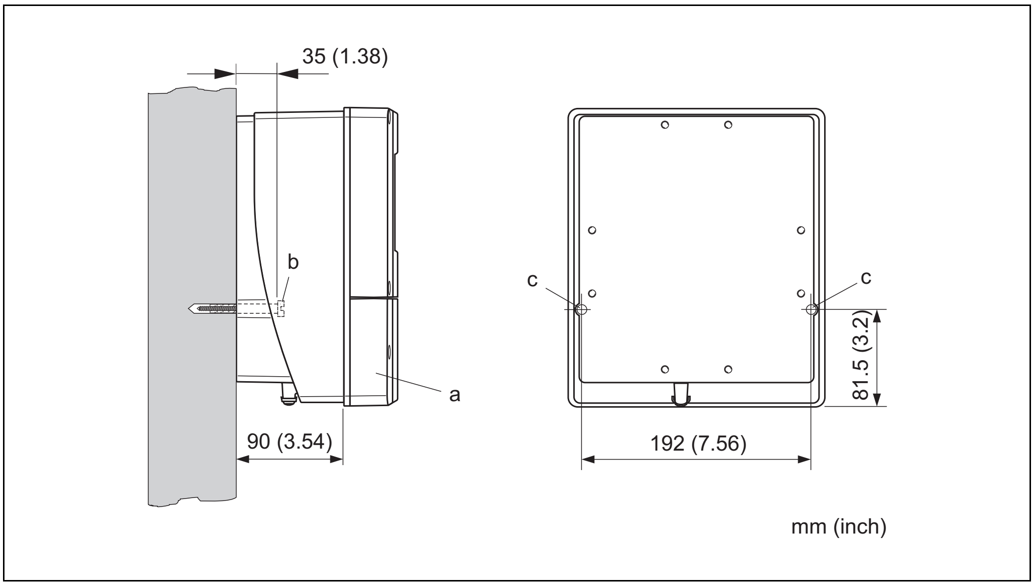


Fig. 13: Mounted directly on the wall

Installation in control panel

1. Prepare the opening in the panel as illustrated in the diagram.
2. Slide the housing into the opening in the panel from the front.
3. Screw the fasteners onto the wall-mount housing.
4. Screw threaded rods into holders and tighten until
   the housing is solidly seated on the panel wall. Afterwards, tighten the locking nuts.
   Additional support is not necessary.

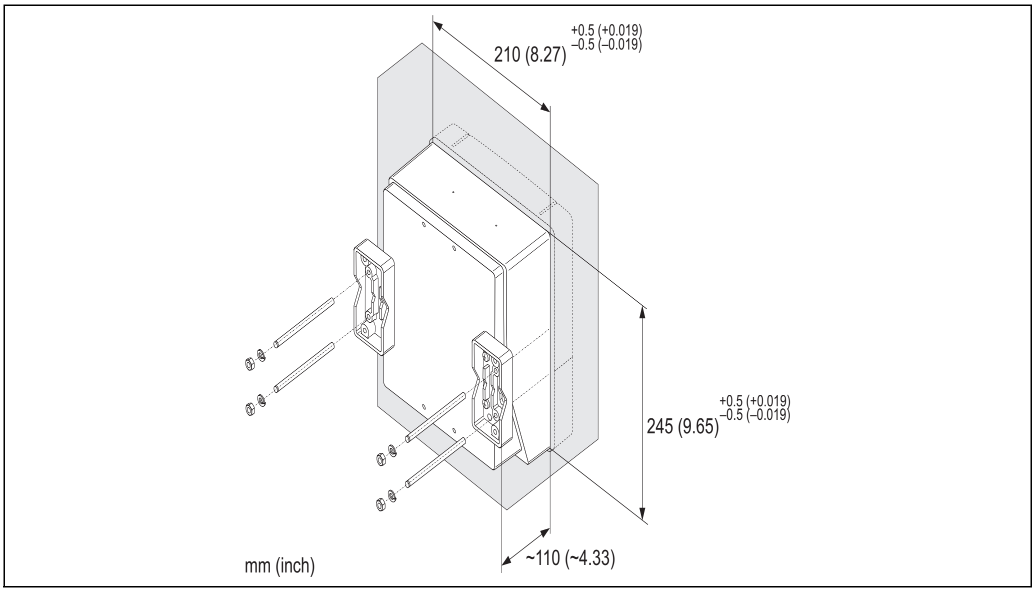


Fig. 14: Panel Installation (wall-mount housing)

Pipe mounting

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

Caution!
If a warm pipe is used for installation, make sure that the housing temperature does not exceed the max. permitted value of +60 °C.

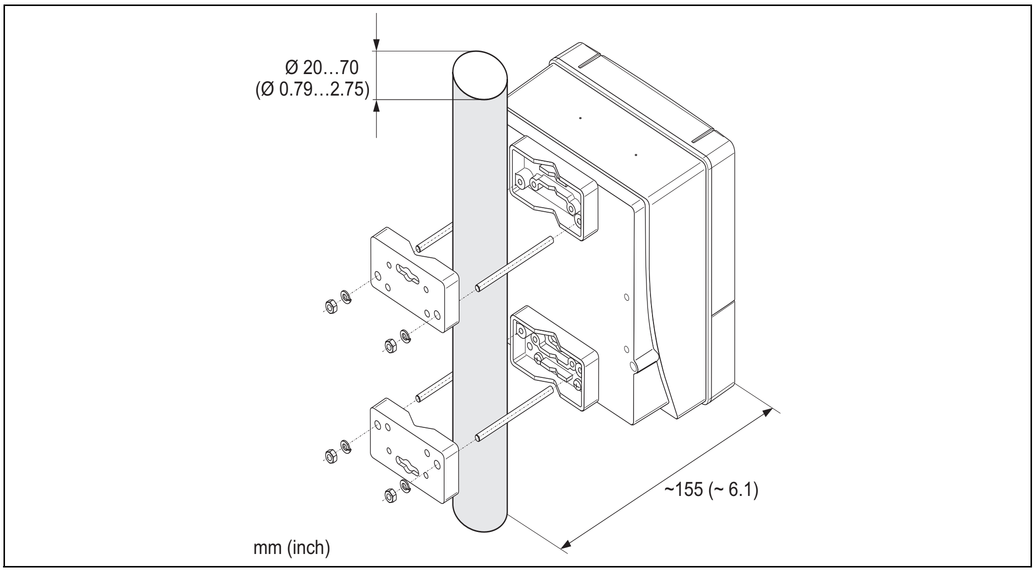


Fig. 15: Pipe mounting (wall-mount housing)

3.3.3 Turning the local display

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

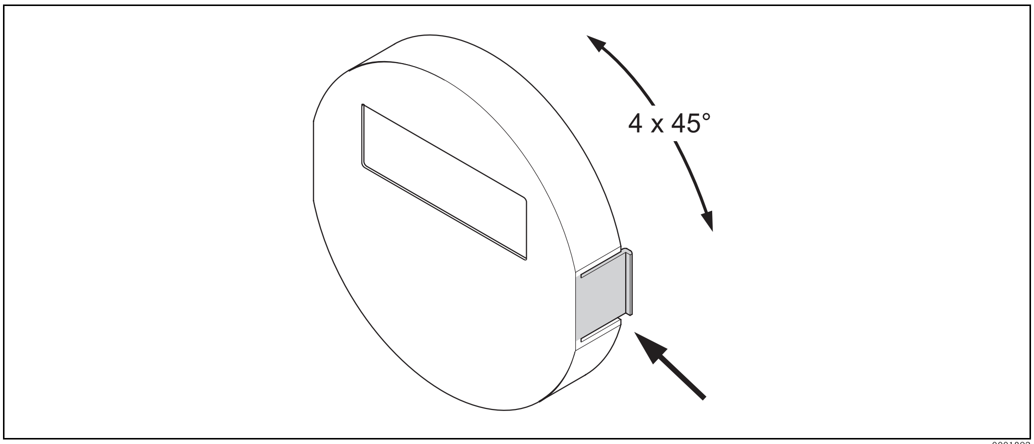


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Fig. 16: Turning the local display (field housing)

3.4 Post installation check

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

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	-
Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range etc.?	→ Page 7
Installation	Notes
Does the arrow on the sensor nameplate match the direction of flow through the pipe?	-
Are the measuring point number and labeling correct (visual inspection)?	-
Has the correct orientation been chosen for the sensor, in other words is it suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?	→ Page 14
Process environment / process conditions	Notes
Is the measuring device protected against moisture and direct sunlight?	-

4 Wiring

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

4.1 Connecting the remote version

4.1.1 Connecting the sensor/transmitter

Warning!

- Risk of electric shock. Switch off the power supply before opening the device.
  Do not install or wire the device while it is connected to the power supply.
  Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective earth to the ground terminal on the housing before the power supply is applied.
- You may only connect the sensor to the transmitter with the same serial number. Communication errors can occur if this is not observed when connecting the devices.

1. Remove the connection compartment cover (a) by loosening the fixing screws on the transmitter and sensor housing.
2. Feed the connecting cable (b) through the appropriate cable runs.
3. Establish the connections between sensor and transmitter in accordance with the wiring diagram:
   – see Fig. 17
   – see wiring diagram in screw cap
4. Screw the connection compartment cover (a) back onto the sensor and transmitter housing.

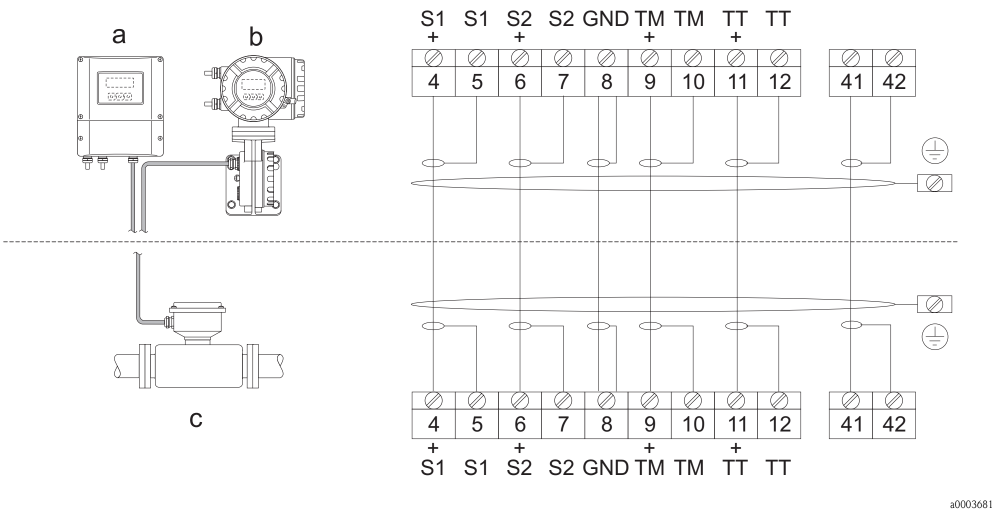

Fig. 17: Connecting the remote version

a Wall-mount housing: non-hazardous area and ATEX II3G / zone 2 → see separate "Ex documentation"
b Wall-mount housing: ATEX II2G / Zone 1 /FM/CSA → see separate "Ex documentation"
c Remote version, flanged version

Terminal No.: 4/5 = gray; 6/7 = green; 8 = yellow; 9/10 = pink; 11/12 = white; 41/42 = brown

4.1.2 Cable specification, connecting cable

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:

- 6 x 0.38 mm^2 PVC cable with common shield and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km
- Capacitance core/shield: ≤ 420 pF/m
- Cable length: max. 20 m
- Permanent operating temperature: max. +105 °C

Note!
The cable must be installed securely, to prevents movement.

4.2 Connecting the measuring unit

4.2.1 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 the electronics.
- Risk of electric shock. Connect the protective earth 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 (f) from the transmitter housing.
2. Feed the power supply cable (a) and the signal cable (b) through the appropriate cable entries.
3. Perform wiring:
   - Wiring diagram (aluminum housing) → Fig. 18
   - Wiring diagram (stainless steel housing → Fig. 19
   - Wiring diagram (wall-mount housing) → Fig. 20
   - Terminal assignment → Page 27
4. Screw the cover of the connection compartment (f) back onto the transmitter housing.

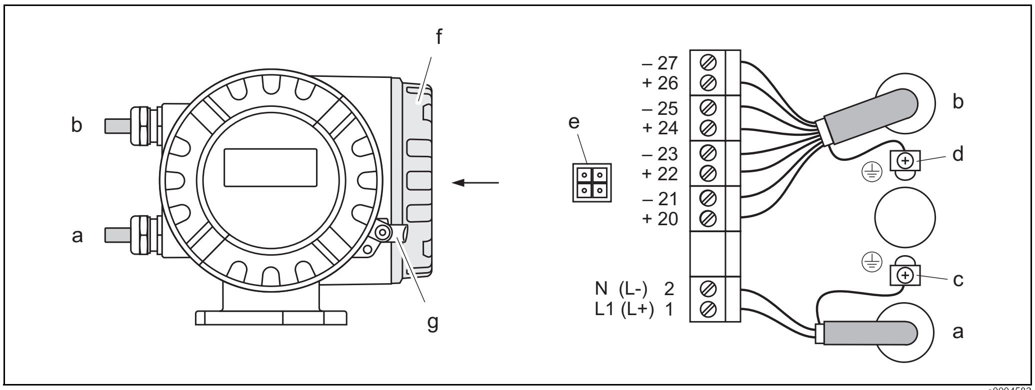

Fig. 18: Connecting the transmitter (aluminum field housing). Cable cross-section: max. 2.5 mm²

- a *Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC*
  *Terminal **No. 1:** L1 for AC, L+ for DC*
  *Terminal **No. 2:** N for AC, L- for DC*
- b *Signal cable: Terminals **Nos. 20–27**→ Page 27*
- c *Ground terminal for protective earth*
- d *Ground terminal for signal cable shield*
- e *Service adapter for connecting service interface FXA 193 (FieldCheck, ToF Tool - Fieldtool Package)*
- f *Connection compartment cover*
- g *Securing clamp*

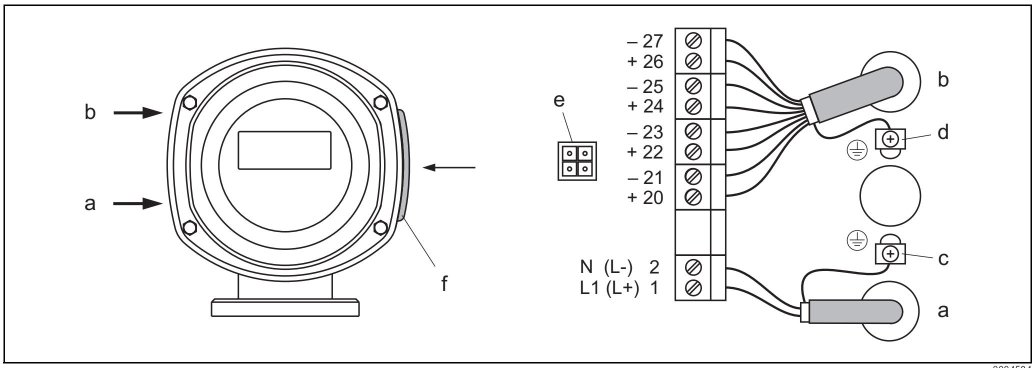

Fig. 19: Connecting the transmitter (stainless steel field housing); cable cross-section: max. 2.5 mm²

- a *Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC*
  *Terminal **No. 1:** L1 for AC, L+ for DC*
  *Terminal **No. 2:** N for AC, L- for DC*
- b *Signal cable: Terminals **Nos. 20–27**→ Page 27*
- c *Ground terminal for protective earth*
- d *Ground terminal for signal cable shield*
- e *Service adapter for connecting service interface FXA 193 (FieldCheck, ToF Tool - Fieldtool Package)*
- f *Connection compartment cover*

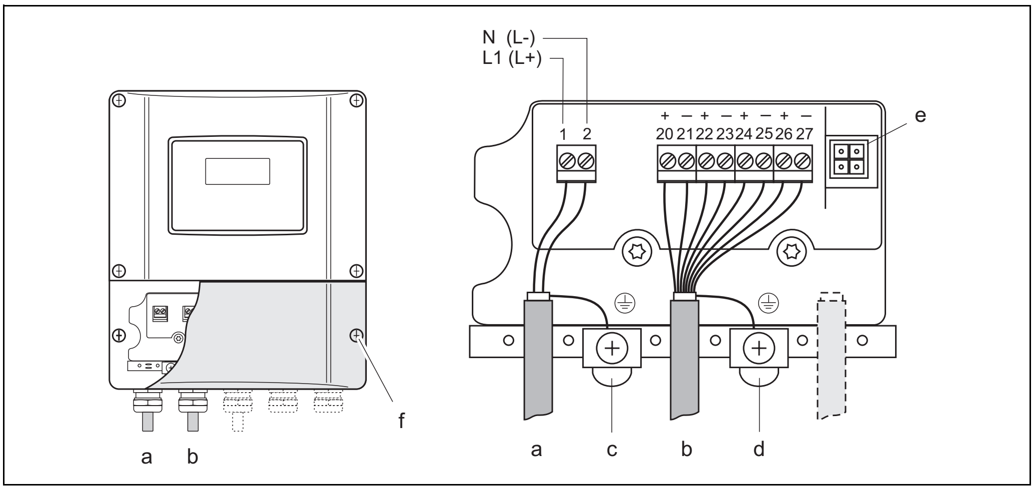

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Fig. 20: Connecting the transmitter (wall-mount housing); cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L- for DC
b Signal cable: Terminals Nos. 20–27→ Page 27
c Ground terminal for protective earth
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA 193 (FieldCheck, ToF Tool - Fieldtool Package)
f Connection compartment cover

4.2.2 Terminal assignment

Electrical values for inputs → Page 75

Electrical values for outputs → Page 75

	Terminal No. (inputs/outputs)			
Order version	**20 (+) / 21 (–)**	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 (+) / 27 (–)**
80***-***********A	-	-	Frequency output	Current output HART
80***-***********D	Status input	Status output	Frequency output	Current output HART
80***-***********S	-	-	Frequency output Ex i, passive	Current output Ex i active, HART
80***-***********T	-	-	Frequency output Ex i, passive	Current output Ex i passive, HART
80***-***********8	Status input	Frequency output	Current output 2	Current output 1 HART

4.2.3 HART connection

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

Note!
- The measuring circuit's minimum load must be at least 250 Ω.
- The CURRENT SPAN function must be set to "4–20 mA" (individual options see device function).
- See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".

Connection of the HART handheld communicator

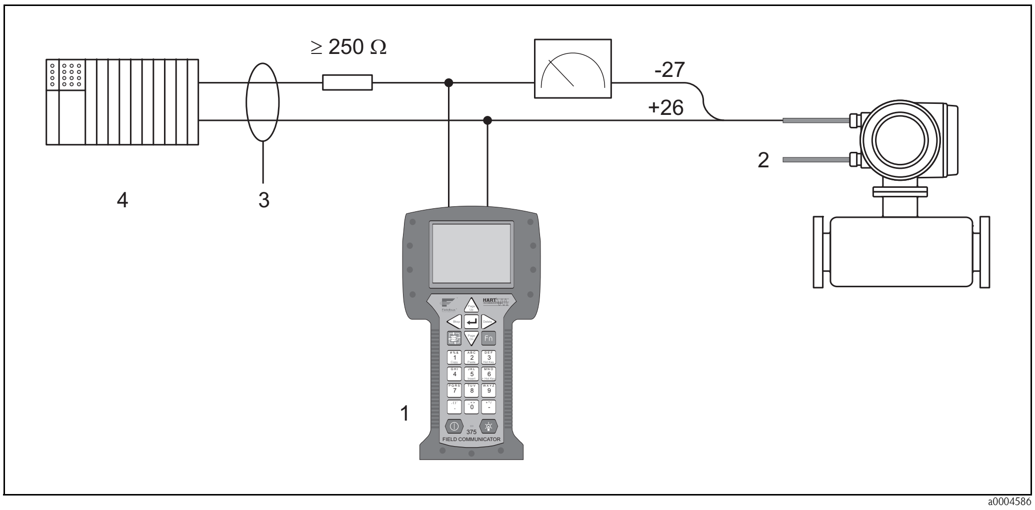

Fig. 21: Electrical connection of HART handheld terminal

1 = HART handheld terminal 2 = Power supply 3 = Shielding 4 = Other switching units or PLC with passive input

Connection of a PC with an operating software

In order to connect a PC with operating software (e.g. "ToF Tool – Fieldtool Package"), a HART modem (e.g. "Commubox FXA 191") is needed.

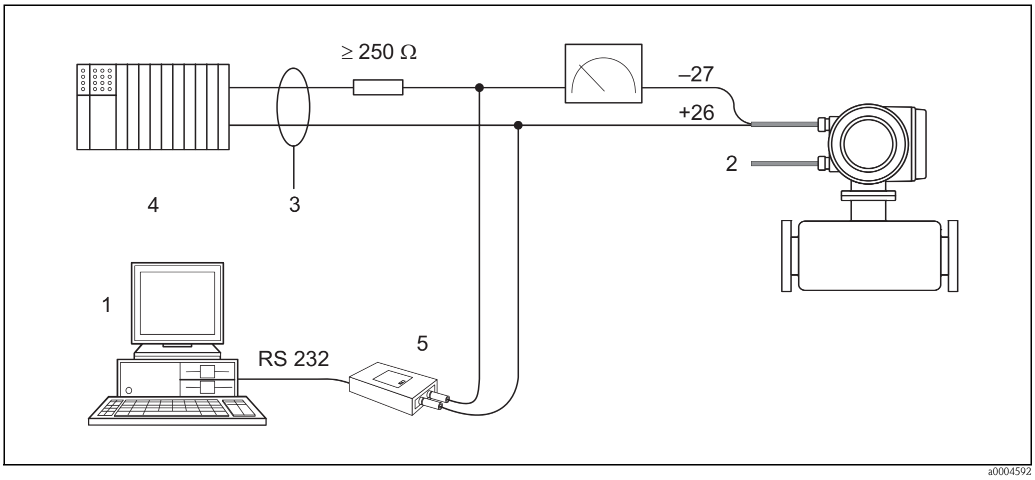

Fig. 22: Electrical connection of a PC with operating software

1 = PC with operating software 2 = Power supply, 3 = Shielding
4 = Other switching units or PLC with passive input 5 = HART modem such as Commubox FXA 191

4.3 Degree of protection

The devices fulfill all the requirements for IP 67.

Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter. → Page 25
- Firmly tighten the cable entries.
- The cables must loop down before they enter the cable entries ("water trap"). This arrangement prevents moisture from penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

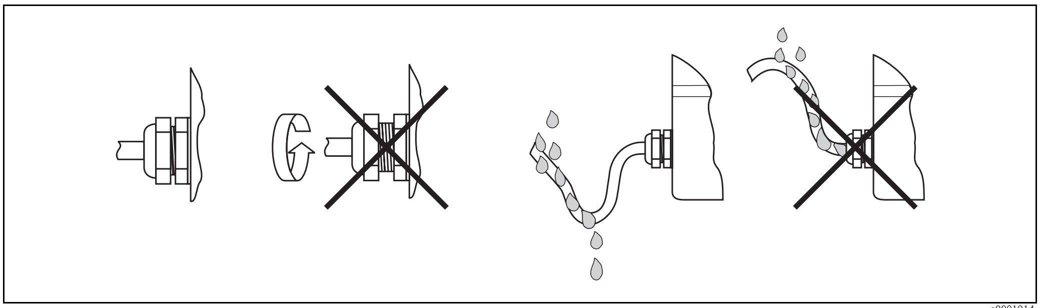

Fig. 23: Installation instructions, cable entries

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

4.4 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?	→ Page 25
Do the cables have adequate strain relief?	-
Cables correctly segregated by type? Without loops and crossovers?	-
Are the power supply and signal cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	-
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as “water traps”?	→ Page 29
Are all housing covers installed and firmly tightened?	-

5 Operation

5.1 Display and operating elements

The local display enables you to read all important variables of the simulation directly at the measuring point and configure the device using the function matrix.
The display consists of two 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).

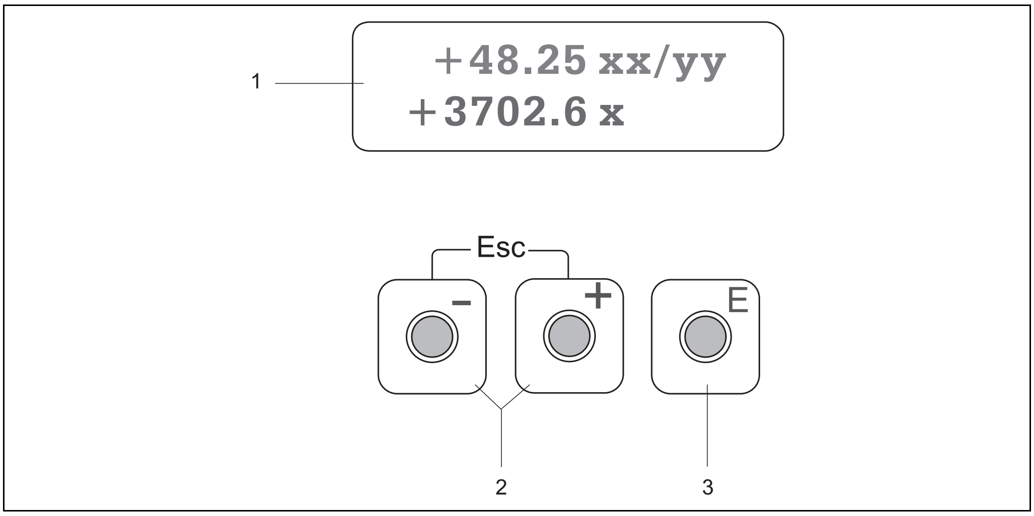

Fig. 24: Display and operating elements

1 Liquid crystal display
The backlit, two-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).
– Upper display line: shows primary measured values, e.g. mass flow in [kg/h] or in [%].
– Lower display line: shows additional measured variables and status variables, e.g. totalizer reading in [t], bar graph, measuring point designation.

2 Plus/minus keys
– Enter numerical values, select parameters
– Select different function groups within the function matrix
Press the +/– keys simultaneously to trigger the following functions:
– Exit the function matrix step by step → HOME position
– Press and hold down +/– keys for longer than 3 seconds → Return directly to HOME position
– Cancel data entry

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

5.2 Brief operating instructions to the function matrix

Note!
- See the general notes → Page 33
- Function descriptions → see the "Description of Device Functions" manual

1. HOME position → E → Entry into the function matrix
2. Select a function group (e.g. CURRENT OUTPUT 1)
3. Select a function (e.g. TIME CONSTANT)
   Change parameter / enter numerical values:
   +/− → Select or enter enable code, parameters, numerical values
   E → Save your entries
4. Exit the function matrix:
   – Press and hold down Esc key (−/+) for longer than 3 seconds → HOME position
   – Repeatedly press Esc key (−/+) → Return step-by-step to HOME position

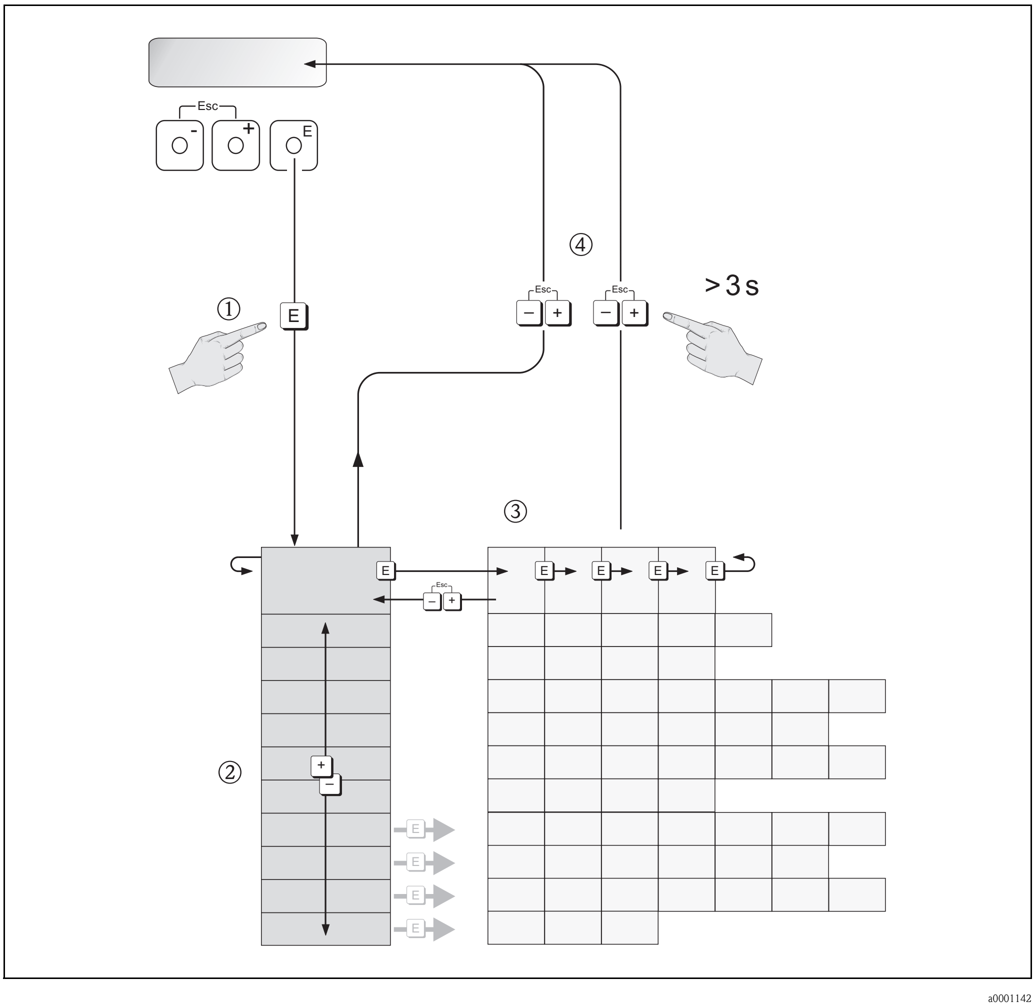

Fig. 25: Selecting functions and configuring parameters (function matrix)

5.2.1 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 in a number of function groups.

Comply with the following instructions when configuring functions:
- You select functions as described already. → Page 32
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press +/- to select SURE [YES] and press E 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 these Operating Instructions.

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

5.2.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 80) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ see the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the +/- operating elements are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is 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 the Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.

5.2.3 Disabling the programming mode

Programming mode is 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).

5.3 Error messages

5.3.1 Type of error

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

The measuring system distinguishes between two types of error:
- *System error:* This group includes all device errors, e.g. communication errors, hardware errors etc. → Page 59
- *Process error:* This group includes all application errors, e.g. fluid not homogeneous, etc. → Page 62

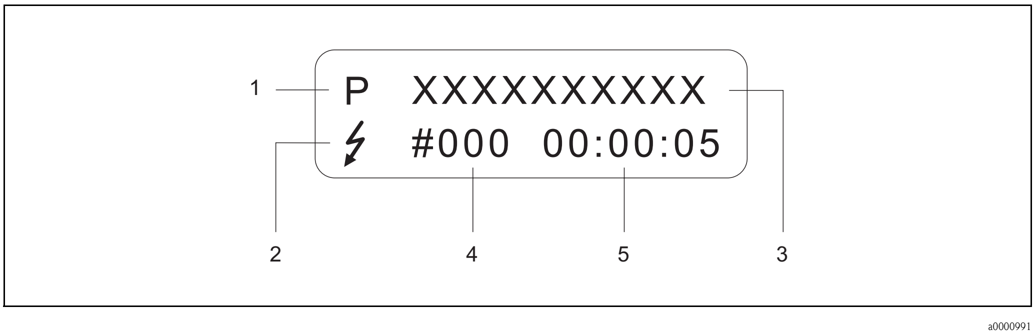

Fig. 26: Error messages on the display (example)

1 *Error type: P = process error, S = system error*
2 *Error message type: ϟ = fault message, ! = notice message*
3 *Error designation: e.g. MEDIUM INHOM. = fluid is not homogeneous*
4 *Error number: e.g. #702*
5 *Duration of most recent error occurrence (in hours, minutes and seconds)*

5.3.2 Error message type

Users have the option of weighting system and process errors differently, by defining them as **Fault messages** or **Notice messages**. You can define messages in this way with the aid of the function matrix (see the "Description of Device Functions" manual).
Serious system errors, e.g. module defects, are always identified and classified 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).

Fault message (ϟ)
- The error in question interrupts or stops the current operation and has an immediate effect on the outputs. The response of the outputs (failsafe mode) can be defined by means of functions in the function matrix → Page 64
- Displayed as → Lightning flash (ϟ), error type (S: system error, P: process error)

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

5.4 Communication

In addition to local operation, the measuring device can be configured and measured values can be obtained by means of the HART protocol. Digital communication takes place using the 4–20 mA current output HART. → Page 28
The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes. The HART master, e.g. a handheld terminal or PC-based operating programs (such as ToF Tool – Fieldtool Package), require device description (DD) files which are used to access all the information in a HART device. Information is exclusively transferred using "commands". There are three different command groups:

There are three different command groups:

- *Universal Commands*
  Universal commands are supported and used by all HART devices. The following are examples of functions connected with them:
  – Recognizing HART devices
  – Reading digital measured values (volume flow, totalizer etc.)
- *Common practice commands:*
  Common practice commands offer functions which are supported and can be executed by most but not all field devices.
- *Device-specific commands:*
  These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, among other things, such as empty/full pipe calibration values, low flow cut off settings, etc.

✎ Note!
The measuring device has access to all three command classes.
List of all "Universal Commands" and "Common Practice Commands": → Page 39

5.4.1 Operating options

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

Note!
- The HART protocol requires the "4…20 mA HART" setting (individual options see device function) in the CURRENT SPAN function (current output 1).

HART
handheld terminal DXR 375

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

Operating program "ToF Tool – Fieldtool Package"

Modular software package consisting of the service program "ToF Tool" for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and evolution of pressure measuring instruments as well as the "Fieldtool" service program for the configuration and diagnosis of Proline flow measuring devices. The Proline flow measuring devices are accessed via a service interface or via the service interface FXA 193 or the HART protocol.

Contents of the "ToF Tool – Fieldtool Package":
- Commissioning, maintenance analysis
- Configuring flowmeters
- Service functions
- Visualization of process data
- Troubleshooting
- Controlling the "Fieldcheck" tester/simulator

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 FXA 193.

Operating program "SIMATIC PDM" (Siemens)

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

Operating program "AMS" (Emerson Process Management)

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

5.4.2 Current device description files

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

HART protocol:

Valid for software:	2.01.XX	→ Function "Device software" (8100)
Device data HART		
Manufacturer ID:	11_{hex} (ENDRESS+HAUSER)	→ Function "Manufacturer ID" (6040)
Device ID:	50_{hex}	→ Function "Device ID" (6041)
HART version data:	Device Revision 6/ DD Revision 1	
Software release:	11.2005	

Operating program:	Sources for obtaining device descriptions:
Handheld terminal DXR 375	▪ Use update function of handheld terminal
ToF Tool – Fieldtool Package	▪ www.tof–fieldtool.endress.com (→ Download → Software → Device driver) ▪ CD–ROM (Endress+Hauser order number 50097200)
FieldCare / DTM	▪ www.endress.com (→ Download → Software → Device driver) ▪ CD–ROM (Endress+Hauser order number 50097200)
AMS	▪ www.endress.com (→ Download → Software → Device driver) ▪ CD–ROM (Endress+Hauser order number 50097200)
SIMATIC PDM	▪ www.endress.com (→ Download → Software → Device driver) ▪ CD–ROM (Endress+Hauser order number 50097200)

Operation via the service protocol

Valid for device software:	2.01.XX	→ Function "Device software" (8100)
Software release:	11.2005	

Operating program:	Sources for obtaining device descriptions:
ToF Tool – Fieldtool Package	▪ www.tof–fieldtool.endress.com (→ Download → Software → Device driver) ▪ CD–ROM (Endress+Hauser order number 50097200)

Tester/simulator:	Sources for obtaining device descriptions:
Fieldcheck	▪ Update by means of ToF Tool – Fieldtool Package via Fieldflash module

5.4.3 Device and process variables

Device variables:
The following device variables are available using the HART protocol:

Code (decimal)	Device variable
0	OFF (unassigned)
2	Mass flow
5	Volume flow
6	Corrected volume flow
7	Density
8	Reference density
9	Temperature
250	Totalizer 1
251	Totalizer 2

Process variables:

At the factory, the process variables are assigned to the following device variables:
- Primary process variable (PV) → Mass flow
- Secondary process variable (SV) → Totalizer 1
- Third process variable (TV) → Density
- Fourth process variable (FV) → Temperature

✎ Note!
You can set or change the assignment of device variables to process variables using Command 51.
→ Page 42

5.4.4 Universal / Common practice HART commands

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

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Universal Commands			
0	Read unique device identifier Access type = read	none	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12-byte device ID: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, e.g. 81 = Promass 83 or 80 = Promass 80 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Bytes 9-11: Device identification
1	Read primary process variable Access type = read	none	– Byte 0: HART unit code of the primary process variable – Bytes 1-4: Primary process variable *Factory setting:* Primary process variable = Mass flow Note! ▪ You can set the assignment of device variables to process variables using Command 51. ▪ Manufacturer-specific units are represented using the HART unit code “240”.
2	Read the primary process variable as current in mA and percentage of the set measuring range Access type = read	none	– Bytes 0-3: Current current of the primary process variable in mA – Bytes 4-7: Percentage of the set measuring range *Factory setting:* Primary process variable = Mass flow Note! You can set the assignment of device variables to process variables using Command 51.
3	Read the primary process variable as current in mA and four (preset using Command 51) dynamic process variables Access type = read	none	24 bytes are sent as a response: – Bytes 0-3: Primary process variable current in mA – Byte 4: HART unit code of the primary process variable – Bytes 5-8: Primary process variable – Byte 9: HART unit code of the secondary process variable – Bytes 10-13: Secondary process variable – Byte 14: HART unit code of the third process variable – Bytes 15-18: Third process variable – Byte 19: HART unit code of the fourth process variable – Bytes 20-23: Fourth process variable *Factory setting:* ▪ Primary process variable = Mass flow ▪ Secondary process variable = Totalizer 1 ▪ Third process variable = Density ▪ Fourth process variable = Temperature Note! ▪ You can set the assignment of device variables to process variables using Command 51. ▪ Manufacturer-specific units are represented using the HART unit code “240”.

Command No. HART command / Access type		**Command data (numeric data in decimal form)**	**Response data (numeric data in decimal form)**
6	Set HART shortform address Access type = write	Byte 0: desired address (0 to 15) *Factory setting:* 0 Note! With an address >0 (multidrop mode), the current output of the primary process variable is set to 4 mA.	Byte 0: active address
11	Read unique device identification using the TAG (measuring point designation) Access type = read	Bytes 0–5: TAG	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12-byte device ID if the specified TAG agrees with the one saved in the device: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 81 = Promass 83 or 80 = Promass 80 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Bytes 9-11: Device identification
12	Read user message Access type = read	none	Bytes 0–24: User message Note! You can write the user message using Command 17.
13	Read TAG, descriptor and date Access type = read	none	– Bytes 0–5: TAG – Bytes 6-17: Descriptor – Bytes 18–20: Date Note! You can write the TAG, descriptor and date using Command 18.
14	Read sensor information on primary process variable	none	– Bytes 0–2: Sensor serial number – Byte 3: HART unit code of sensor limits and measuring range of the primary process variable – Bytes 4–7: Upper sensor limit – Bytes 8–11: Lower sensor limit – Bytes 12–15: Minimum span Note! ▪ The data relate to the primary process variable (= Mass flow). ▪ Manufacturer-specific units are represented using the HART unit code “240”.
15	Read output information of primary process variable Access type = read	none	– Byte 0: Alarm selection ID – Byte 1: Transfer function ID – Byte 2: HART unit code for the set measuring range of the primary process variable – Bytes 3–6: Upper range, value for 20 mA – Bytes 7–10: Start of measuring range, value for 4 mA – Bytes 11-14: Attenuation constant in [s] – Byte 15: Write protection ID – Byte 16: OEM dealer ID, 17 = E+H *Factory setting:* Primary process variable = Mass flow Note! ▪ You can set the assignment of device variables to process variables using Command 51. ▪ Manufacturer-specific units are represented using the HART unit code “240”.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
16	Read the device production number Access type = read	none	Bytes 0-2: Production number
17	Write user message Access = write	You can save any 32-character long text in the device under this parameter: Bytes 0-23: Desired user message	Displays the current user message in the device: Bytes 0-23: Current user message in the device
18	Write TAG, descriptor and date Access = write	With this parameter, you can store an 8 character TAG, a 16 character descriptor and a date: – Bytes 0-5: TAG – Bytes 6-17: Descriptor – Bytes 18-20: Date	Displays the current information in the device: – Bytes 0-5: TAG – Bytes 6-17: Descriptor – Bytes 18-20: Date

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

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Common Practice Commands			
34	Write damping value for primary process variable Access = write	Bytes 0-3: Attenuation constant of the primary process variable in seconds *Factory setting:* Primary process variable = Mass flow	Displays the current damping value in the device: Bytes 0-3: Damping value in seconds
35	Write measuring range of primary process variable Access = write	Write the desired measuring range: – Byte 0: HART unit code of the primary process variable – Bytes 1-4: Upper range, value for 20 mA – Bytes 5-8: Start of measuring range, value for 4 mA *Factory setting:* Primary process variable = Mass flow Note! ▪ You can set the assignment of device variables to process variables using Command 51. ▪ If the HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.	The currently set measuring range is displayed as a response: – Byte 0: HART unit code for the set measuring range of the primary process variable – Bytes 1-4: Upper range, value for 20 mA – Bytes 5-8: Start of measuring range, value for 4 mA Note! Manufacturer-specific units are represented using the HART unit code “240”.
38	Device status reset (Configuration changed) Access = write	none	none
40	Simulate output current of primary process variable Access = write	Simulation of the desired output current of the primary process variable. An entry value of 0 exits the simulation mode: Byte 0-3: Output current in mA *Factory setting:* Primary process variable = Mass flow Note! You can set the assignment of device variables to process variables with Command 51.	The momentary output current of the primary process variable is displayed as a response: Byte 0-3: Output current in mA
42	Perform master reset Access = write	none	none

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
44	Write unit of primary process variable Access = write	Set unit of primary process variable. Only unit which are suitable for the process variable are transferred to the device: Byte 0: HART unit code *Factory setting:* Primary process variable = Mass flow Note! ▪ If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit. ▪ If you change the unit of the primary process variable, this has no impact on the system units.	The current unit code of the primary process variable is displayed as a response: Byte 0: HART unit code Note! Manufacturer-specific units are represented using the HART unit code “240”.
48	Read additional device status Access = read	none	The device status is displayed in extended form as the response: Coding: see table → Page 44
50	Read assignment of the device variables to the four process variables Access = read	none	Display of the current variable assignment of the process variables: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the secondary process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable *Factory setting:* ▪ Primary process variable: Code 1 for mass flow ▪ Secondary process variable: Code 250 for totalizer 1 ▪ Third process variable: Code 7 for density ▪ Fourth process variable: Code 9 for temperature Note! You can set the assignment of device variables to process variables with Command 51.
51	Write assignments of the device variables to the four process variables Access = write	Setting of the device variables to the four process variables: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the secondary process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable *Code of the supported device variables:* See data → Page 38 *Factory setting:* ▪ Primary process variable = Mass flow ▪ Secondary process variable = Totalizer 1 ▪ Third process variable = Density ▪ Fourth process variable = Temperature	The variable assignment of the process variables is displayed as a response: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the secondary process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
53	Write device variable unit Access = write	This command sets the unit of the given device variables. Only those units which suit the device variable are transferred: – Byte 0: Device variable code – Byte 1: HART unit code *Code of the supported device variables:* See data → Page 38 Note! ▪ If the written unit is not the correct one for the device variable, the device will continue with the last valid unit. ▪ If you change the unit of the device variable, this has no impact on the system units.	The current unit of the device variables is displayed in the device as a response: – Byte 0: Device variable code – Byte 1: HART unit code Note! Manufacturer-specific units are represented using the HART unit code “240”.
59	Write number of preambles in response message Access = write	This parameter sets the number of preambles which are inserted in the response messages: Byte 0: Number of preambles (2 to 20)	As a response, the current number of the preambles is displayed in the response message: Byte 0: Number of preambles

5.4.5 Device status / Error messages

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

Note!
You can find a detailed explanation of the device status and error messages and their elimination in the “System error messages” section. → Page 59

Byte–bit	Error No.	Short error description → Page 58
0-0	001	Serious device error
0-1	011	Measuring amplifier has faulty EEPROM
0-2	012	Error when accessing data of the measuring amplifier EEPROM
1-1	031	S-DAT: defective or missing
1-2	032	S-DAT: Error accessing saved values
1-5	051	I/O board and the amplifier board are not compatible.
3-3	111	Totalizer checksum error
3-4	121	I/O board and the amplifier board (software versions) are not compatible.
4-3	251	Internal communication fault on the amplifier board.
4-4	261	No data reception between amplifier and I/O board
7-3	351	Current output: Flow is out of range.
7-4	352	
7-5	353	
7-6	354	
7-7	355	Frequency output: Flow is out of range.
8-0	356	
8-1	357	
8-2	358	
8-3	359	Pulse output: Pulse output frequency is out of range.
8-4	360	
8-5	361	
8-6	362	
9-0	379	The measuring tube oscillation frequency is outside the permitted range.
9-1	380	
9-2	381	The temperature sensor on the measuring tube is likely defective.
9-3	382	
9-4	383	The temperature sensor on the carrier tube is likely defective.
9-5	384	
9-6	385	One of the measuring tube exciter coils (inlet or outlet) is likely defective.
9-7	386	
10-0	387	One of the measuring tube exciter coils (inlet or outlet) is likely defective.
10-1	388	
10-2	389	Amplifier error
10-3	390	
12-1	474	Maximum flow value entered is exceeded.
12-7	501	New amplifier software version is loaded. Currently no other commands are possible.
13-0	502	Upload and download of device files. Currently no other commands are possible.

Byte–bit	Error No.	Short error description → Page 58
13-5	586	The fluid properties do not allow normal measuring operation.
13-6	587	Extreme process conditions exist. The measuring system can therefore not be started.
13-7	588	Overdriving of the internal analog to digital converter. A continuation of the measurement is no longer possible!
14-3	601	Positive zero return active
14-7	611	Simulation current output 1 active
15-0	612	Simulation current output 2 active
15-3	621	Simulation frequency output active
15-7	631	Simulation pulse output active
16-3	641	Simulation status output active
17-7	671	Simulation status input active
18-3	691	Simulation of response to error (outputs) active
18-4	692	Simulation of measured variable active
19-0	700	The process fluid density is outside the upper or lower limit values
19-1	701	The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme.
19-2	702	Frequency control is not stable, due to inhomogeneous fluid.
19-3	703	Overdriving of the internal analog to digital converter. A continuation of the measurement is still possible!
19-4	704	
19-5	705	The electronics' measuring range will be exceeded. The mass flow is too high.
20-5	731	The zero point adjustment is not possible or has been canceled.

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” → Page 23
- Checklist for “Post connection check” → Page 30

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:

PROMASS 80 **START-UP...**	Startup message
▼	
DEVICE SOFTWARE **V XX.XX.XX**	Current software version
▼	
SYSTEM OK **→ OPERATION**	Beginning of normal measuring mode

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

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 or ToF Tool – Fieldtool Package. 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 "Commissioning" Quick Setup

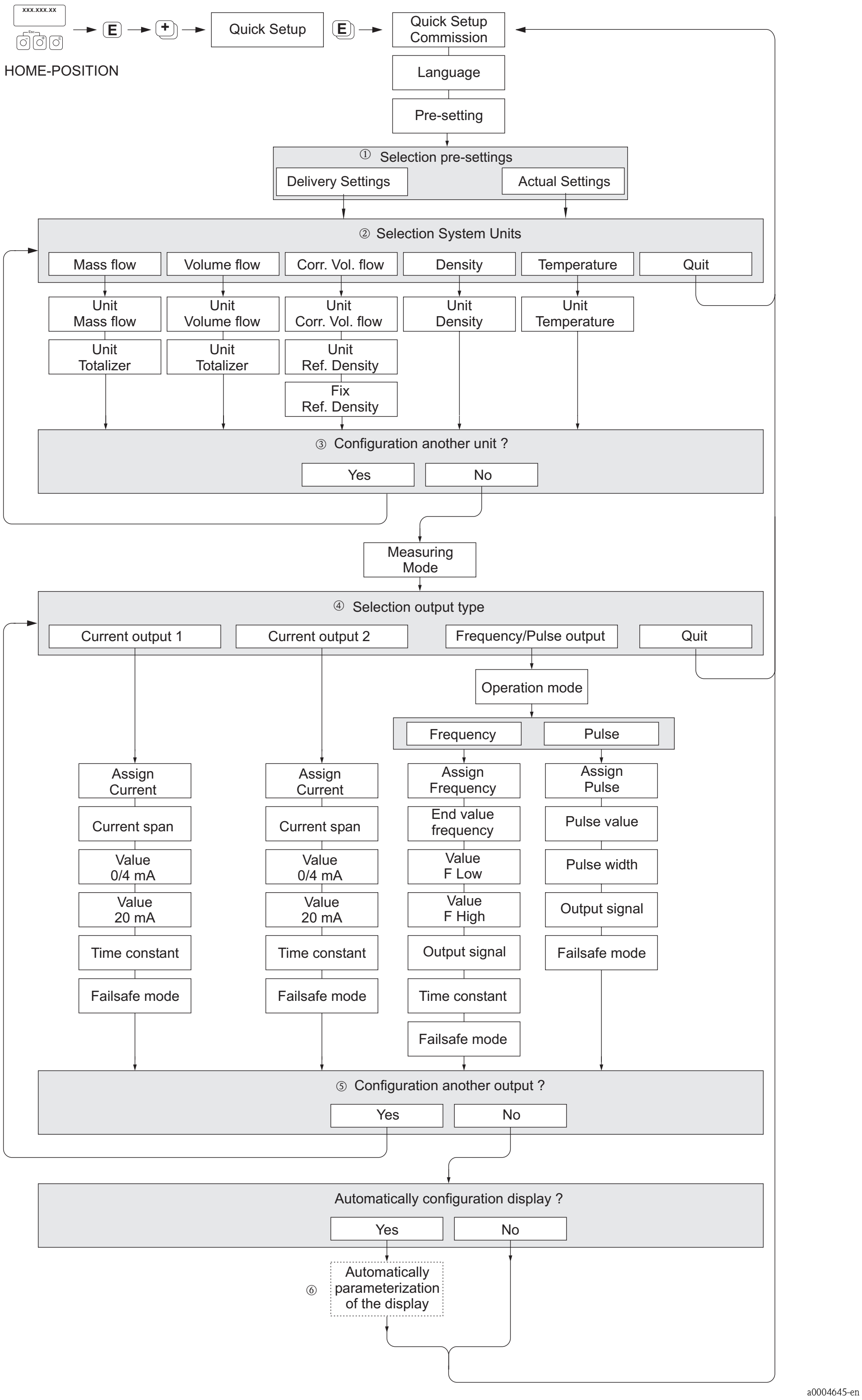

Fig. 27: "Commissioning" Quick Setup

① Selecting DELIVERY SETTINGS returns each selected unit to the factory setting.
Selecting ACTUAL SETTINGS applies the units you have set previously.

② Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.

③ The YES option remains visible until all the units have been configured. NO is the only option displayed when no further units are available.

④ Only the outputs not yet configured in the current Setup are offered for selection in each cycle.

⑤ The YES option remains visible until all the outputs have been configured. NO is the only option displayed when no further outputs are available.

⑥ The "automatic parameterization of the display" option contains the following basic settings/factory settings:
YES: line 1= mass flow; line 2 = totalizer 1;
information line = operating/system conditions
NO: The existing (selected) settings remain.

Note!
- The display returns to the cell SETUP COMMISSIONING if you press the Esc (- +) key combination during an interrogation. The stored parameters remain valid.

6.4 Configuration

6.4.1 One current output: active/passive

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

Caution!
Configuring the current outputs as “active” or “passive” is possible for non-Ex i I/O boards only. Ex i I/O boards are permanently wired as “active” or “passive”. Also refer to table → Page 27

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 → Page 65
3. Set the jumpers in accordance with → Fig. 28

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.

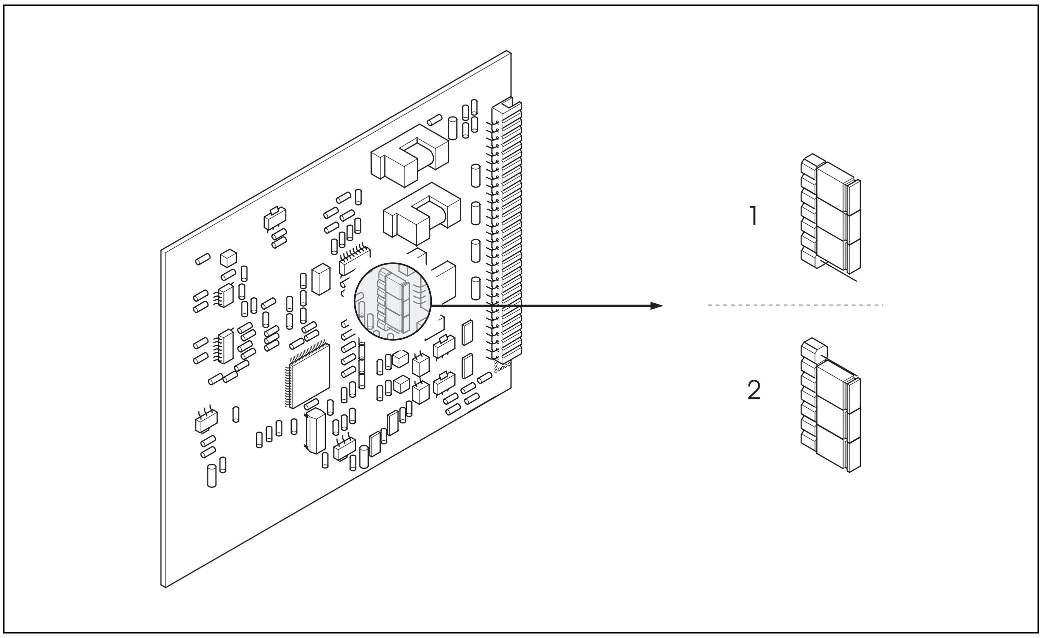

Fig. 28: Configuring the current output (I/O board)

1 Active current output (default)
2 Passive current output

6.4.2 Two current outputs: active/passive

The current outputs are configured as “active” or “passive” by means of various jumpers on the current input 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 → Page 65
3. Set the jumpers → Fig. 29

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.

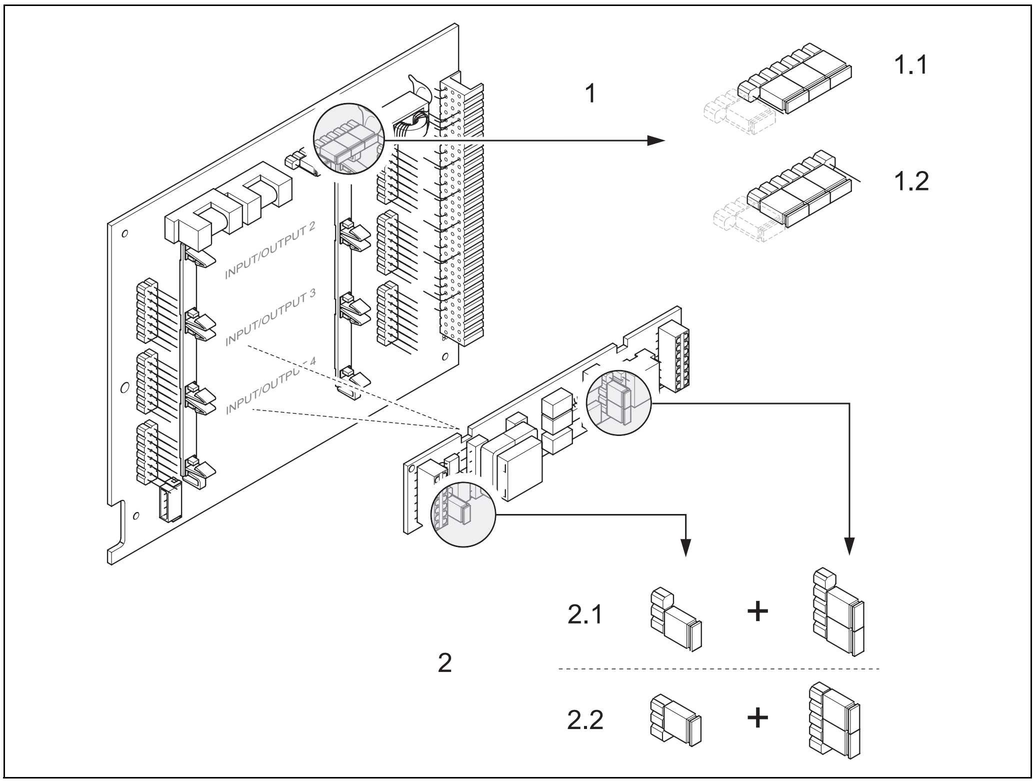

Fig. 29: Configuring current outputs with the aid of jumpers (I/O board)

1 Current output 1 with HART
1.1 Active current output (default)
1.2 Passive current output
2 Current output 2 (optional, plug-in module)
2.1 Active current output (default)
2.2 Passive current output

6.5 Adjust

6.5.1 Zero point adjustment

All Promass measuring devices are calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate.
Calibration takes place under reference operating conditions. → Page 76
Consequently, the zero point adjustment is generally **not** necessary for Promass!

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy and very low flow rates
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids.

Preconditions for a zero point adjustment

Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids with no gas or solid contents.
- A Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  – Normal operation → valves 1 and 2 open
  – Zero point adjustment *with* pump pressure → Valve 1 open / valve 2 closed
  – Zero point adjustment *without* pump pressure → Valve 1 closed / valve 2 open

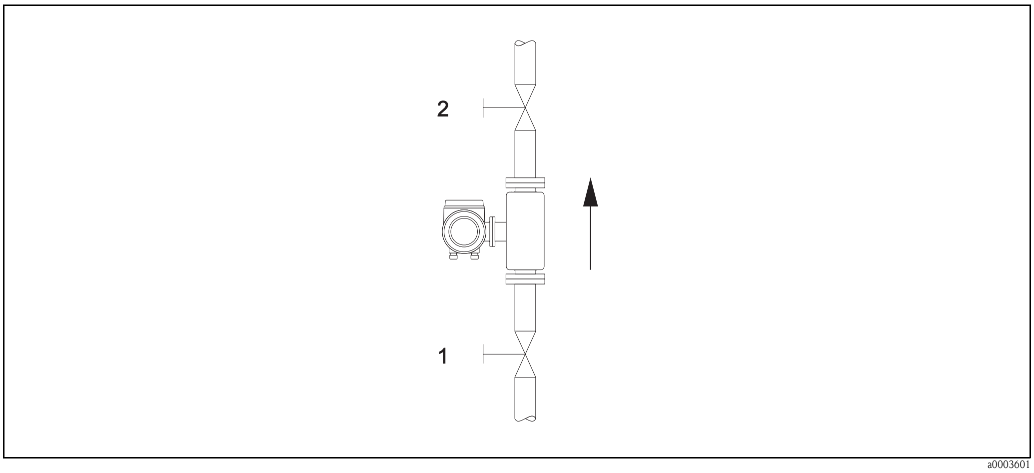

Fig. 30: Zero point adjustment and shutoff valves

Caution!
- If the fluid is very difficult to measure (e.g. containing entrained solids or gas) it may prove impossible to obtain a stable zero point despite repeated zero point adjustments. In instances of this nature, please contact your E+H service center.
- You can view the currently valid zero point value using the ZERO POINT function (see the “Description of Device Functions” manual).

Performing a zero point adjustment

1. Let the system run until operating conditions have been reached.
2. Stop the flow (v = 0 m/s).
3. Check the shutoff valves for leaks.
4. Check that operating pressure is correct.
5. Perform a zero point adjustment as follows:

Key	Procedure	Display text
E	HOME position → Enter the function matrix	> GROUP SELECTION< MEASURED VARIABLES
+/−	Select the PROCESS PARAMETER function group	> GROUP SELECTION< PROCESS PARAMETER
E (hold)	Select the ZERO ADJUST. function	ZERO ADJUST. CANCEL
+/−	After you press +/−, you are automatically prompted to enter the code if the function matrix is still disabled.	CODE ENTRY ***
+/−	Enter the code (80 = default)	CODE ENTRY 80
E	Confirm the code as entered. The ZERO ADJUST function reappears on the display.	PROGRAMMING ENABLED ZERO ADJUST. CANCEL
+/−	Select START	ZERO ADJUST. START
E	Confirm the entry by pressing the Enter key. The confirmation prompt appears on the display.	SURE? NO
+/−	Select YES.	SURE? YES
E	Confirm the entry by pressing the Enter key. Zero point adjustment now starts. While zero point adjustment is in progress, the display shown here is visible for 30 to 60 seconds. If the flow of fluid in the pipe exceeds 0.1 m/s, an error message appears on the display: ZERO ADJUST NOT POSSIBLE. When the zero point adjustment completes, the ZERO ADJUST. function reappears on the display.	ZERO ADJUST. RUNNING ZERO ADJUST. CANCEL
E	After actuating the Enter key, the new zero point value is displayed.	ZERO POINT
+/− (together)	Simultaneously pressing +/− → HOME position	

6.5.2 Density adjustment

Measuring accuracy in determining fluid density has a direct effect on calculating volume flow. Density adjustment, therefore, is necessary under the following circumstances:

- The sensor does not measure exactly the density value that the user expects, based on laboratory analyses.
- The fluid properties are outside the measuring points set at the factory, or the reference operating conditions used to calibrate the measuring device.
- The system is used exclusively to measure a fluid's density which must be registered to a high degree of accuracy under constant conditions.

Performing a 1-point or 2-point density adjustment

Caution!

- Onsite density adjustment can be performed only if the user has detailed knowledge of the fluid density, obtained for example from detailed laboratory analyses.
- The target density value specified in this way must not deviate from the measured fluid density by more than ±10%.
- An error in defining the target density affects all calculated density and volume functions.
- Density adjustment changes the factory density calibration values or the calibration values set by the service technician.
- The functions outlined in the following instructions are described in detail in the "Description of Device Functions" manual.

1. Fill the sensor with fluid. Make sure that the measuring tubes are completely filled and that liquids are free of gas bubbles.
2. Wait until the temperature difference between fluid and measuring tube has equalized. The time you have to wait for equalization depends on the fluid and the temperature level.
3. Select the density adjustment function:
   HOME → E → +/- → PROCESS PARAMETERS → E → DENSITY SET POINT
   – When you press +/- you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code.
   – Use +/- to enter the fluid's target density and press E to save this value (input range = actual density value ±10%).
4. Press E to select the MEASURE FLUID function.
   Use +/- to select the setting START and press E. The message DENSITY ADJUST RUNNING then appears on the display for 10 seconds. During this time Promass measures the current density of the fluid (measured density value).
5. Press F and select the DENSITY ADJUST function.
   Now use +/- to select the setting DENSITY ADJUST and press E. Promass compares the measured density value with the specified value and calculates the new density coefficient.

   Caution!
   If a density adjustment does not complete correctly, you can select the RESTORE ORIGINAL function to reactivate the default density coefficient.
6. Use +/- Use Q to return to the HOME position (press +/- simultaneously).

6.6 Purge and pressure monitoring connections

The sensor housing protects the inner electronics and mechanics and is filled with dry nitrogen. Beyond that, up to a specified measuring pressure it additionally serves as secondary containment.

⚠ Warning!
For a process pressure above the specified containment pressure, the housing does not serve as an additional secondary containment. In case a danger of measuring tube failure exists due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose housing is equipped with special pressure monitoring connections (ordering option). With the help of these connections, fluid collected in the housing in the event of tube failure can be drained off. This diminishes the danger of mechanical overload of the housing, which could lead to a housing failure and accordingly is connected with an increased danger potential. These connections can also be used for gas purging (gas detection).

The following instructions apply to handling sensors with purge or pressure monitoring connections:
- Do not open the purge connections unless the containment can be filled immediately with a dry inert gas.
- Use only low gauge pressure to purge. Maximum pressure 5 bar.

6.7 Data storage device (HistoROM)

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

6.7.1 HistoROM/S–DAT (sensor–DAT)

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

7 Maintenance

No special maintenance work is required.

7.1 Exterior cleaning

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

7.2 Cleaning with pigs (Promass H, I)

If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection into account. See also Technical Information. → Page 96

7.3 Replacing seals

Under normal circumstances, fluid wetted seals of the Promass A and Promass M sensors do not require replacement. Replacement is necessary only in special circumstances, for example if aggressive or corrosive fluids are incompatible with the seal material.

✎ Note!
- The period between changes depends on the fluid properties and on the frequency of cleaning cycles in the case of CIP/SIP cleaning.
- Replacement seals (accessories)

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
Proline Promass 80 transmitter	Transmitter for replacement or for stock. Use the order code to define the following specifications: – Approvals – Degree of protection / version – Cable entries – Display / power supply / operation – Software – Outputs / inputs	80XXX – XXXXX * * * * * *

8.2 Measuring principle-specific accessories:

Accessory	Description	Order code
Mounting set for transmitter	Mounting set for remote version. Suitable for: – Wall mounting – Pipe mounting – Installation in control panel Mounting set for aluminum field housing: Suitable for pipe mounting (3/4" to 3")	DK8WM – *
Post mounting set for the Promass A sensor	Post mounting set for the Promass A	DK8AS – * *
Mounting set for the Promass A sensor	Mounting set for Promass A, comprising: – 2 process connections – Seals	DK8MS – * * * * * *
Set of seals for sensor	For regular replacement of the seals of the Promass M and Promass A sensors. Set consists of two seals.	DKS – * * *

8.3 Communication-specific accessories:

Accessory	Description	Order code
HART Communicator DXR 375 handheld terminal	Handheld terminal for remote configuration and for obtaining measured values via the current output HART (4 to 20 mA). Contact your Endress+Hauser representative for more information.	DXR375 – * * * *

8.4 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 – *
ToF Tool – Fieldtool Package	Modular software package consisting of the service program “ToF Tool” for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and the “Fieldtool” service program for the configuration and diagnosis of Proline flow measuring devices. The Proline flow measuring devices are accessed via a service interface or via the service interface FXA 193. Contents of the “ToF Tool – Fieldtool Package”: – Commissioning, maintenance analysis – Configuring flowmeters – Service functions – Visualization of process data – Troubleshooting – Access to the verification data and updating the software of the “Fieldcheck” flow simulator Contact your Endress+Hauser representative for more information.	DXS10 – * * * * *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the “ToF Tool – Fieldtool Package” 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

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 → Page 70 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 → Page 65
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 → Page 65 2. Display module defective → order spare parts → Page 65 3. Measuring electronics defective → order spare parts → Page 65
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 → Page 65
▼	
Error messages on display	
Errors that occur during commissioning or measuring are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows (example): – Error type: **S** = system error, **P** = process error – Error message type: ϟ = fault message, **!** = notice message – **MEDIUM INHOM.** = error designation (e.g. fluid is not homogeneous) – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – **#702** = error number Caution! ▪ See the information on → Page 34 ▪ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.	
▼	
Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → Page 63

9.2 System error messages

Serious system errors are **always** recognized by the instrument as a “Fault message” and are shown as a lightning flash (ϟ) 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.
→ Page 8
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 → Page 34

No.	Error message / Type	Cause	Remedy / spare part
S = System error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
No. # 0xx → Hardware error			
001	S: CRITICAL FAILURE ϟ: # 001	Serious device error	Replace the amplifier board. Spare part → Page 65
011	S: AMP HW EEPROM ϟ: # 011	Amplifier: Defective EEPROM	Replace the amplifier board. Spare parts → Page 65
012	S: AMP SW EEPROM ϟ: # 012	Measuring amplifier: Error when accessing data of the EEPROM	The EEPROM data blocks in which an error has occurred are displayed in the TROUBLESHOOTING function. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the erroneous parameter values. Note! The measuring device has to be restarted if an error has occurred in a totalizer block (see error No. 111/CHECKSUM TOTAL.).
031	S: SENSOR HW DAT ϟ: # 031	Sensor DAT: 1. S-DAT is defective. 2. S-DAT is not plugged into the amplifier board or is missing.	1. Replace the S-DAT. Spare parts → Page 65 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. – Plug the S-DAT into the amplifier board → Page 67 → Page 69
032	S: SENSOR SW DAT ϟ: # 032	Sensor DAT: Error accessing the calibration values stored in the S-DAT.	– Check whether the S-DAT is correctly plugged into the amplifier board → Page 67 → Page 69 2. Replace the S-DAT if it is defective. Spare parts → Page 65 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. Spare parts → Page 65
051	A / C COMPATIB. ϟ: # 051	The I/O board and the amplifier board are not compatible.	Use only compatible modules and boards. Check the compatibility of the modules used. Check the: – Spare part set number – Hardware revision code
No. # 1xx → Software error			

No.	Error message / Type	Cause	Remedy / spare part
111	CHECKSUM TOTAL ϟ: # 111	Totalizer checksum error	1. Restart the measuring device 2. Replace the amplifier board if necessary. Spare parts → Page 65
121	A / C COMPATIB. !: # 121	Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). Note! – This message is only listed in the error history. – Nothing is displayed on the display.	Module with lower software version has either to be actualized by ToF Tool – Fieldtool Package with the required software version or the module has to be replaced. Spare parts → Page 65
No. # 2xx → Error in DAT / no communication			
251	COMMUNICATION I/O ϟ: # 251	Internal communication fault on the amplifier board.	Remove the amplifier board. Spare parts → Page 65
261	COMMUNICATION I/O ϟ: # 261	No data reception between amplifier and I/O board or faulty internal data transfer.	Check the BUS contacts
No. # 3xx → System limits exceeded			
351 to 354	CURRENT RANGE n !: # 351 to 354	Current output: Flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
355 to 358	FREQUENCY RANGE n !: # 355 to 358	Frequency output: Flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
359 to 362	PULSE RANGE !: # 359 to 362	Pulse output: Pulse output frequency is out of range.	1. Increase the setting for pulse weighting 2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.). *Determine the pulse width:* – Version 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration. – Version 2: Enter the maximum (pulse) frequency as the half "reciprocal value" that a pulse must be present at the connected counter to ensure its registration. Example: The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is: $\frac{1}{2 \cdot 10\ \text{Hz}} = 50\ \text{ms}$ a0004437 3. Reduce flow.
379 to 380	S: FREQ. LIM ϟ: # 379 to 380	The measuring tube oscillation frequency is outside the permitted range. Causes: – Change the upper or lower limit setting, as applicable. – Increase or reduce flow, as applicable.	Contact your E+H service organization.
381	S: FLUIDTEMP.MIN. ϟ: # 381	The temperature sensor on the measuring tube is likely defective.	Check the following electrical connections before you contact your E+H service organization: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board. → Page 67 → Page 69 – Remote version: Check sensor and transmitter terminal connections No. 9 and 10. → Page 24
382	S: FLUIDTEMP.MAX. ϟ: # 382		
383	S: CARR.TEMP.MIN ϟ: # 383	The temperature sensor on the carrier tube is likely defective.	Check the following electrical connections before you contact your E+H service organization: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 67 → Page 69 – Remote version: Check sensor and transmitter terminal connections No. 11 and 12. → Page 24
384	S: CARR.TEMP.MAX ϟ: # 384		

No.	Error message / Type	Cause	Remedy / spare part
385	S: INL.SENS.DEF. ϟ: # 385	One of the measuring tube exciter coils (inlet) is likely defective.	Check the following electrical connections before you contact your E+H service organization: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 67 → Page 69 – Remote version: Check sensor and transmitter terminal connections No. 4, 5, 6 and 7. → Page 24
386	S: OUTL.SENS.DEF. ϟ: # 386	One of the measuring tube exciter coils (outlet) is likely defective.	
387	S: SEN.ASY.EXCEED ϟ: # 387	Measuring pipe excitation coil is probably faulty.	
388 to 390	S: AMP. FAULT ϟ: # 388 to 390	Amplifier error	Contact your E+H service organization.
No. # 5xx → Application error			
501	S: SW.–UPDATE ACT. !: # 501	New amplifier or communication (I/O module) software version is loaded. Currently no other functions are possible.	Wait until process is finished. The device will restart automatically.
502	S: UP-/DOWNLOAD ACT. !: # 502	Up- or downloading the device data via configuration program. Currently no other functions are possible.	Wait until process is finished.
No. # 6xx → Simulation mode active			
601	S: POSITIVE ZERO RETURN !: # 601	Positive zero return active. Caution! This message has the highest display priority.	Switch off positive zero return
611 to 614	S: SIM. CURR. OUT. n !: # 611 to 614	Simulation current output active	
621 to 624	S: SIM. FREQ. OUT. n !: # 621 to 624	Simulation frequency output active	Switch off simulation
631 to 634	S: SIM. PULSE n !: # 631 to 634	Simulation pulse output active	Switch off simulation
641 to 644	S: SIM. STATUS OUT n !: # 641 to 644	Simulation status output active	Switch off simulation
671 to 674	S: SIM. STATUS IN n !: # 671 to 674	Simulation status input active	Switch off simulation
691	S: SIM. FAILSAFE !: # 691	Simulation of response to error (outputs) active	Switch off simulation
692	S: SIM. MEASURAND !: # 692	Simulation of measuring variables (e.g. mass flow)	Switch off simulation

9.3 Process error messages

Process errors can be defined as either "Fault" or "Notice" messages and can thereby be weighted differently. This is specified via the function matrix
(→ "Description of Device Functions" manual).

Note!
- The listed error message types below correspond to the factory setting.
- See the information on → Page 34

No.	Error message / Type	Cause	Remedy / spare part
P = Process error ϟ = Fault message (with an effect on the inputs and outputs) ! = Notice message (without an effect on the inputs and outputs)			
586	P: OSC. AMP. LIM. ϟ: # 586	The fluid properties do not allow a continuation of the measurement. Causes: – Extremely high viscosity – Process fluid is very inhomogeneous (gas or solid content)	Change or improve process conditions.
587	P: TUBE NOT OSC ϟ: # 587	Extreme process conditions exist. The measuring system can therefore not be started.	Change or improve process conditions.
588	P: NOISE LIMIT ϟ: # 588	Overdriving of the internal analog to digital converter. Causes: – Cavitation – Extreme pressure pulses – High gas flow velocity A continuation of the measurement is no longer possible!	Change or improve process conditions, e.g. by reducing the flow velocity.
No. # 7xx → Other process errors)			
700	P: EMPTY PIPE !: # 700	The process fluid density is outside the upper or lower limit values set in the EPD function Causes: – Air in the measuring tube – Partly filled measuring tube	1. Ensure that there is no gas content in the process liquid. 2. Adapt the values in the EPD function to the current process conditions.
701	P: EXC. CURR. LIM. !: # 701	The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme, e.g. high gas or solid content. The instrument continues to work correctly.	In particular with outgassing fluids and/or increased gas content, the following measures are recommended to increase system pressure: 1. Install the instrument at the outlet side of a pump. 2. Install the instrument at the lowest point of an ascending pipeline. 3. Install a flow restriction, e.g. reducer or orifice plate, downstream from the instrument.
702	P: FLUID INHOM. !: # 702	Frequency control is not stable, due to inhomogeneous process fluid, e.g. gas or solid content.	
703	P: NOISE LIMIT CH0 !: # 703	Overdriving of the internal analog to digital converter. Causes: – Cavitation – Extreme pressure pulses – High gas flow velocity A continuation of the measurement is still possible!	Change or improve process conditions, e.g. by reducing the flow velocity.
704	P: NOISE LIMIT CH1 !: # 704		
705	P: FLOW LIMIT ϟ: # 705	The mass flow is too high. The electronics' measuring range will be exceeded.	Reduce flow
731	P: ABJ. ZERO FAIL !: # 731	The zero point adjustment is not possible or has been canceled.	Make sure that zero point adjustment is carried out at "zero flow" only (v = 0 m/s). → Page 51

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.	
Measured value reading fluctuates even though flow is steady.	1. Check the fluid for presence of gas bubbles. 2. TIME CONSTANT function → increase value (→ OUTPUTS / CURRENT OUTPUT / CONFIGURATION) 3. DISPLAY DAMPING function → increase value (→ USER INTERFACE / CONTROL / BASIC CONFIGURATION)
Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	1. Check the fluid for presence of gas bubbles. 2. Activate the ON-VAL. LF-CUTOFF function, i.e. enter or increase the value for the low flow cut off (→ BASIC FUNCTION / PROCESS PARAMETER / CONFIGURATION).
The fault cannot be rectified or some other fault not described above has occurred. In these instances, please contact your E+H 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 with the following information: – Brief description of the fault – Nameplate specifications : Order code and serial number **Returning devices to Endress+Hauser** The procedures on must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. Page 8 Always enclose a duly completed "Declaration of contamination" form with the flowmeter. You will find a preprinted "Dangerous Goods Sheet" at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective → order replacement → Page 65

9.5 Process error messages

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

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

Failsafe mode of outputs and totalizers		
	Process/system error is 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 Page 34 ff.		
Current output 1, 2	MINIMUM CURRENT The current output will be set to the lower value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the "Description of Device Functions" manual). MAXIMUM CURRENT The current output will be set to the higher value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the "Description of Device Functions" manual). HOLD VALUE Measured value display on the basis of the last saved value preceding occurrence of the fault. ACTUAL VALUE Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow"
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 VALUE 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"
Totalizer 1, 2	STOP The totalizers are paused until the error is rectified. ACTUAL VALUE The fault is ignored. The totalizer continues to count in accordance with the current flow value. HOLD VALUE The totalizers continue to count the flow in accordance with the last valid flow value (before the error occurred).	Totalizer stops
Status output	Status output → nonconductive in the event of fault or power supply failure	No effect on status output

9.6 Spare parts

The previous sections contain a detailed troubleshooting guide. → Page 58
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. → Page 9

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

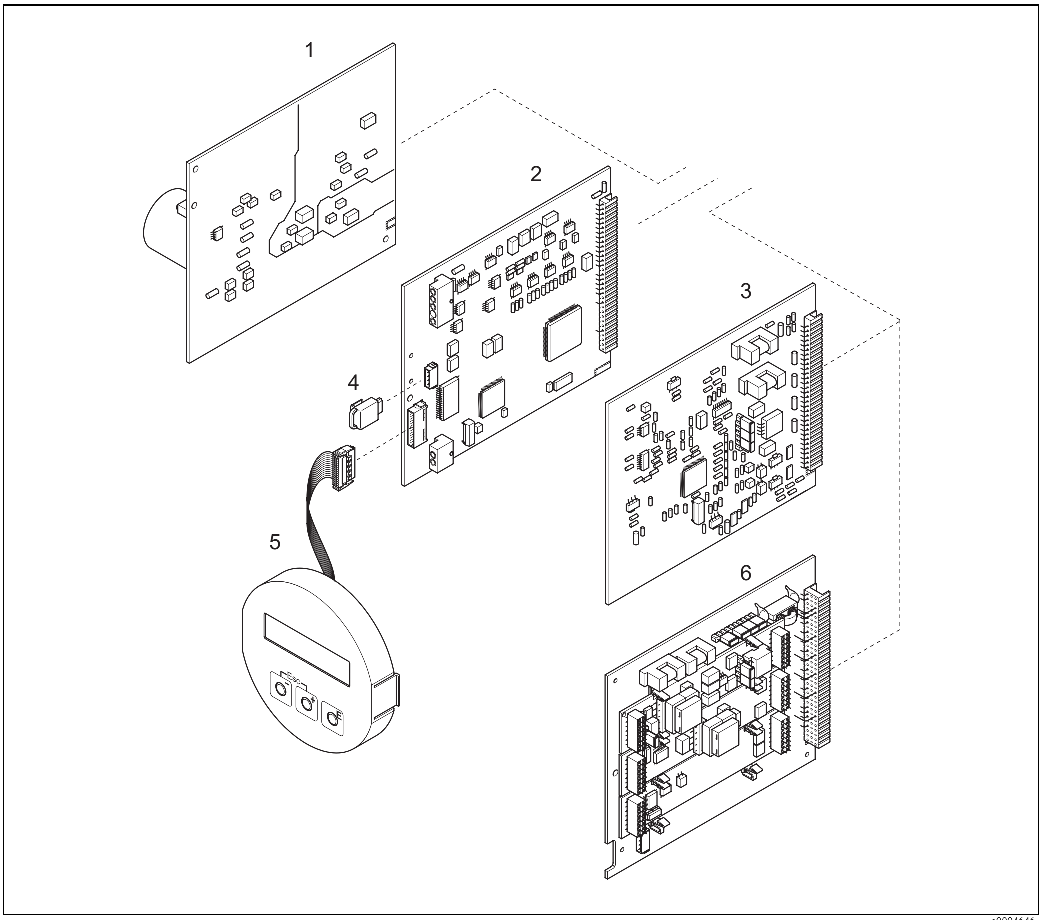

Fig. 31: Spare parts for transmitter Promass 80 (field and wall-mount housing)

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)
4 HistoROM / S-DAT (sensor data storage device)
5 Display module
*6 I/O board (COM module); version 80***–***********8 only*

9.6.1 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 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.

Caution!
Use only original Endress+Hauser parts.

Fig. 32, installation and removal:

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, 7):
   Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
5. Remove amplifier board (5):
   – Disconnect the plug of the sensor signal cable (5.1) including S-DAT (5.3) from the board.
   – Gently disconnect the plug of the excitation current cable (5.2) 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.
6. Installation is the reverse of the removal procedure.

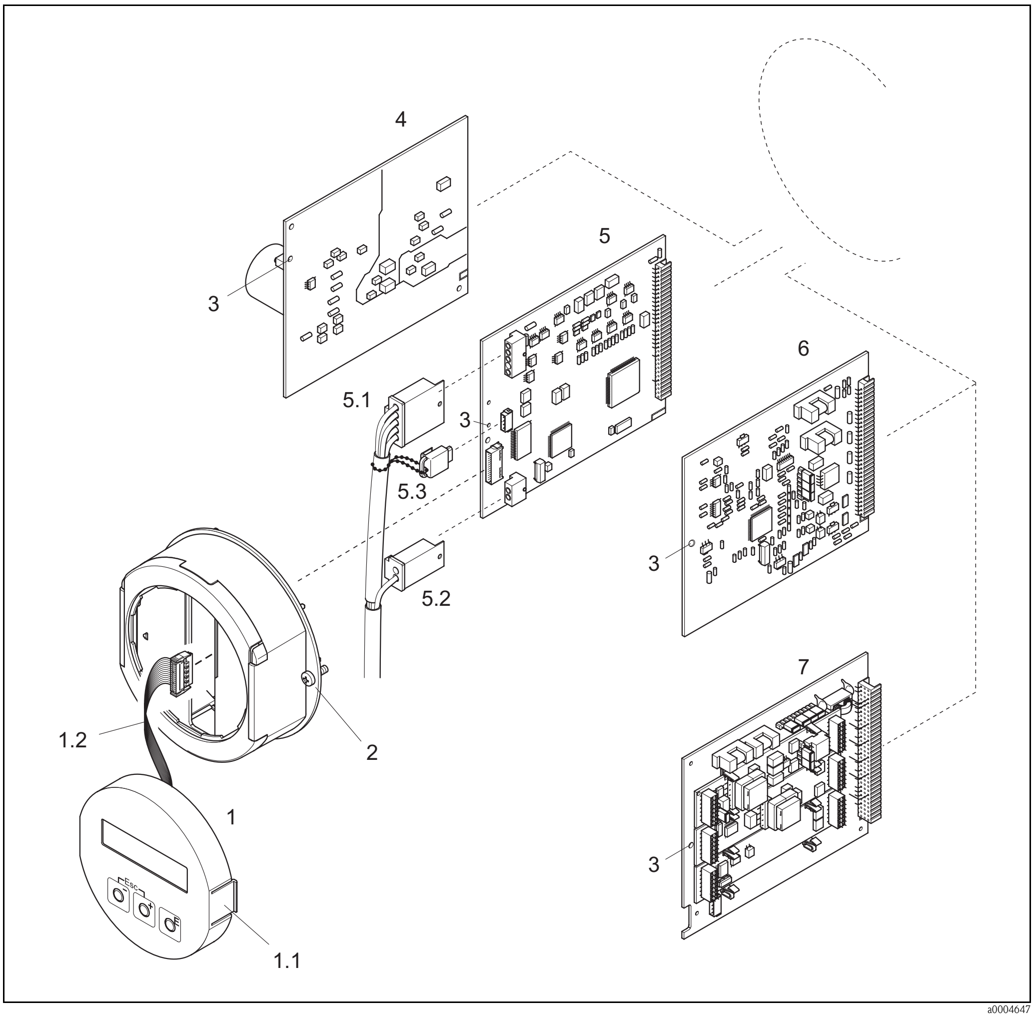

Fig. 32: Field housing: removing and installing printed circuit boards

1 Local display
1.1 Latch
1.2 Ribbon cable (display module)
2 Screws of electronics compartment cover
3 Aperture for installing/removing boards
4 Power unit board
5 Amplifier board
5.1 Signal cable (sensor)
5.2 Excitation current cable (sensor)
5.3 S-DAT (sensor data memory)
6 I/O board (flexible assignment)
7 I/O board (permanent assignment)

Wall-mount 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.

Caution!
Use only original Endress+Hauser parts.

Fig. 33, installation and removal:

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):
   – Sensor signal cable plug (7.1) including S-DAT (7.3)
   – Unplug excitation current cable (7.2). Gently disconnect the plug, i.e. without moving it back and forward.
   – Ribbon cable (3) of the display module
4. Remove the screws and remove the cover (4) from the electronics compartment.
5. Remove the boards (6, 7, 8, 9):
   Insert a thin pin into the hole (5) provided for the purpose and pull the board clear of its holder.
6. Installation is the reverse of the removal procedure.

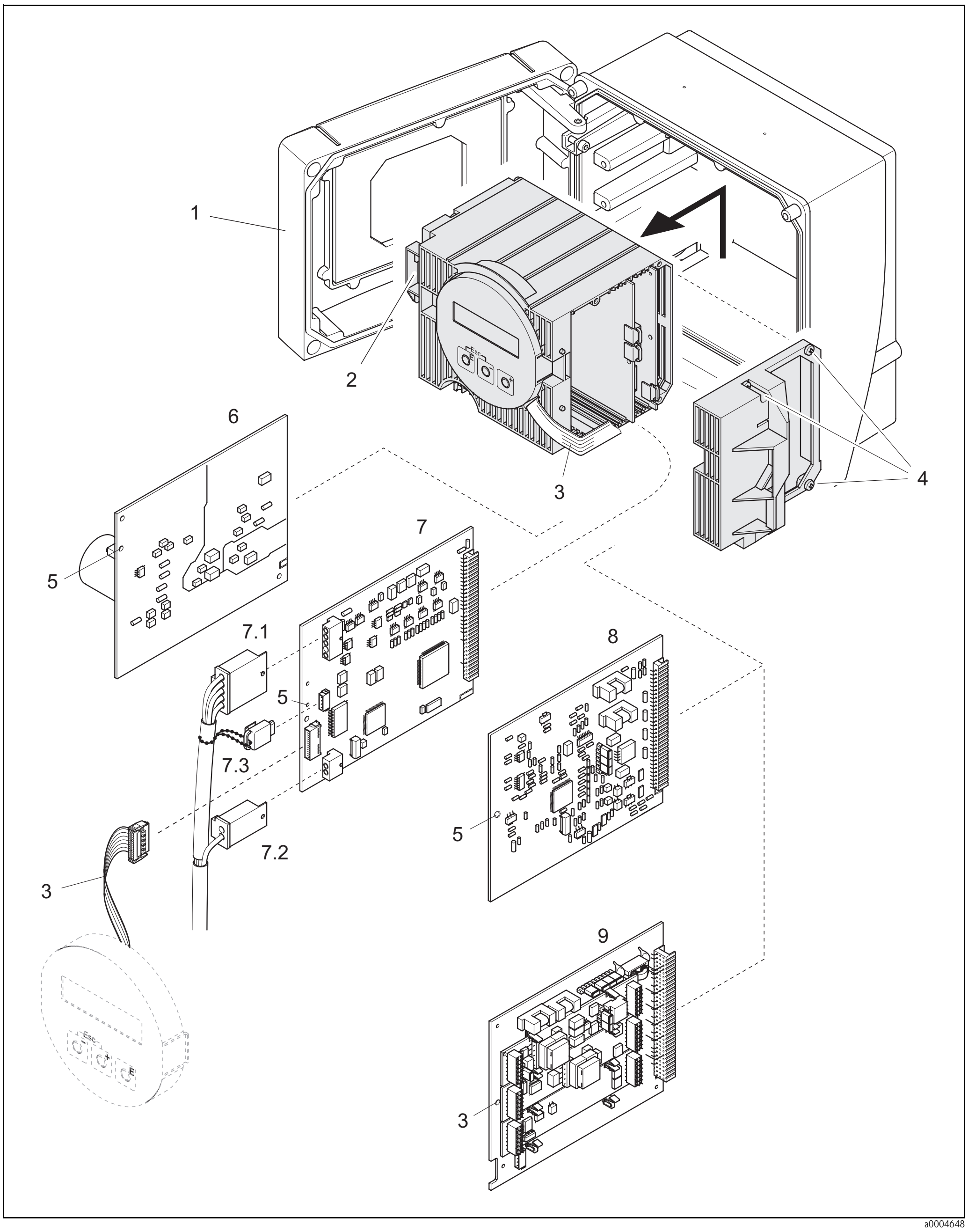

Fig. 33: Field housing: removing and installing printed circuit boards

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 Signal cable (sensor)
7.2 Excitation current cable (sensor)
7.3 S-DAT (sensor data memory)
8 I/O board (flexible assignment)
9 I/O board (permanent assignment)

9.6.2 Replacing the device fuse

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

The main fuse is on the power unit board. → Fig. 32
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power unit board. → Page 66
3. Remove the protective 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.

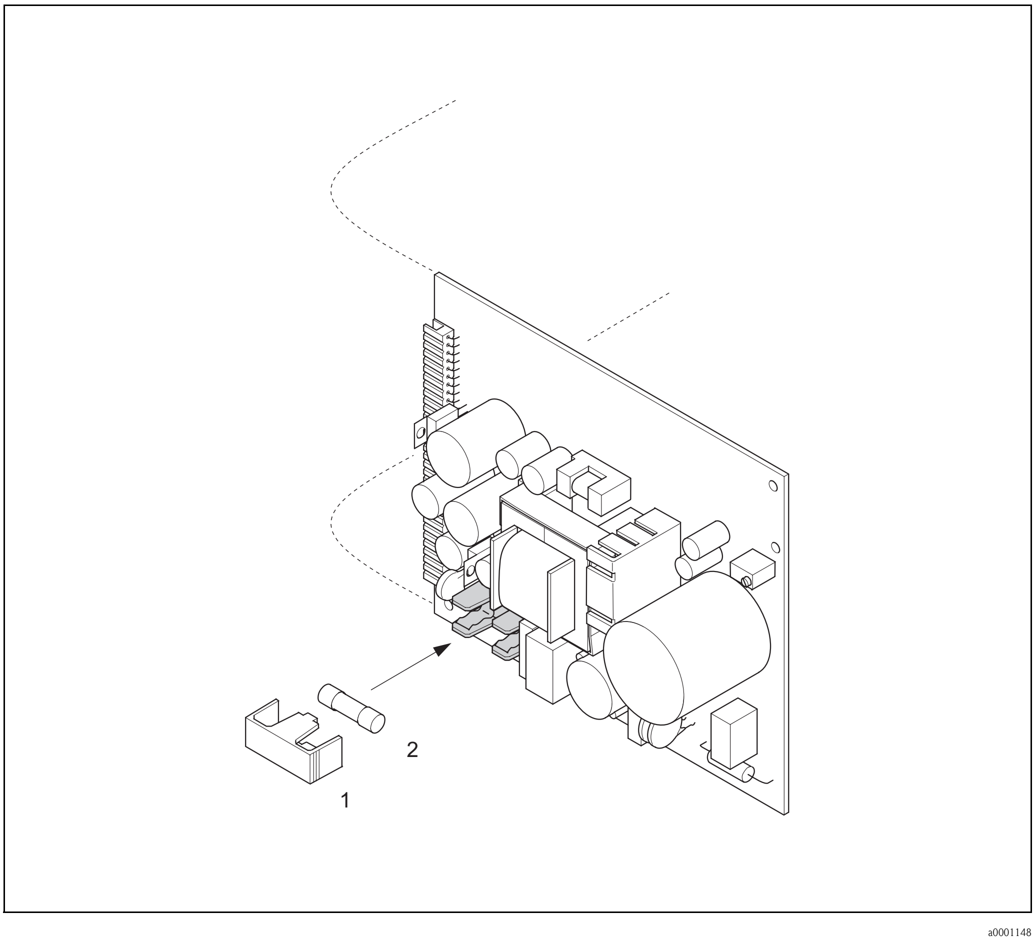

Fig. 34: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse

9.7 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:
- 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, such as a safety data sheet as per EN 91/155/EEC.
- 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, i.e. if it is flammable, toxic, caustic, carcinogenic etc.
  With Promass A and Promass M, the threaded process connections must be removed from the sensor first and then cleaned.

Note!
You will find a preprinted “Declaration of contamination” form at the back of this manual.

Warning!
- 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.

9.8 Disposal

Observe the regulations applicable in your country!

9.9 Software history

Note!
Up or downloading a software version normally requires a special service software.

Date	Software version	Changes to software	Operating Instructions
11.2005	2.01.XX	Software expansion: – Promass I DN80, DN50FB – General instrument functions	71008475/12.05
11.2004	2.00.XX	Software expansion: – New sensor DN 250 – Chinese language package (English and Chinese contents) New functions: – Empty pipe detection via exciting current (EPD EXC.CURR.MAX (6426)) – DEVICE SOFTWARE (8100) → Display of the device software (NAMUR recommendation 53)	50098468/11.04

Date	Software version	Changes to software	Operating Instructions
10.2003	Amplifier: 1.06.xx Communication module: 1.03.xx	Software expansion: – Language groups – Corrected volume flow measurement – Adjustments to Fieldcheck and Simubox – Reset error history – SIL 2 New functions: – Operation hours counter – Intensity of background illumination adjustable – Simulation pulse output – Counter for access code – Up-/Download with ToF-Tool-Field-Tool Package – 2nd totalizer Compatible with: – ToF-Tool FieldTool Package (the latest SW version can be downloaded under: www.tof-fieldtool.endress.com) – HART Communicator DXR 375 with Device Rev. 5, DD Rev. 1	50098468/10.03
03.2003	Amplifier: 1.05.xx Communication module: 1.02.01	Software adaptation: – 2nd current output	50098468/03.03
09.2002	Amplifier: 1.04.00	Software adaptation: – Promass E New functions: – Function CURRENT SPAN – Function FAILSAFE MODE	50098468/09.02
04.2002	Amplifier: 1.02.02	Software expansion: – Promass H – Ex i current output, frequency output	50098468/04.02
11.2001	Amplifier: 1.02.01	Software adjustment	50098468/11.01
06.2001	Amplifier: 1.02.00 Communication module: 1.02.00	Software expansion: – General instrument functions – "Pulse width" software function New functions: – HART operating via Universal Commands and Common Practice Commands	
05.2001 03.2001	Amplifier: 1.01.01 Amplifier: 1.01.00	Software adjustment	
11.2000	Amplifier: 1.00.xx Communication module: 1.01.xx	Original software Compatible with: – Fieldtool – HART Communicator DXR 275 (OS 4.6 or higher) with Rev. 1, DD 1.	50098468/11.00

10 Technical data

10.1 Technical data at a glance

10.1.1 Applications

The measuring device described in these Operating Instructions is to be used only for measuring the mass flow rate of liquids and gases. At the same time, the system also measures fluid density and fluid temperature. These parameters are then used to calculate other variables such as volume flow. Fluids with widely differing properties can be measured.

Examples:
- Chocolate, condensed milk, liquid sugar
- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases etc.

The operational safety of the measuring devices cannot be guaranteed if the system is used incorrectly or used for purposes other than those intended. The manufacturer accepts no liability for damages being produced from this.

10.1.2 Function and system design

Measuring principle

Mass flow measurement by the Coriolis principle

Measuring system

The “Promass 80/83” flow measuring system consists of the following components:
- Promass 80 or 83 transmitter
- Promass F, Promass M, Promass E, Promass A, Promass H or Promass I sensor

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

10.1.3 Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range

Measuring ranges for liquids (Promass F, M):

DN	Range for full scale values (liquids) $m_{min(F)}$ to $m_{max(F)}$
8	0 to 2000 kg/h
15	0 to 6500 kg/h
25	0 to 18000 kg/h
40	0 to 45000 kg/h
50	0 to 70000 kg/h
80	0 to 180000 kg/h
100 (only Promass F)	0 to 350000 kg/h
150 (only Promass F)	0 to 800000 kg/h
250 (only Promass F)	0 to 2200000kg/h

Measuring ranges for liquids (Promass H, I):

DN	Range for full scale values (liquids) $m_{min(F)}$ to $m_{max(F)}$
8	0 to 2000 kg/h
15	0 to 6500 kg/h
15[1)]	0 to 18000 kg/h
25	0 to 18000 kg/h
25[1)]	0 to 45000 kg/h
40	0 to 45000 kg/h
40[1)]	0 to 70000 kg/h
50	0 to 70000 kg/h
50[1)]	0 to 180000 kg/h
80 (Promass I only)	0 to 180000 kg/h
[1)] DN 15, 25, 40, 50 “FB” = Full bore versions of Promass I	

Measuring ranges for liquids (Promass A):

DN	Range for full scale values (liquids) $m_{min(F)}$ to $m_{max(F)}$
1	0 to 20 kg/h
2	0 to 100 kg/h
4	0 to 450 kg/h

Measuring ranges for liquids (Promass E):

DN	Range for full scale values (liquids) $m_{min(F)}$ to $m_{max(F)}$
8	0 to 2000 kg/h
15	0 to 6500 kg/h
25	0 to 18000 kg/h
40	0 to 45000 kg/h
50	0 to 70000 kg/h

Measuring ranges for gases (except Promass H)

The full scale values depend on the density of the gas. Use the formula below to calculate the full scale values:

$m_{max(G)} = m_{max(F)} \cdot \rho_{(G)} : x$ [kg/m³]

$m_{max(G)}$ = Max. full scale value for gas [kg/h]
$m_{max(F)}$ = Max. full scale value for liquid [kg/h]
$\rho_{(G)}$ = Gas density in [kg/m³] at operating conditions
x = 160 (Promass F DN 8 to 100, M, I); x = 250 (Promass F DN 150 to 250); x = 225 (Promass E); x = 32 (Promass A)

Here, $m_{max(G)}$ can never be greater than $m_{max(F)}$

Calculation example for gas:

- Sensor type: Promass F, DN 50
- Gas: air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range: 70000 kg/h
- x = 160 (for Promass F DN 50)

Max. possible full scale value:
$m_{max(G)} = m_{max(F)} \cdot \rho_{(G)} : x\ [kg/m^3] = 70000\ kg/h \cdot 60.3\ kg/m^3 : 160\ kg/m^3 = 26400\ kg/h$

Recommended full scale values

See → Page 84 (“Limiting flow”)

Operable flow range	Greater than 1000 : 1. Flows above the preset full scale value do not overload the amplifier, i.e. totalizer values are registered correctly.
Input signal	*Status input (auxiliary input):* $U = 3$ to 30 V DC, $R_i = 5\ k\Omega$, galvanically isolated. Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start, batching start/stop (optional)

10.1.4 Output

Output signal	*Current output:* Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% of full scale value/C, resolution: 0.5 µ A ▪ Active: 0/4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$) ▪ Passive: 4 to 20 mA; supply voltage U_S 18 to 30 V DC; $R_i \geq 150\ \Omega$ *Pulse / frequency output:* Passive, open collector, 30 V DC, 250 mA, galvanically isolated. ▪ Frequency output: full scale frequency 2 to 1000 Hz ($f_{max} = 1250$ Hz), on/off ratio 1:1, pulse width max. 2 sec. ▪ Pulse output: pulse value and pulse polarity selectable, pulse width adjustable (0.5 to 2000 ms)
Signal on alarm	*Current output:* Failsafe mode selectable (for example, according to NAMUR recommendation NE 43) *Pulse / frequency output:* Failsafe mode selectable *Status output:* “Nonconductive” in the event of fault or power supply failure
Load	See “Output signal”
Switching output	*Status output:* Open collector, max. 30 V DC / 250 mA, galvanically isolated. Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.
Low flow cutoff	Switch points for low flow cut off 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	→ Page 24
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 entry	*Power supply and signal cables (inputs/outputs):* ▪ Cable entry M20 x 1.5 (8 to 12 mm) ▪ 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) ▪ Threads for cable entries, 1/2" NPT, G 1/2"
Cable specifications (remote version)	→ Page 25
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 saves measuring system data if power supply fails. ▪ S-DATis an exchangeable data storage chip with sensor specific data: (nominal diameter, serial number, calibration factor, zero point etc.).
Potential equalization	No measures necessary.

10.1.6 Performance characteristics

Reference operating conditions	*Error limits following ISO/DIS 11631:* ▪ 20 to 30 °C; 2 to 4 bar ▪ Calibration systems as per national norms ▪ Zero point calibrated under operating conditions ▪ Field density calibrated (or special density calibration)

Maximum measured error

The following values refer to the pulse/frequency output. Measured error at the current output is typically ±5 μA.

o.r. = of reading

Mass flow (liquid)

Promass F, M, A:

±0.15% ± [(zero point stability : measured value) · 100]% o.r.

Promass E:

±0.35% ± [(zero point stability : measured value) · 100]% o.r.

Promass H, I:

±0.175% ± [(zero point stability : measured value) · 100]% o.r.

Mass flow (gas)

Promass F:

±0.35% ± [(zero point stability : measured value) · 100]% o.r.

Promass M, A, I:

±0.50% ± [(zero point stability : measured value) · 100]% o.r.

Promass E:

±0.75% ± [(zero point stability : measured value) · 100]% o.r.

Volume flow (liquid)

Promass F:

±0.20% ± [(zero point stability : measured value) · 100]% o.r.

Promass M, A:

±0.25% ± [(zero point stability : measured value) · 100]% o.r.

Promass E:

±0.45% ± [(zero point stability : measured value) · 100]% o.r.

Promass H, I:

±0.50% ± [(zero point stability : measured value) · 100]% o.r.

Zero point stability (Promass A):

DN	Max. full scale value [kg/h] or [l/h]	Zero point stability [kg/h] or [l/h]
1	20	0.0010
2	100	0.0050
4	450	0.0225

Zero point stability (Promass F, M):

DN	Max. full scale value [kg/h] or [l/h]	Zero point stability		
		Promass F [kg/h] or [l/h]	Promass F (high-temperature) [kg/h] or [l/h]	Promass M [kg/h] or [l/h]
8	2000	0.030	–	0.100
15	6500	0.200	–	0.325
25	18000	0.540	1.80	0.90
40	45000	2.25	–	2.25
50	70000	3.50	7.00	3.50
80	180000	9.00	18.00	9.00
100	350000	14.00	–	–
150	800000	32.00	–	–
250	2200000	88.00	–	–

Zero point stability (Promass H, I):

DN	Max. full scale value in [kg/h] or [l/h]	Zero point stability	
		Promass H in [kg/h] or [l/h]	Promass I in [kg/h] or [l/h]
8	2000	0.20	0.20
15	6500	0.65	0.65
15[1)]	18000	–	1.8
25	18000	1.8	1.8
25[1)]	45000	–	4.5
40	45000	4.5	4.5
40[1)]	70000	–	7.0
50	70000	7.0	7.0
50[1)]	180000	–	18.0
80	180000	–	18.0

[1)] DN 15, 25, 40, 50 “FB” = Full bore versions of Promass I

Zero point stability (Promass E):

DN	Max. full scale value [kg/h] or [l/h]	Zero point stability [kg/h] or [l/h]
8	2000	0.200
15	6500	0.650
25	18000	1.80
40	45000	4.50
50	70000	7.00

Sample calculation

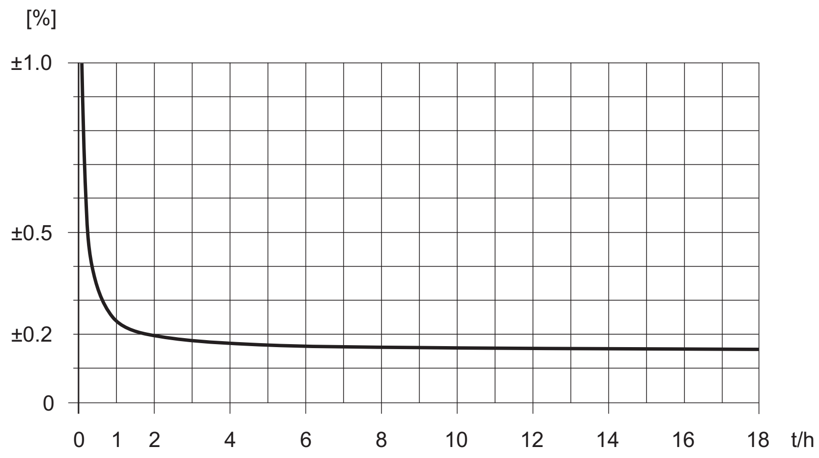

Fig. 35: Maximum measured error in % of reading (example: Promass 80 F, M / DN 25)

Calculation example (mass flow, liquid):
Given: Promass 80 F / DN 25, flow = 8000 kg/h
Max. measured error: ±0.15% ± [(zero point stability : measured value) · 100]% o.r.
Maximum measured error → ±0.15% ±0.54 kg/h : 8000 kg/h · 100% = ±0.157%

Density (liquid)

1 g/cc = 1 kg/l

After field density calibration or under reference conditions:

Promass F:

±0.0005 g/cc

Promass M, E, A, H:

±0.0010 g/cc

Promass I:

±0.0020 g/cc

Special density calibration (optional), not for high-temperature version (calibration range = 0.8 to 1.8 g/cc, 5 to 80 °C):

Promass F:

±0.001 g/cc

Promass M, A, H:

±0.002 g/cc

Promass I:

±0.004 g/cc

Standard calibration:

Promass F:
±0.01 g/cc

Promass M, E, A, H, I:
±0.02 g/cc

Temperature
±0.5 °C ±0.005 · T (T = fluid temperature in °C)

Repeatability

Mass flow (liquid):

Promass F, M, A, H, I:
±0.05% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Promass E:
±0.20% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Mass flow (gas):

Promass F, M, A, I:
±0.25% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Promass E:
±0.35% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Volume flow (liquid):

Promass F:
±0.05% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Promass M, A:
±0.10% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Promass E:
±0.25% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

Promass H, I:
±0.20% ± [1/2 · (zero point stability : measured value) · 100]% o.r.

o.r. = of reading
Zero point stability: see "Max. measured error"→ Page 77

Calculation example (mass flow, liquid):
Given: Promass 80 F / DN 25, flow = 8000 kg/h
Repeatability: ±0.05% ± [1/2 · (zero point stability : measured value) · 100]% o.r.
Repeatability → ±0.05% ±1/2 · 0.54 kg/h : 8000 kg/h · 100% = ±0.053%

Density measurement (liquid)

1 g/cc = 1 kg/l

Promass F:

±0.00025 g/cc

Promass M, H, E, A:

±0.0005 g/cc

Promass I:

±0.001 g/cc

Temperature measurement

±0.25 °C ±0.0025 · T (T = fluid temperature in °C)

Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is ±0.0002% of the full scale value / °C. The typical measured error of the Promass E sensor is ±0.0003% of the full scale value / °C.

Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

Promass F, M:

DN	Promass F Promass F, high-temperature [% o.r./bar]	Promass M [% o.r./bar]	Promass M / (high pressure) [% o.r./bar]
8	No influence	0.009	0.006
15	No influence	0.008	0.005
25	No influence	0.009	0.003
40	–0.003	0.005	–
50	–0.008	No influence	–
80	–0.009	No influence	–
100	–0.012	–	–
150	–0.009	–	–
250	–0.009	–	–
o.r. = of reading			

Promass E:

With nominal diameters DN 8 to 40, the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure can be neglected.
For DN 50 the effect is –0.009% o.r. / bar (o.r. = of reading).

Promass A:

A difference between calibration pressure and process pressure has no effect on measuring accuracy.

Promass H, I:

DN	Promass H [% o.r./bar]	Promass I [% o.r./bar]
8	–0.017	0.006
15	–0.021	0.004
15 *	–	0.006
25	–0.013	0.006
25 *	–	No influence
40	–0.018	No influence
40 *	–	0.006
50	–0.020	0.006
50 *	–	0.003
80	–	0.003
* DN 15, 25, 40, 50 "FB" = Full bore versions of Promass I o.r. = of reading		

10.1.7 Operating conditions: Installation

Installation instructions	→ Page 14
Inlet and outlet runs	There are no installation requirements regarding inlet and outlet runs.
Length of connecting cable	Max. 20 meters (remote version)
System pressure	→ Page 15

10.1.8 Operating conditions: Environment

Ambient temperature	Standard: –20 to +60 °C (sensor, transmitter) Optional: –40 to +60 °C (sensor, transmitter) Note! ▪ Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions. ▪ At ambient temperatures below –20 °C the readability of the display may be impaired.
Storage temperature	–40 to +80 °C (preferably at +20 °C)
Degree of protection	Standard: IP 67 (NEMA 4X) for transmitter and sensor
Shock resistance	According to IEC 68-2-31
Vibration resistance	Acceleration up to 1 g, 10 to 150 Hz, following IEC 68-2-6
CIP cleaning	yes
SIP cleaning	yes
Electromagnetic compatibility (EMC)	As per EN 61326/A1 (IEC 1326) and NAMUR recommendation NE 21

10.1.9 Operating conditions: Process

Medium temperature range

Sensor:

Promass F, A, H:

–50 to +200 °C

Promass F (high-temperature version):

–50 to +350 °C

Promass M, I:

–50 to +150 °C

Promass E:

–40 to +125 °C

Seals:

Promass F, E, H, I:

No internal seals

Promass M:

Viton –15 to +200 °C; EPDM –40 to +160 °C; silicon –60 to +200 °C; Kalrez –20 to +275 °C; FEP sheathed (not for gas applications): –60 to +200 °C

Promass A

(only for mounting sets with threaded connections)
Viton –15 to 200 °C; EPDM –40 to +160 °C; silicon –60 to +200 °C; Kalrez –20 to +275 °C

Limiting medium pressure range (rated pressure)

The material load curves (pressure–temperature diagrams) for the process connections are included in the separate "Technical information" documentation for the respective measuring device, which you can download in PDF format at www.endress.com.
A list of the available "Technical information" documents can be found in the "Supplementary documentation" section → Page 96

Pressure ranges of secondary containment:

Promass F:

DN 8 to 50: 40 bar or 600 psi; DN 80: 25 bar or 375 psi;
DN 100 to 150: 16 bar or 250 psi; DN 250: 10 bar or 150 psi

Promass M:

100 bar or 1500 psi

Promass E:

No secondary containment

Promass A:

25 bar or 375 psi

Promass H:

DN 8 to 15: 25 bar or 375 psi; DN 25 to 50: 16 bar or 250 psi

Promass I:

40 bar or 600 psi

Limiting flow

See "Measuring range" section. → Page 73

Select nominal diameter by optimizing between required flow range and permissible pressure loss. See the "Measuring range" section for a list of max. possible full scale values.

- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as liquids with entrained solids (flow velocity < 1 m/s).
- For gas measurement the following rules apply:
  - Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula → Page 74

Pressure loss

Pressure loss depends on the fluid properties and on its flow rate. The following formulas can be used to approximately calculate the pressure loss:

Pressure loss formulas for Promass F, M and E

Reynolds number	$Re = \frac{2 \cdot m}{\pi \cdot d \cdot \nu \cdot \rho}$ a0004623
Re ≥ 2300[1)]	$\Delta p = K \cdot \nu^{0.25} \cdot m^{1.85} \cdot \rho^{-0.86}$ a0004626
Re < 2300	$\Delta p = K1 \cdot \nu \cdot m + \frac{K2 \cdot \upsilon^{0.25} \cdot m^2}{\rho}$ a0004628
Δp = pressure loss [mbar] ν = kinematic viscosity [m^2/s] m = mass flow [kg/s]	ρ = fluid density [kg/m3] d = inside diameter of measuring tubes [m] K to K2 = constants (depending on nominal diameter)

[1)] To compute the pressure loss for gases, always use the formula for Re ≥ 2300.

Pressure loss formulas for Promass H and I

Reynolds number	$Re = \frac{4 \cdot m}{\pi \cdot d \cdot \nu \cdot \rho}$ a0003381
Re ≥ 2300[1)]	$\Delta p = K \cdot \nu^{0.25} \cdot m^{1.75} \cdot \rho^{-0.75} \cdot \frac{K3 \cdot m^2}{\rho}$ a0004631
Re < 2300	$\Delta p = K1 \cdot \nu \cdot m + \frac{K3 \cdot m^2}{\rho}$ a0004633
Δp = pressure loss [mbar] ν = kinematic viscosity [m2/s] m = mass flow [kg/s]	ρ = fluid density [kg/m3] d = inside diameter of measuring tubes [m] K to K3 = constants (depending on nominal diameter)

[1)] To compute the pressure loss for gases, always use the formula for Re ≥ 2300.

Pressure loss coefficient for Promass A

Reynolds number	$Re = \frac{4 \cdot m}{\pi \cdot d \cdot \nu \cdot \rho}$ a0003381
Re ≥ 2300[1)]	$\Delta p = K \cdot \nu^{0.25} \cdot m^{1.75} \cdot \rho^{-0.75}$ a0003380
Re < 2300	$\Delta p = K1 \cdot \nu \cdot m$ a0003379

Δp = pressure loss [mbar]
ν = kinematic viscosity [m2/s]
m = mass flow [kg/s]
ρ = fluid density [³kg/m3]
d = inside diameter of measuring tubes [m]
K to K3 = constants (depending on nominal diameter)

[1)] To compute the pressure loss for gases, always use the formula for Re ≥ 2300.

Pressure loss coefficient for Promass F

DN	d [m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$9.60 \cdot 10^{7}$	$1.90 \cdot 10^{7}$
15	$8.30 \cdot 10^{-3}$	$5.80 \cdot 10^{6}$	$1.90 \cdot 10^{7}$	$10.60 \cdot 10^{5}$
25	$12.00 \cdot 10^{-3}$	$1.90 \cdot 10^{6}$	$6.40 \cdot 10^{6}$	$4.50 \cdot 10^{5}$
40	$17.60 \cdot 10^{-3}$	$3.50 \cdot 10^{5}$	$1.30 \cdot 10^{6}$	$1.30 \cdot 10^{5}$
50	$26.00 \cdot 10^{-3}$	$7.00 \cdot 10^{4}$	$5.00 \cdot 10^{5}$	$1.40 \cdot 10^{4}$
80	$40.50 \cdot 10^{-3}$	$1.10 \cdot 10^{4}$	$7.71 \cdot 10^{4}$	$1.42 \cdot 10^{4}$
100	$51.20 \cdot 10^{-3}$	$3.54 \cdot 10^{3}$	$3.54 \cdot 10^{4}$	$5.40 \cdot 10^{3}$
150	$68.90 \cdot 10^{-3}$	$1.36 \cdot 10^{3}$	$2.04 \cdot 10^{4}$	$6.46 \cdot 10^{2}$
250	$102.26 \cdot 10^{-3}$	$3.00 \cdot 10^{2}$	$6.10 \cdot 10^{3}$	$1.33 \cdot 10^{2}$

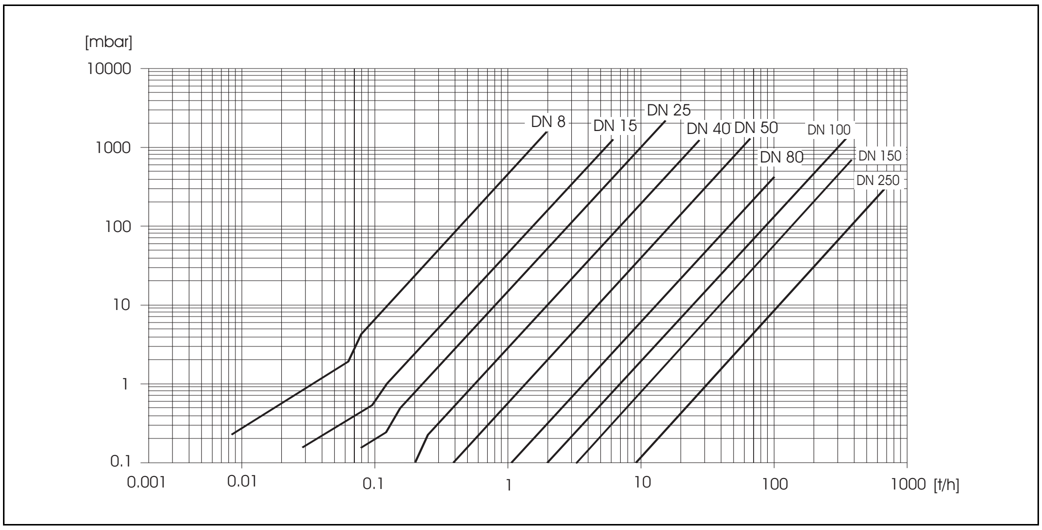

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Fig. 36: Pressure loss diagram for water

Pressure loss coefficient for Promass M

DN	d [m]	K	K1	K2
8	$5.53 \cdot 10^{-3}$	$5.2 \cdot 10^7$	$8.6 \cdot 10^7$	$1.7 \cdot 10^7$
15	$8.55 \cdot 10^{-3}$	$5.3 \cdot 10^6$	$1.7 \cdot 10^7$	$9.7 \cdot 10^5$
25	$11.38 \cdot 10^{-3}$	$1.7 \cdot 10^6$	$5.8 \cdot 10^6$	$4.1 \cdot 10^5$
40	$17.07 \cdot 10^{-3}$	$3.2 \cdot 10^5$	$1.2 \cdot 10^6$	$1.2 \cdot 10^5$
50	$25.60 \cdot 10^{-3}$	$6.4 \cdot 10^4$	$4.5 \cdot 10^5$	$1.3 \cdot 10^4$
80	$38.46 \cdot 10^{-3}$	$1.4 \cdot 10^4$	$8.2 \cdot 10^4$	$3.7 \cdot 10^4$
High pressure version				
8	$4.93 \cdot 10^{-3}$	$6.0 \cdot 10^7$	$1.4 \cdot 10^8$	$2.8 \cdot 10^7$
15	$7.75 \cdot 10^{-3}$	$8.0 \cdot 10^6$	$2.5 \cdot 10^7$	$1.4 \cdot 10^6$
25	$10.20 \cdot 10^{-3}$	$2.7 \cdot 10^6$	$8.9 \cdot 10^6$	$6.3 \cdot 10^5$

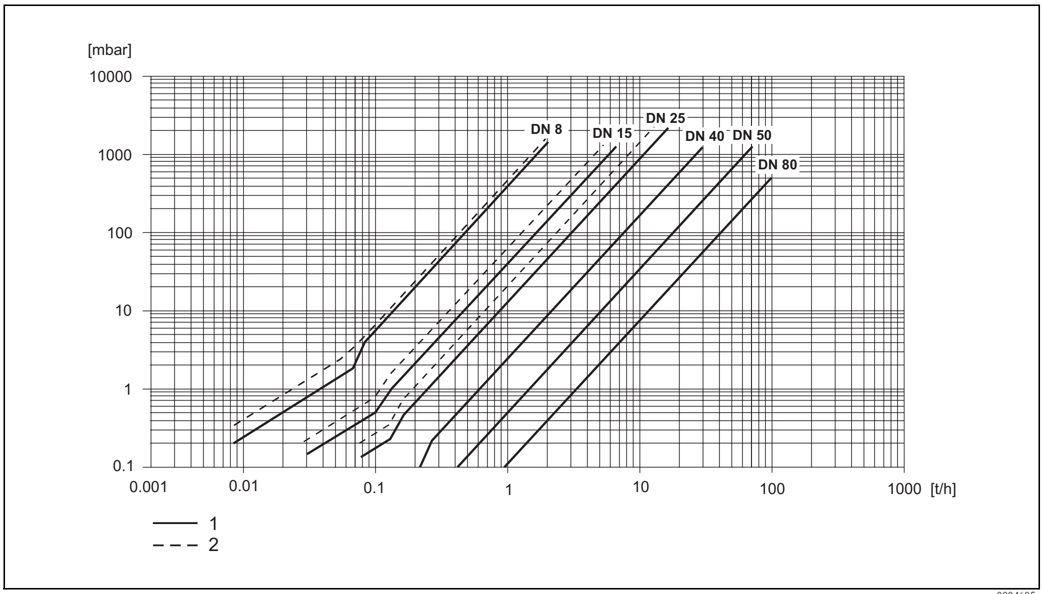

Fig. 37: Pressure loss diagram for water

1 Promass M
2 Promass M (high pressure version)

Pressure loss coefficient for Promass E

DN	d [m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$7.91 \cdot 10^{7}$	$2.10 \cdot 10^{7}$
15	$8.30 \cdot 10^{-3}$	$7.62 \cdot 10^{6}$	$1.73 \cdot 10^{7}$	$2.13 \cdot 10^{6}$
25	$12.00 \cdot 10^{-3}$	$1.89 \cdot 10^{6}$	$4.66 \cdot 10^{6}$	$6.11 \cdot 10^{5}$
40	$17.60 \cdot 10^{-3}$	$4.42 \cdot 10^{5}$	$1.35 \cdot 10^{6}$	$1.38 \cdot 10^{5}$
50	$26.00 \cdot 10^{-3}$	$8.54 \cdot 10^{4}$	$4.02 \cdot 10^{5}$	$2.31 \cdot 10^{4}$

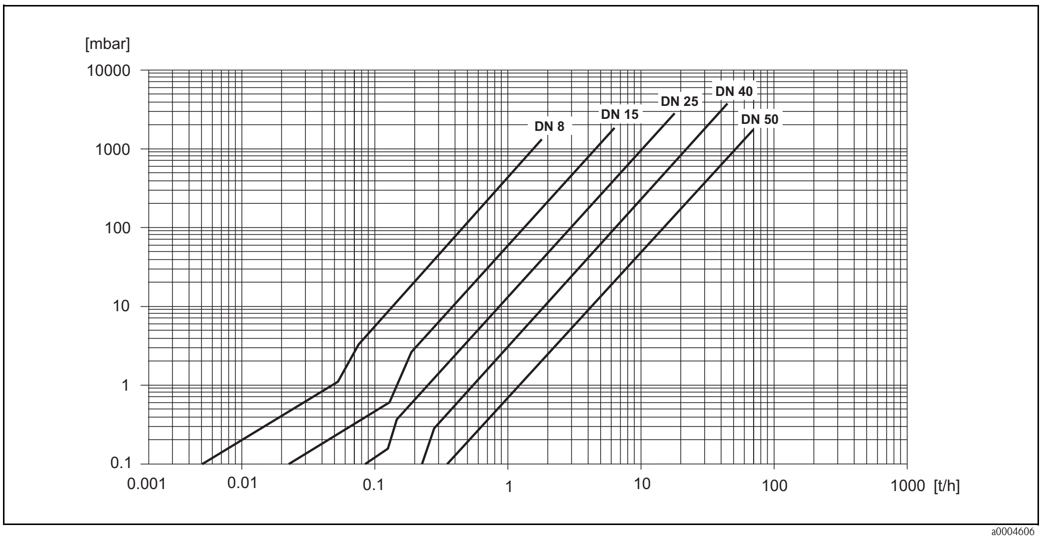

Fig. 38: Pressure loss diagram for water

Pressure loss coefficient for Promass A

DN	d [m]	K	K1
1	$1.1 \cdot 10^{-3}$	$1.2 \cdot 10^{11}$	$1.3 \cdot 10^{11}$
2	$1.8 \cdot 10^{-3}$	$1.6 \cdot 10^{10}$	$2.4 \cdot 10^{10}$
4	$3.5 \cdot 10^{-3}$	$9.4 \cdot 10^{8}$	$2.3 \cdot 10^{9}$
High pressure version			
2	$1.4 \cdot 10^{-3}$	$5.4 \cdot 10^{10}$	$6.6 \cdot 10^{10}$
4	$3.0 \cdot 10^{-3}$	$2.0 \cdot 10^{9}$	$4.3 \cdot 10^{9}$

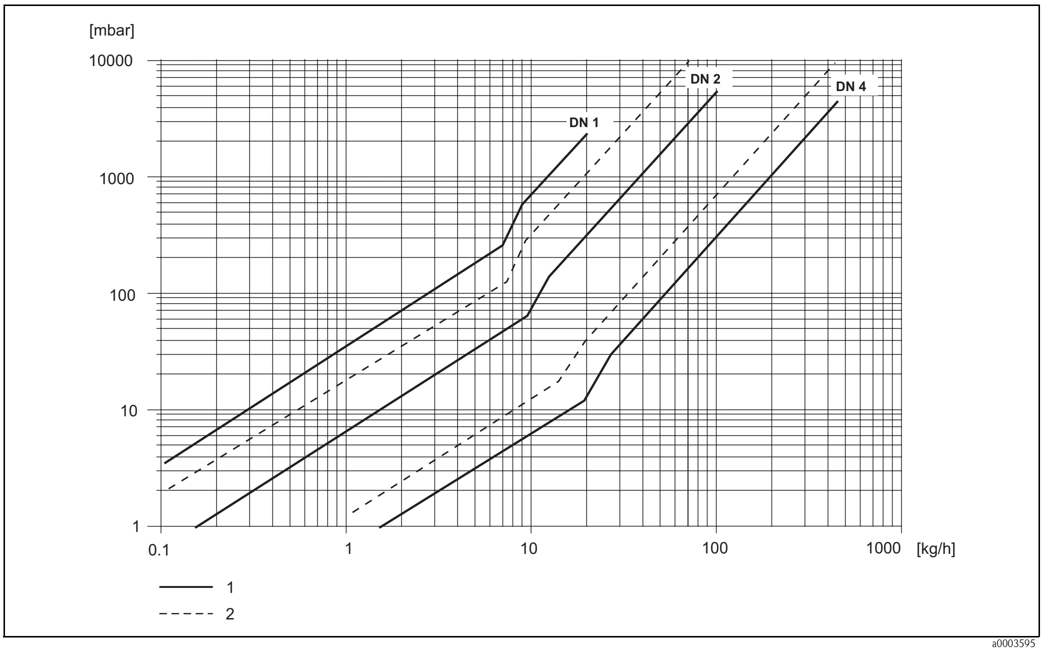

Fig. 39: Pressure loss diagram for water

1 Standard version
2 High pressure version

Pressure loss coefficient for Promass H

DN	d [m]	K	K1	K3
8	$8.51 \cdot 10^{-3}$	$8.04 \cdot 10^{6}$	$3.28 \cdot 10^{7}$	$1.15 \cdot 10^{6}$
15	$12.00 \cdot 10^{-3}$	$1.81 \cdot 10^{6}$	$9.99 \cdot 10^{6}$	$1.87 \cdot 10^{5}$
25	$17.60 \cdot 10^{-3}$	$3.67 \cdot 10^{5}$	$2.76 \cdot 10^{6}$	$4.99 \cdot 10^{4}$
40	$25.50 \cdot 10^{-3}$	$8.75 \cdot 10^{4}$	$8.67 \cdot 10^{5}$	$1.22 \cdot 10^{4}$
50	$40.5 \cdot 10^{-3}$	$1.35 \cdot 10^{4}$	$1.72 \cdot 10^{5}$	$1.20 \cdot 10^{3}$
Pressure loss data includes interface between measuring tube and piping				

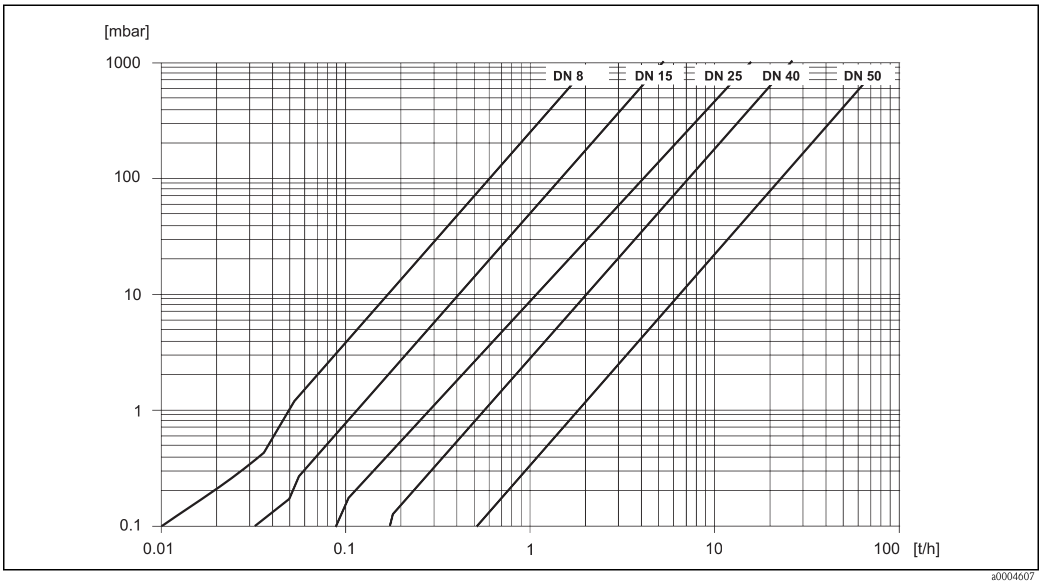

Fig. 40: Pressure loss diagram for water

Pressure loss coefficient for Promass I

DN	d [m]	K	K1	K3
8	$8.55 \cdot 10^{-3}$	$8.1 \cdot 10^{6}$	$3.9 \cdot 10^{7}$	$129.95 \cdot 10^{4}$
15	$11.38 \cdot 10^{-3}$	$2.3 \cdot 10^{6}$	$1.3 \cdot 10^{7}$	$23.33 \cdot 10^{4}$
15 1)	$17.07 \cdot 10^{-3}$	$4.1 \cdot 10^{5}$	$3.3 \cdot 10^{6}$	$0.01 \cdot 10^{4}$
25	$17.07 \cdot 10^{-3}$	$4.1 \cdot 10^{5}$	$3.3 \cdot 10^{6}$	$5.89 \cdot 10^{4}$
25 1)	$25.60 \cdot 10^{-3}$	$7.8 \cdot 10^{4}$	$8.5 \cdot 10^{5}$	$0.11 \cdot 10^{4}$
40	$25.60 \cdot 10^{-3}$	$7.8 \cdot 10^{4}$	$8.5 \cdot 10^{5}$	$1.19 \cdot 10^{4}$
40 1)	$35.62 \cdot 10^{-3}$	$1.3 \cdot 10^{4}$	$2.0 \cdot 10^{5}$	$0.08 \cdot 10^{4}$
50	$35.62 \cdot 10^{-3}$	$1.3 \cdot 10^{4}$	$2.0 \cdot 10^{5}$	$0.25 \cdot 10^{4}$
50 1)	$54.8 \cdot 10^{-3}$	$2.3 \cdot 10^{3}$	$5.5 \cdot 10^{4}$	$1.0 \cdot 10^{2}$
80	$54.8 \cdot 10^{-3}$	$2.3 \cdot 10^{3}$	$5.5 \cdot 10^{4}$	$3.5 \cdot 10^{2}$
Pressure loss data includes interface between measuring tube and piping 1) DN 15, 25, 40, 50 "FB" = Full bore versions of Promass I				

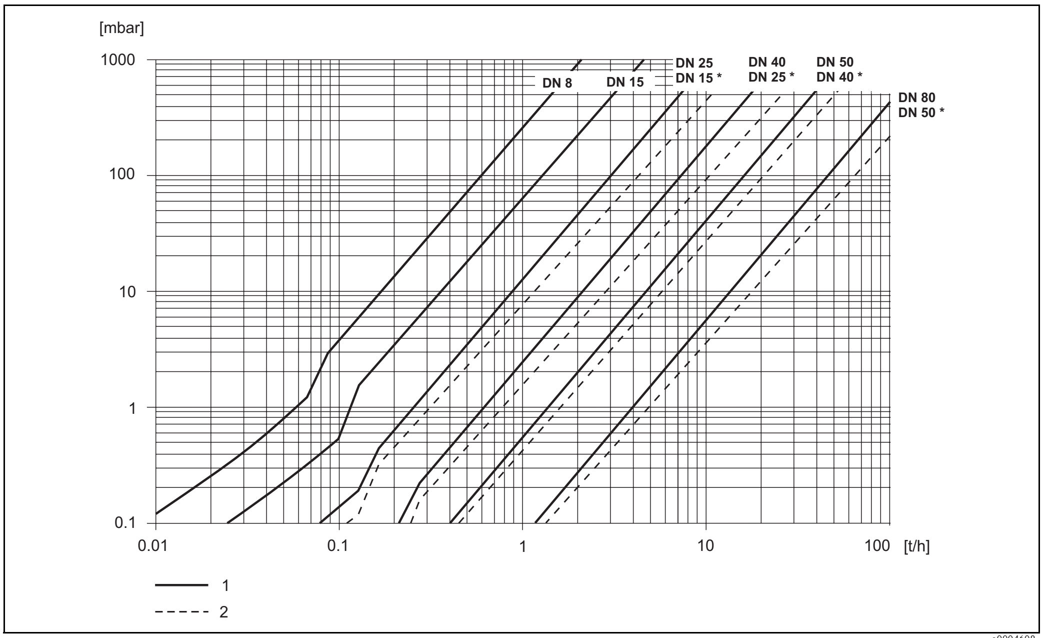

Fig. 41: Pressure loss diagram for water

1 *Standard versions*
2 *Full bore versions (*)*

10.1.10 Mechanical construction

Design / dimensions

The dimensions and lengths of the sensor and transmitter can be found in the separate documentation "Technical information" for the respective measuring device, which you can download in PDF format at www.endress.com. A list of the available "Technical information" documents can be found in the "Supplementary documentation" section → Page 96.

Weight

- Compact version: see table below
- Remote version
  - Sensor: see table below
  - Wall-mount housing: 5 kg

Promass F / DN	8	15	25	40	50	80	100	150	250 [1]
Compact version	11	12	14	19	30	55	96	154	400
Compact version, high-temperature	–	–	14.7	–	30.7	55.7	–	–	–
Remote version	9	10	12	17	28	53	94	152	398
Remote version, high-temperature	–	–	13.5	–	29.5	54.5	–	–	–

[1] With 10" ANSI Cl 300 flanges

Promass M / DN	8	15	25	40	50	80
Compact version	11	12	15	24	41	67
Remote version	9	10	13	22	39	65

Promass E / DN	8	15	25	40	50
Compact version	8	8	10	15	22
Remote version	6	6	8	13	20

Promass A / DN	1	2	4
Compact version	10	11	15
Remote version	8	9	13

Promass H / DN	8	15	25	40	50
Compact version	12	13	19	36	69
Remote version	10	11	17	34	67

Promass I / DN	8	15	15 [1]	25	25 [1]	40	40 [1]	50	50 [1]	80 [2]
Compact version	12	15	19	20	40	41	65	67	120	124
Remote version	10	13	17	18	38	39	63	65	118	122

[1] DN 15, 25, 40, 50 "FB" = Full bore versions of Promass I
[2] Promass I only

Weight data in [kg]. All values (weight) refer to devices with EN/DIN PN 40 flanges.

Material

Transmitter housing

- Compact housing: stainless steel 1.4301/304
- Compact housing: powder coated die-cast aluminum
- Wall-mount housing: powder coated die-cast aluminum
- Remote field housing: powder-coated die-cast aluminum

Sensor housing / containment:

Promass F:

Acid- and alkali-resistant outer surface
DN 8 to 50: stainless steel 1.4301/304
DN 80 to 250: stainless steel 1.4301/304 and 1.4308/304L

Promass M:

Acid- and alkali-resistant outer surface
DN 8 to 50: steel, chemically nickel-plated
DN 80: stainless steel

Promass E, A, H, I:

- Acid- and alkali-resistant outer surface
- Stainless steel 1.4301/304

Connection housing, sensor (remote version):

- Stainless steel 1.4301/304 (standard)
- powder coated die-cast aluminum (high-temperature version and version for heating)

Process connections

Promass F:

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602/N 06022
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri–Clamp (OD–tubes)→ stainless steel 1.4404/316L
- VCO connection → Stainless steel 1.4404/316L

Promass F (high-temperature version):

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602 (N 06022)

Promass E:

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- VCO connection → Stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri–Clamp (OD–tubes)→ stainless steel 1.4404/316L

Promass M:

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L, titanium grade 2
- Flange DIN 11864-2 Form A (flat range) → stainless steel 1.4404/316L
- PVDF connection to DIN / ANSI / JIS
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Coulpings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri–Clamp (OD–tubes)→ stainless steel 1.4404/316L

Promass M (high pressure version):

- Connector → stainless steel 1.4404/316L
- Couplings → stainless steel 1.4401/316

Promass A:

- Mounting set for flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022.
  Loose flanges → stainless steel 1.4404/316L
- VCO Coupling → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022
- Tri–Clamp (OD–tubes) (1/2") → stainless steel 1.4539/904L
- Mounting set for SWAGELOK (1/4", 1/8") → stainless steel 1.4401/316
- Mounting set for NPT-F (1/4") → stainless steel 1.4539/904L1.4539/904L,
  Alloy C-22 2.4602/N 06022

Promass H:

- Flanges EN 1092—1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4301/304, parts in contact with medium: zirconium 702

Promass I:

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4301/304
- Flange DIN 11864-2 Form A (flat range) → titanium grade 2
- Hygienic coupling DIN 11851 / SMS 1145 → titanium grade 2
- Couplings ISO 2853 / DIN 11864-1 → titanium grade 2
- Tri–Clamp (OD–tubes) → titanium grade 2

Measuring tube(s):

Promass F:

- DN 8 to 100: stainless steel 1.4539/904L
- DN 150: stainless steel 1.4404/316L
- DN 250: stainless steel 1.4404/316L; manifold: CF3M
- DN 8 to 150: Alloy C-22 2.4602/N 06022

Promass F (high-temperature version):

- DN 25, 50, 80: Alloy C-22 2.4602/N 06022

Promass M:

- DN 8 to 50: titanium grade 9
- DN 80: titanium grade 2

Promass M (high pressure version):

- Titanium grade 9

Promass E:

- Stainless steel 1.4539/904L

Promass A:

- Stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022

Promass H:

- Zirconium 702/R 60702

Promass I:

- Titanium grade 9
- Titanium grade 2 (flange disks)

Seals:

Promass F, E, H, I:

Welded process connections without internal seals

Promass M:

Viton, EPDM, silicon, Kalrez, FEP sheathing (not for gas applications)

Promass A:

Viton, EPDM, silicon, Kalrez

Material load diagram	The material load curves (pressure–temperature diagrams) for the process connections are included in the separate "Technical information" documentation for the respective measuring device, which you can download in PDF format at www.endress.com. A list of the available "Technical information" documents can be found in the "Supplementary documentation" section → Page 96
Process connections	→ Page 92 ff.

10.1.11 Human interface

Display elements	▪ Liquid crystal display: illuminated, two lines with 16 characters per line ▪ Selectable display of different measured values and status variables ▪ At ambient temperatures below –20 °C the readability of the display may be impaired.
Operating elements	▪ Local operation with push buttons (–, +, E) ▪ 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

Note!
You can change the language group via the operating program "ToF Tool - Fieldtool Package."

Remote operation	Operation by means of HART protocol

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 Authority (ACA)".
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA etc.) can be supplied by your Endress+Hauser Sales Center on request. All information relevant to explosion protection is available in separate Ex documents that you can order as necessary.
Sanitary compatibility	▪ 3A authorization (all measuring systems, except Promass H) ▪ EHEDG-tested (Promass A and Promass I only)
Pressure device approval	Flowmeters with a nominal diameter smaller or equal DN 25 are covered by Art. 3(3) of the European directive 97/23/EC (Pressure Equipment Directive) and are designed according to sound engineer practice. For larger nominal diameters, optional approvals according to Cat. II/III are available when required (depends on fluid and process pressure).
Functional safety	SIL -2: In accordance with IEC 61508/IEC 61511-1 (FDIS)
Other standards and guidelines	▪ EN 60529 Degrees of protection by housing (IP code) ▪ EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use ▪ EN 61326/A1 (IEC 1326) "Emission in accordance with requirements for Class A". Electromagnetic compatibility (EMC requirements) ▪ 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, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. → Page 56

✎ Note!
The Endress+Hauser service organization can provide detailed information on the order codes of your choice.

10.1.15 Documentation

❑ Flow measurement (FA005D/06/en)

❑ Technical information Promass 80F, 80M, 83F, 83M (TI053D/06/en)

❑ Technical Information Promass 80E, 83E (TI061D/06/en)

❑ Technical Information Promass 80A, 83 A (TI054D/06/en)

❑ Technical information Promass 80H, 80I, 83H, 83I (TI052D/06/en)

❑ Description of Device Functions Promass 80 (BA058D/06/en)

❑ Supplementary documentation on Ex-ratings: ATEX, FM, CSA

❑ Functional safety manual Promass 80, 83 (SD077D/06/en)

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Declaration of Contamination
Erklärung zur Kontamination

Endress+Hauser
People for Process Automation

Because of legal regulations and for the safety of our employees and operating equipment, we need the "declaration of contamination", with your signature, before your order can be handled. Please make absolutely sure to include it with the shipping documents, or – even better – 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", bevor Ihr Auftrag bearbeitet werden kann. Legen Sie diese unbedingt den Versandpapieren bei oder bringen Sie sie idealerweise außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp ____________________________

Serial number
Seriennummer ____________________

Process data/ *Prozessdaten*

Temperature / *Temperatur* _________ [°C] Pressure / *Druck* _________ [Pa]

Conductivity / *Leitfähigkeit* _________ [S] Viscosity / *Viskosität* _________ [mm^2/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 security sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Reason for return / *Grund zur Rücksendung* ____

____

____

Company data / *Angaben zum Absender*

Company / *Firma* ____________________________

____

Address / *Adresse*

____

____

Contact person / *Ansprechpartner* ____________________

Department / *Abteilung* ____________________

Phone number/ *Telefon* ____________________

Fax / E-Mail ____________________

Your order No. / *Ihre Auftragsnr.* ____________________

We hereby certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free from any residues in dangerous quantities.
Hiermit bestätigen wir, dass die zurückgesandten Teile sorgfältig gereinigt wurden, und nach unserem Wissen frei von Rückständen in gefahrbringender Menge sind.

P/SF/Konta VIII

____
(place, date / *Ort, Datum*)

____
(Company stamp and legally binding signature)
(Firmenstempel und rechtsverbindliche Unterschrift)

www.endress.com/worldwide

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People for Process Automation

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