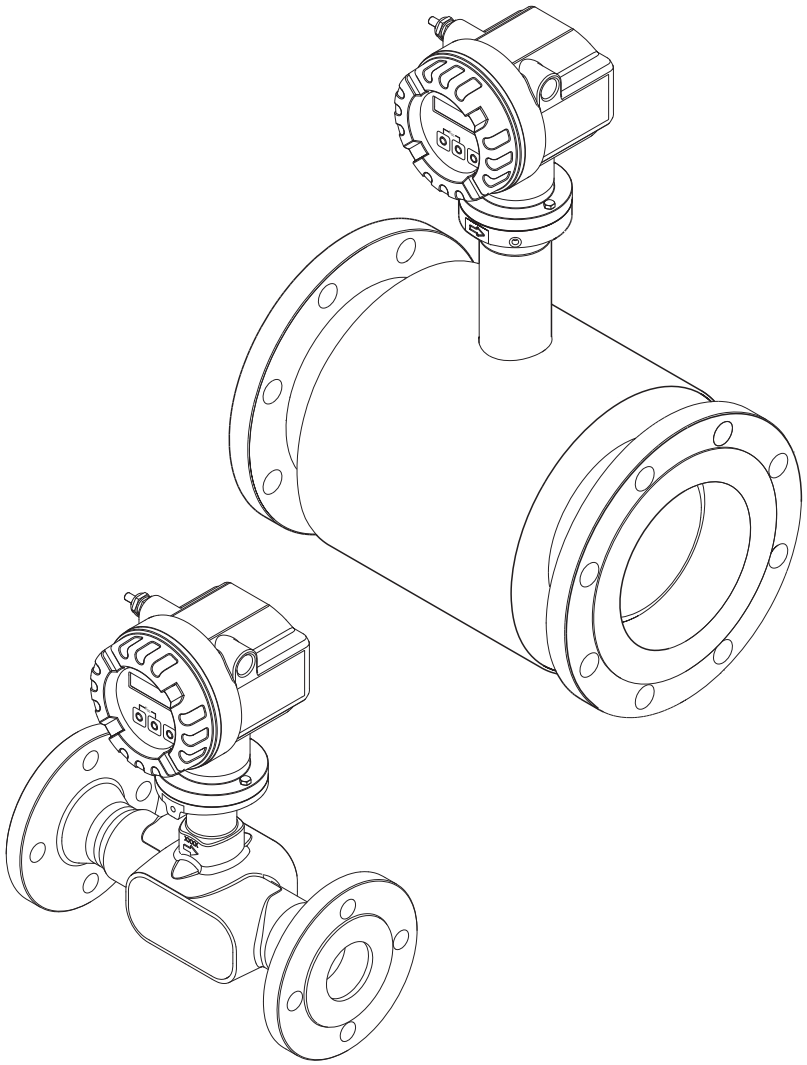
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Operating Instructions

# Proline Prosonic Flow 92F PROFIBUS PA

## Ultrasonic Flow Measuring System



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Valid as of version
V1.01.XX (device software)

Endress+Hauser

People for Process Automation

# Brief operating instructions

These brief operating instructions explain how to commission your measuring device quickly and easily:

| | |
|---|---|
| **Safety instructions** | → 5 |
| First of all, familiarize yourself with the safety instructions so that you can carry out the following working steps quickly and easily. Here you can find information about such topics as the designated use of the measuring device, operational safety and the safety icons and symbols used in the document. | |
| ▼ | |
| **Installation** | → 10 |
| The "Installation" section contains all of the necessary information for incoming acceptance, the installation conditions that have to be observed (orientation, installation site, vibrations etc.), through to the actual installation of the measuring device. | |
| ▼ | |
| **Wiring** | → 16 |
| The "Wiring" section describes the electrical connection of the measuring device and the connection of the remote version connecting cable. Additional topics of this chapter include:<br>■ The specifications of the signal and fieldbus cable<br>■ The terminal assignment<br>■ The degree of protection | |
| ▼ | |
| **Operating options** | → 26 |
| A brief overview of the various operating options. | |
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| Commissioning the PROFIBUS interface | |
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| **Hardware settings** | → 30 |
| Information about setting the write protection, addressing mode and the device address | |
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| **Customer-specific configuration** | → 73 |
| Complex measurement tasks require the configuration of additional functions which you can individually select, set and adapt to your process conditions using appropriate device functions. | |
| ▼ | |
| **Data back-up** | → 32 |
| The configuration of the transmitter can be stored on the integrated T–DAT data storage device.<br>✎ Note!<br>For time-saving commissioning, the settings stored in the T-DAT can be transmitted:<br>– For equivalent measuring points (equivalent configuration)<br>– In the event of device/board replacement. | |

✎ Note!
Always start troubleshooting with the checklist on → 51 if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

# 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 flow rate of liquids in closed pipes, e.g.:
- Acids, alkalis, paints, oils
- Liquefied gas
- Ultrapure water with a low conductivity, water, wastewater

In addition to measuring the volume flow, the measuring device also always measures the sound velocity of the fluid. In this way, different fluids can be distinguished or the fluid quality can be monitored.

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

## 1.2 Installation, commissioning and operation

Note the following points:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner operator. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in these Operating Instructions is mandatory.
- In the case of special fluids (incl. fluids for cleaning), Endress+Hauser will be happy to assist in clarifying the corrosion resistance properties of wetted materials. Slight changes to the temperature, concentration or degree of contamination in the process can, however, alter the corrosion resistance. Consequently, Endress+Hauser does not accept any guarantee or liability with regard to the corrosion resistance of wetted materials in a specific application. The user is responsible for the choice of suitable wetted materials in the process.
- If carrying out welding work on the piping, the welding unit may not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, unless the power supply is galvanically isolated.
- Invariably, local regulations governing the opening and repair of electrical devices apply.

## 1.3 Operational safety

- 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 listed in this supplementary documentation is mandatory. The symbol on the front of this supplementary Ex documentation indicates the approval and the inspection authority (Ex Europe, FM USA, CSA Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of IEC/EN 61326 and NAMUR recommendations NE 21, NE 43 and NE 53.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser representative will supply you with current information and updates to these Operating Instructions.

## 1.4 Return

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.
- Please note the measures on → 65

## 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". The devices can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following symbols:

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 the 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 "Prosonic Flow 92" flowmeter system consists of the following components:
- Prosonic Flow 92 transmitter
- Prosonic Flow F Inline sensor

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

### 2.1.1 Nameplate of the transmitter

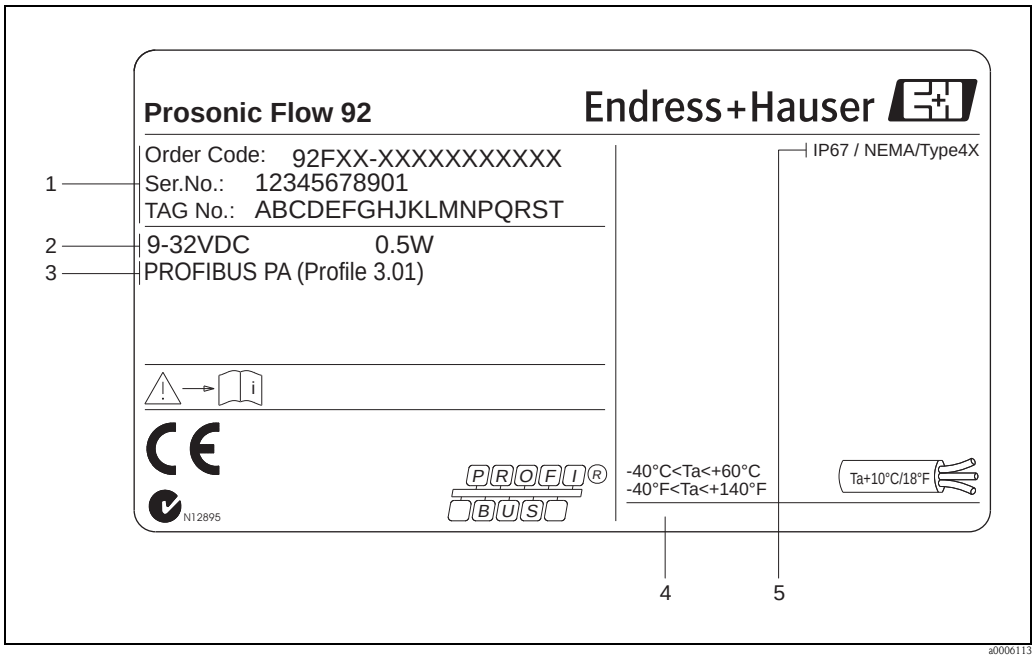



*Fig. 1: Nameplate specifications for the "Prosonic Flow 92" transmitter, compact version (example)*

*1 Order code / serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits*
*2 Power supply: 9 to 32 V DC*
*Power consumption: 0.5 W*
*3 Available outputs*
*4 Permitted ambient temperature range*
*5 Degree of protection*

## 2.1.2 Nameplate of the sensor

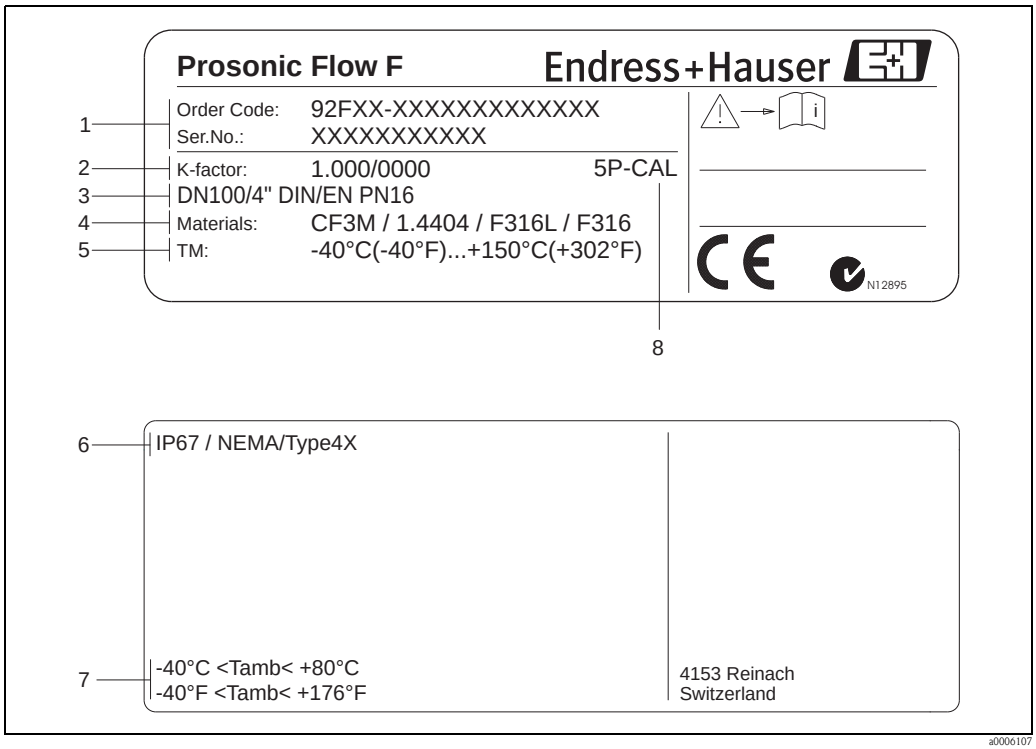



*Fig. 2: Nameplate specifications for the "Prosonic Flow F" sensor (example)*

*1 Order code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits*
*2 Calibration factor with zero point*
*3 Device nominal diameter/nominal pressure*
*4 Measuring tube material*
*5 Medium temperature range*
*6 Degree of protection*
*7 Permitted ambient temperature range*
*8 Additional information (examples):*
*– 5P-CAL: with 5-point calibration*

## 2.1.3 Nameplate for connections

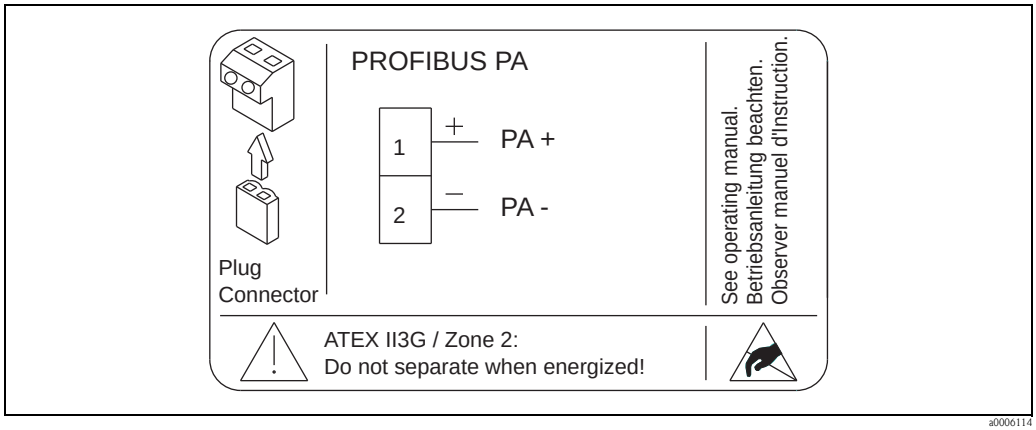



*Fig. 3: Nameplate specifications for Proline transmitter (example)*

## 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 measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of IEC/EN 61326 and NAMUR recommendations NE 21, NE 43 and NE 53.

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 and Media Authority (ACMA).

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

The device thus meets all the requirements of the following specifications:
- Certified to PROFIBUS Specification Profile Version 3.01 (device certification number: available on request).
- The measuring device can also be operated with certified devices of other manufacturers (interoperability).

Note!
A detailed list of all the certificates and approvals is provided in the technical data on → 71.

## 2.3 Registered trademarks

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, D

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

# 3 Installation

## 3.1 Incoming acceptance, transport, storage

### 3.1.1 Incoming acceptance

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

### 3.1.2 Transport

Please note the following when unpacking or transporting to the measuring point:
- The devices must be transported in the container supplied.
- 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.
- Devices with nominal diameters > DN 40 (> 1½") may not be lifted at the transmitter housing or at the connection housing of the remote version when transporting.
  Use carrier slings when transporting and put the slings around both process connections. Avoid chains as these could damage the housing.

⚠ Warning!
Risk of injury if the measuring device slips.
The center of gravity of the entire measuring device might be higher than the points around which the slings are slung. Therefore, when transporting, make sure that the device does not unintentionally turn or slip.

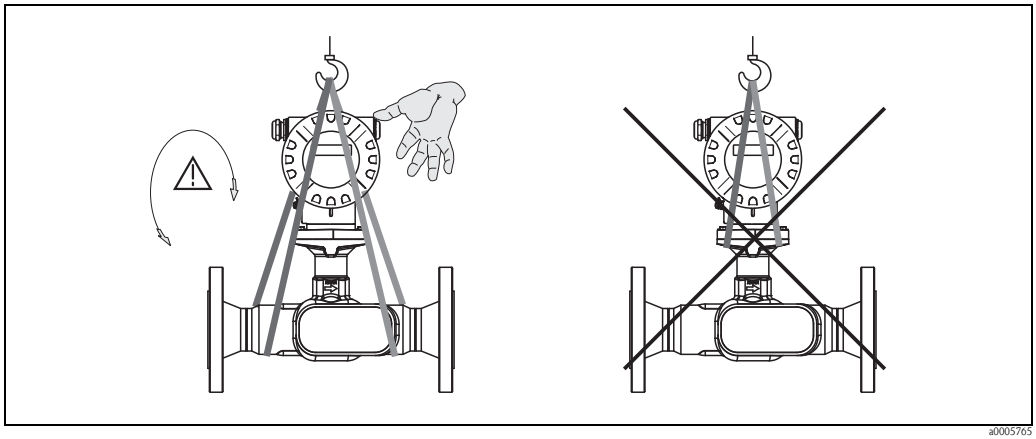



*Fig. 4: Instructions for transporting measuring devices with a nominal diameter > DN 40 (> 1½")*

### 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 (–40 °F to 176 °F), preferably +20 °C (68 °F).
- 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.
- The flow meter flanges must be coplaner with connecting flanges and free from tension.
- The maximum permitted ambient temperatures (→ 68) and fluid temperatures (→ 69) must be observed.
- Pay particular attention to the notes on orientation and piping insulation on the following pages.
- The correct operation of the measuring system is not influenced by pipe vibrations.

### 3.2.1 Dimensions

All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation "Technical Information" → 72.

### 3.2.2 Mounting location

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

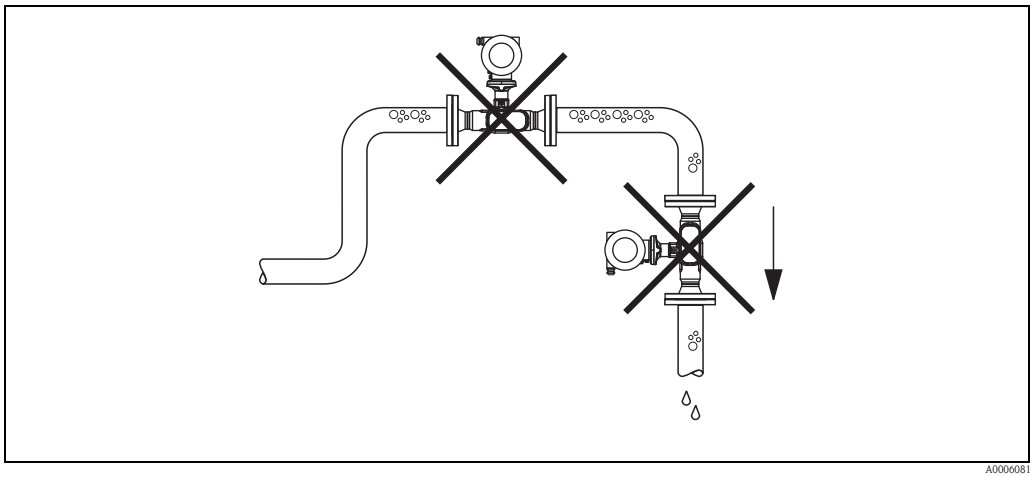



*Fig. 5: Mounting location*

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.

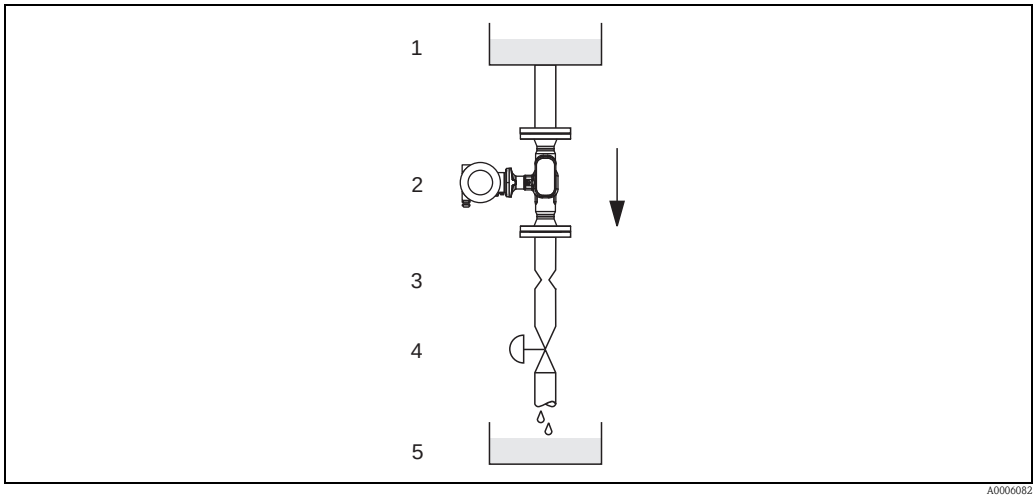



*Fig. 6: Installation in a vertical pipe (e.g. for batching applications)*

*1 Supply tank*
*2 Sensor*
*3 Orifice plate, pipe restriction*
*4 Valve*
*5 Batching tank*

**System pressure**

No additional pressure loss results from installing the device. It is important to ensure that cavitation or degassing does not occur at fittings upstream from the measuring device as this can affect sound transmission in the fluid.
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.

For this reason, preference should be given to the following mounting locations:
- 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).

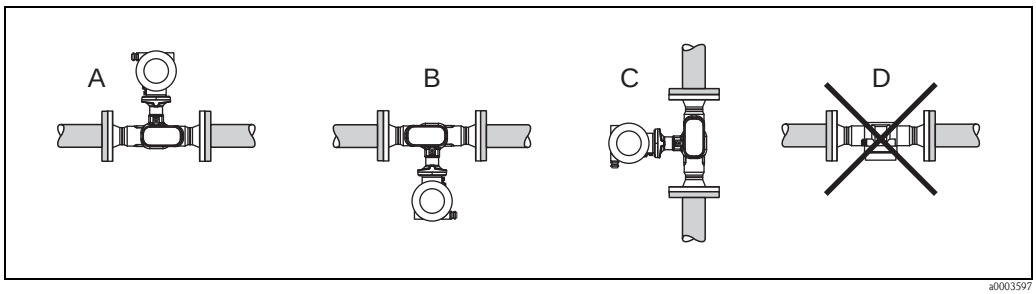



*Fig. 7: Orientations A, B and C recommended; orientation D only recommended under certain circumstances*

### 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 hot water or steam.

Caution!

- Danger of electronics overheating!
  Make sure that the adapter between the sensor and transmitter and the connection housing of the remote version always remain free of insulating material.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the
  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.

### 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.

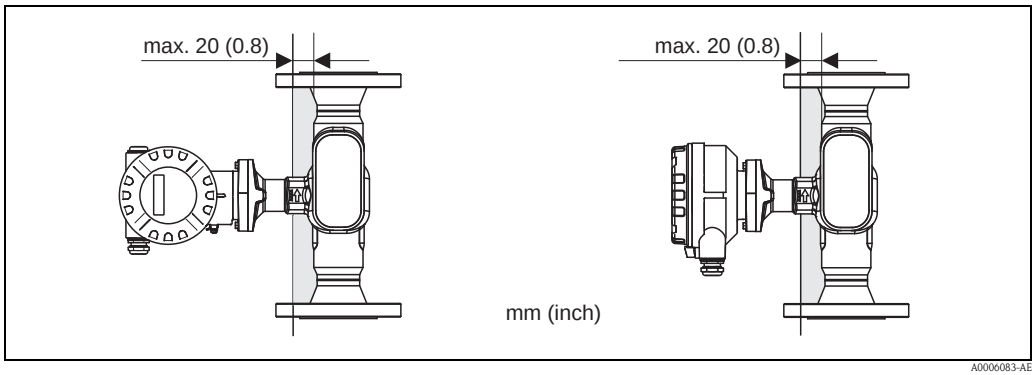



*Fig. 8: A maximum insulation thickness of 20 mm (0.8") must be observed in the area of the electronics/neck.*

If the device is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm (0.4") is recommended to reduce convection. A maximum insulation thickness of 20 mm (0.8") must not be exceeded.

### 3.2.6 Inlet and outlet run

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc.
As a minimum, the inlet and outlet runs shown below must be observed to achieve the specified accuracy of the device. The longest inlet run shown must be observed if two or more flow disturbances are present.

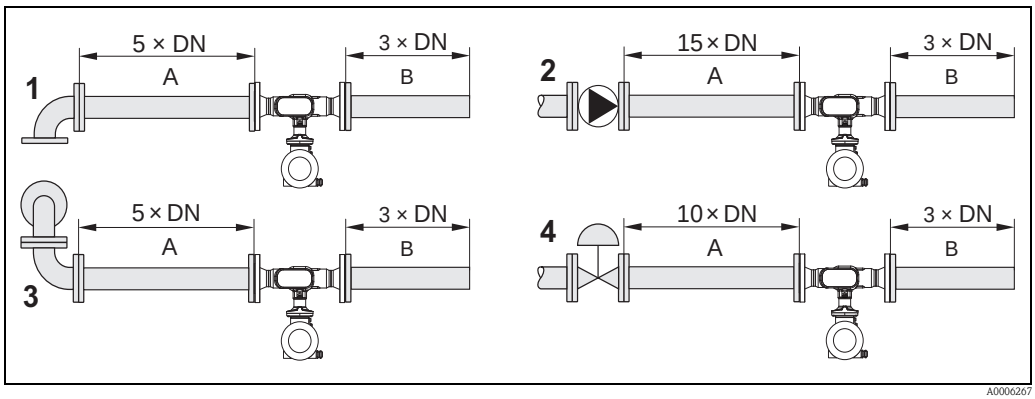



*Fig. 9: Minimum inlet and outlet runs with various flow obstructions (values given for 3 and 4 path version)*

*A = Inlet run, B = Outlet run,*
*1 = 90° elbow or T-piece, 2 = Pump, 3 = 2 x 90° elbow, -dimensional, 4 = Control valve*

### 3.2.7 Vibration

Information on vibration is provided under "Vibration resistance" in the technical data section on → 68.

### 3.2.8 Limiting flow

Information on limiting flow is provided under "Measuring range" in the technical data section on → 66.

## 3.3 Installation instructions

### 3.3.1 Mounting the sensor

- Prior to installing the measuring device in the piping, remove all traces of transport packaging and any protective covers from the sensor.
- Make sure that the internal diameters of seals are the same as, or greater than, those of the measuring device and piping. If seals with a smaller internal diameter are used, this affects the flow and results in inaccurate measurement.
- Ensure that the arrow on the measuring pipe matches the direction of flow in the piping.
- For Carbon steel option remove transport protection coating using mineral spirit (optional).

### 3.3.2 Turning the transmitter housing

1. Loosen the safety screw.
2. Turn the transmitter housing to the desired position (max. 180° in each direction to the stop).

   ✎ Note!
   There are recesses in the rotating groove at 90° stages (only compact version).
   These help you align the transmitter easier.
3. Retighten the securing screw.

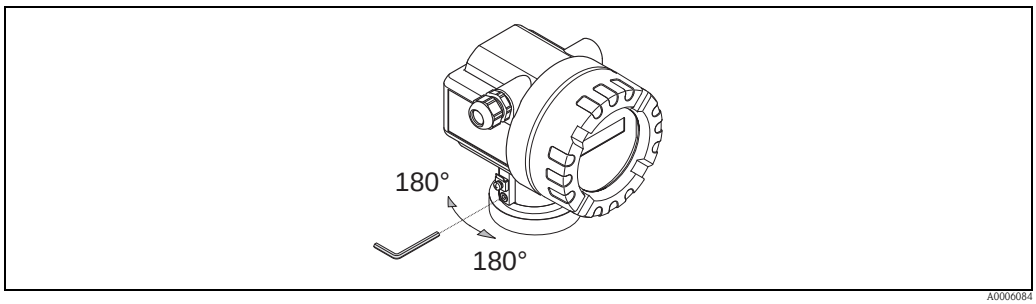



*Fig. 10: Turning the transmitter housing*

### 3.3.3 Turning the local display

1. Unscrew the cover of the electronics compartment from the transmitter housing.
2. Remove the display module from the transmitter retainer rails.
3. Turn the display to the desired position (max. 4 × 45° in each direction) and reset it onto the retaining rails.
4. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

### 3.3.4 Mounting the remote version

The transmitter can be mounted in the following ways:
- Wall mounting
- Pipe mounting (with a separate mounting kit, accessories), → 72

Caution!
When mounting on a pipe, the ambient temperature range may not be exceeded, see → 68.

The transmitter and the sensor must be mounted separate in the following circumstances:
- Poor accessibility
- Lack of space
- Extreme ambient temperatures

Mount the transmitter as illustrated in the diagram.

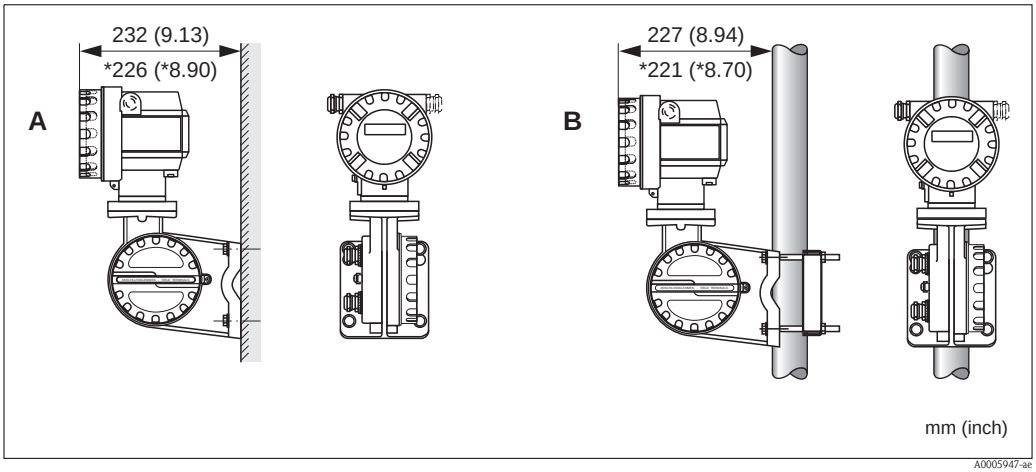



*Fig. 11: Mounting the transmitter (remote version)*

*A Direct wall mounting*
*B Pipe mounting*
** Dimensions for version without local display*

## 3.4 Post-installation check

Perform the following checks after installing the measuring device:

| Device condition and specifications | Notes |
|---|---|
| Is the device damaged (visual inspection)? | - |
| Do the process temperature/pressure, ambient temperature, measuring range etc. correspond to the specifications of the device? | → 66 |
| **Installation** | **Notes** |
| Does the arrow on the sensor or sensor neck match the direction of flow through the pipe? | - |
| Are the measuring point number and labeling correct (visual inspection)? | – |
| **Process environment / process conditions** | **Notes** |
| Is the measuring device protected against direct sunlight? | → 68 |

# 4 Wiring

## 4.1 Cable specifications

### 4.1.1 PROFIBUS PA cable specifications

**Cable type**

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

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

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

| | **Type A** | **Type B** |
|---|---|---|
| Cable structure | Twisted pair, shielded | One or more twisted pairs, fully shielded |
| Wire cross-section | 0.8 $mm^2$ (AWG 18) | 0.32 $mm^2$ (AWG 22) |
| Loop-resistance (DC) | 44 Ω/km | 112 Ω/km |
| Characteristic impedance at 31.25 kHz | 100 Ω ± 20% | 100 Ω ± 30% |
| Attenuation constant at 39 kHz | 3 dB/km | 5 dB/km |
| Capacitive asymmetry | 2 nF/km | 2 nF/km |
| Envelope delay distortion (7.9 to 39 kHz) | 1.7 µs/km | Not specified |
| Shield coverage | 90% | Not specified |
| Max. cable length (incl. spurs > 1 m resp. > 3.28 feet) | 1900 m (6233 feet) | 1200 m (3937 feet) |

Suitable fieldbus cables from various manufacturers for non-hazardous areas:
- Siemens: 6XV1 830-5BH10
- Belden: 3076F
- Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

### Maximum overall cable length

The maximum network expansion depends on the type of protection and the cable specifications. The overall cable length combines the length of the main cable and the length of all spurs (> 1 m resp. > 3.28 feet).

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

| | |
|---|---|
| **Type A** | 1900 m (6233 feet) |
| **Type B** | 1200 m (3937 feet) |

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

### Maximum spur length

The line between the distribution box and field device is described as a spur.
In the case of non-Ex applications, the max. length of a spur depends on the number of spurs (>1 m resp. > 3.28 feet):

| **Number of spurs** | **1 to 12** | **13 to 14** | **15 to 18** | **19 to 24** | **25 to 32** |
|---|---|---|---|---|---|
| **Max. length per spur** | 120 m (393 feet) | 90 m (295 feet) | 60 m (196 feet) | 30 m (98 feet) | 1 m (3.28 feet) |

### Number of field devices

In systems that meet FISCO with EEx ia type of protection, the line length is limited to max. 1000 m (3281 feet). A maximum of 32 users per segment in non-Ex areas or a maximum of 10 users in an Ex-area (EEx ia IIC) is possible. The actual number of users must be determined during configuration.

### Bus termination

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

In the case of a branched bus segment, the device furthest from the segment coupler represents the end of the bus.

If the fieldbus is extended with a repeater then the extension must also be terminated at both ends.

### Further information

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

### 4.1.2 Shielding and grounding

When planning the shielding and grounding for a fieldbus system, there are three important points to consider:
- Electromagnetic compatibility (EMC)
- Explosion protection
- Safety of the personnel

To ensure the optimum electromagnetic compatibility of systems, it is important that the system components and above all the cables, which connect the components, are shielded and that no portion of the system is unshielded. Ideally, the cable shields are connected to the normally metal housings of the connected field devices. Since these are generally connected to the protective earth, the shield of the bus cable is grounded many times. Make sure that the stripped and twisted lengths of cable shield to the terminals are as short as possible.
This approach, which provides the best electromagnetic compatibility and personnel safety, can be used without restriction in systems with good potential equalization.
In the case of systems without potential equalization, a power supply frequency (50 Hz) equalizing current can flow between two grounding points which, in unfavorable cases, e.g. when it exceeds the permissible shield current, may destroy the cable.
To suppress the low frequency equalizing currents on systems without potential equalization, it is therefore recommended to connect the cable shield directly to the building ground (or protective earth) at one end only and to use capacitive coupling to connect all other grounding points.

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

# 4.2 Connecting the remote version

## 4.2.1 Connecting remote transmitter cable

Note!
- The remote version must be grounded. In doing so, the sensor and transmitter must be connected to the same potential matching (→ 12, d).
- You may only connect the sensor to the transmitter with the same serial number (see nameplate). Communication errors can occur if this is not observed when connecting the devices.

**Procedure**

1. Remove the covers of the connection compartments (a/b).
2. Feed the connecting cable (c) through the appropriate cable entries.
3. Wire the sensor and transmitter in accordance with the electrical connection diagram: → 12 or the wiring diagram in the cover of the connection compartment
4. Connect the appropriate cable shield (e/f).
5. Firmly tighten the glands of the cable entries.
6. Screw the covers of the connection compartments (a/b) back on.

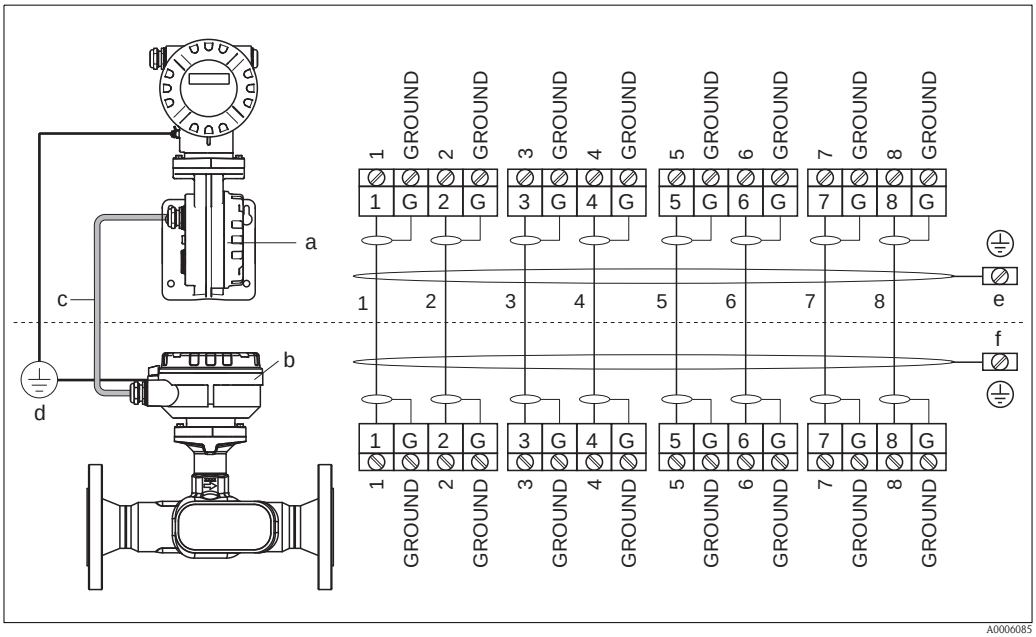



*Fig. 12: Connecting the remote version*

*a Cover of the connection compartment (transmitter)*
*b Cover of the connection compartment (sensor)*
*c Connecting cable (signal cable)*
*d Identical potential matching for sensor and transmitter*
*e Connect the shielding to the ground terminal in the transmitter housing and keep it as short as possible*
*f Connect the shielding to the ground terminal in the connection housing*

## 4.2.2 Cable specification for remote transmitter cable

Only use the cables supplied by Endress+Hauser and pre-terminated at the factory. The cables are available with a fixed length of 10 m (30 feet) and 30 m (90 feet) and optionally available with variable lengths ranging from 1 m (3 feet) to max. 50 m (150 feet). The cable sheathing is made of PVC.

# 4.3 Connecting the measuring unit

## 4.3.1 Connecting the transmitter

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.

Note!
- The national regulations governing the installation of electrical equipment must be observed.
- The remote version must be grounded. In doing so, the sensor and transmitter must be connected to the same potential matching.
- Observe the grounding concept of the plant.
- When connecting the transmitter, use a connecting cable with a continuous service temperature range between –40 °C (–40 °F) and the permitted max. ambient temperature plus 10 °C (plus 18 °F)
- A shielded cable must be used for the connection.
- The terminals for the PROFIBUS PA connection (terminal 1 = PA +, terminal 2 = PA –) have integrated reverse polarity protection. This ensures correct signal transmission via the fieldbus even if the lines are transposed.
- Cable cross-section: max 2.5 mm².

Caution!
- Risk of damaging the PROFIBUS cable!
  If the shielding of the cable is grounded at more than one point in systems without additional potential equalization, power supply frequency equalization currents can occur that damage the cable or the shielding. In such cases the shielding of the cable is to be grounded on only one side, i.e. it must not be connected to the ground terminal of the housing. The shield that is not connected should be insulated!
- We recommend that the PROFIBUS not be looped using conventional cable glands. If you later replace even just one measuring device, the bus communication will have to be interrupted.

**Connecting the transmitter, non-Ex/Ex i version (→ 13)**

1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.
2. Remove the display module (b) from the retaining rails (c) and refit onto the right retaining rail with the left side of the display (this secures the display module).
3. Loosen screw (d) of the cover of the connection compartment and fold the cover down.
4. Push the PROFIBUS cable through the cable gland (e).
5. Unplug the terminal connector (f) from the transmitter housing.
6. Connect the PROFIBUS cable (see → 22, A).
7. Plug the terminal connector (f) into the transmitter housing.
8. Secure the cable shielding to the ground terminal (g, see also → 15, B).
   In doing so, the cable shielding should not exceed a length of 5 mm (0.2") between the stripped PROFIBUS cable and the ground terminal.
9. Remote version only:
   Secure the ground cable to the ground terminal (→ 15, D).
10. Tighten the cable glands (e) (see also → 24).
11. Fold up the cover of the connection compartment (d) and tighten the screw.
12. Remove the display module (b) and fit on the retaining rails (c).
13. Screw the cover of the electronics compartment (a) onto the transmitter housing.

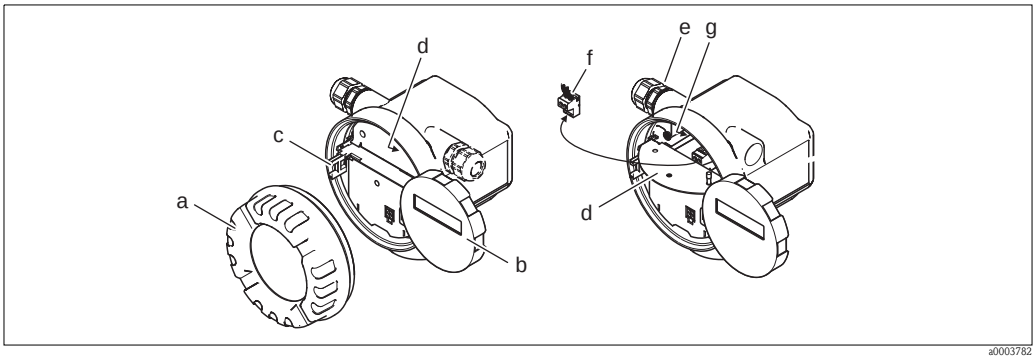



*Fig. 13: Connecting the transmitter, non-Ex/Ex i version*

*a Cover of electronics compartment*
*b Display module*
*c Retaining rail for display module*
*d Connection compartment cover*
*e Cable gland*
*f Terminal connector*
*g Ground terminal*

### Connecting the transmitter, Ex d (→ 14)

1. Open the clamp (a) securing the cover of the connection compartment.
2. Unscrew the cover (b) of the connection compartment from the transmitter housing.
3. Push the PROFIBUS cable through the cable gland (c).
4. Unplug the terminal connector (d) from the transmitter housing.
5. Connect the PROFIBUS cable (see → 15, A).
6. Plug the terminal connector (d) into the transmitter housing.
7. Secure the cable shielding to the ground terminal (e, see also → 15, B).
   In doing so, the cable shielding should not exceed a length of 5 mm (0.2") between the stripped PROFIBUS cable and the ground terminal.
8. Tighten the cable glands (c) (see also → 24).
9. Remote version only:
   Secure the ground cable to the ground terminal (→ 15, D).
10. Screw the cover (b) of the connection compartment onto the transmitter housing.
11. Tighten the clamp (a) securing the cover of the connection compartment.

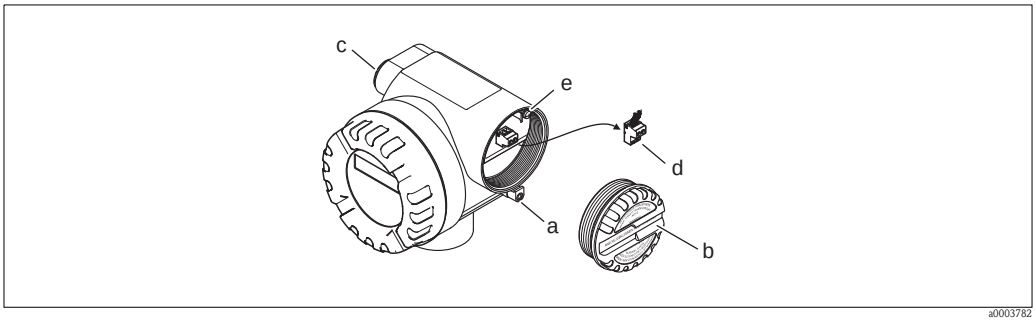



*Fig. 14: Connecting the transmitter, Ex d version*

*a Clamp securing cover of connection compartment*
*b Cover of connection compartment*
*c Cable gland*
*d Terminal connector*
*e Ground terminal*

### Wiring diagram

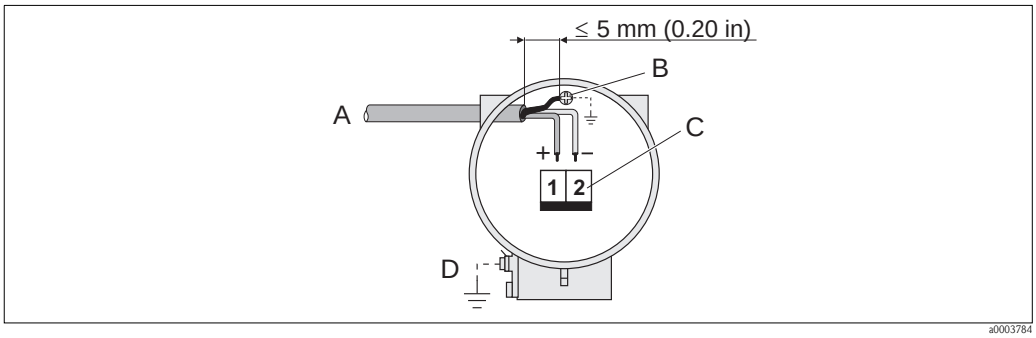



*Fig. 15: Connecting the transmitter*

*A PROFIBUS cable*
*B Ground terminal for cable shielding*
*The cable shielding should not exceed a length of 5 mm (0.2") between the stripped PROFIBUS cable and the ground terminal!*
*C Terminal connector (1 = PA +, 2 = PA –)*
*D Ground terminal for potential equalization (external, only relevant for remote version)*

## 4.3.2 Terminal assignment

| | Terminal No. (inputs/outputs) | |
|---|---|---|
| **Order version** | **1** | **2** |
| 92F**-********** H | PA + | PA – |

### 4.3.3 Fieldbus connector

The connection technology of PROFIBUS PA allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, distribution modules etc. This connection technology using prefabricated distribution modules and plug-in connectors offers substantial advantages over conventional wiring:

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

The measuring device can therefore be supplied with the option of a ready-mounted fieldbus connector. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as a spare part. Contact your E+H service organization.

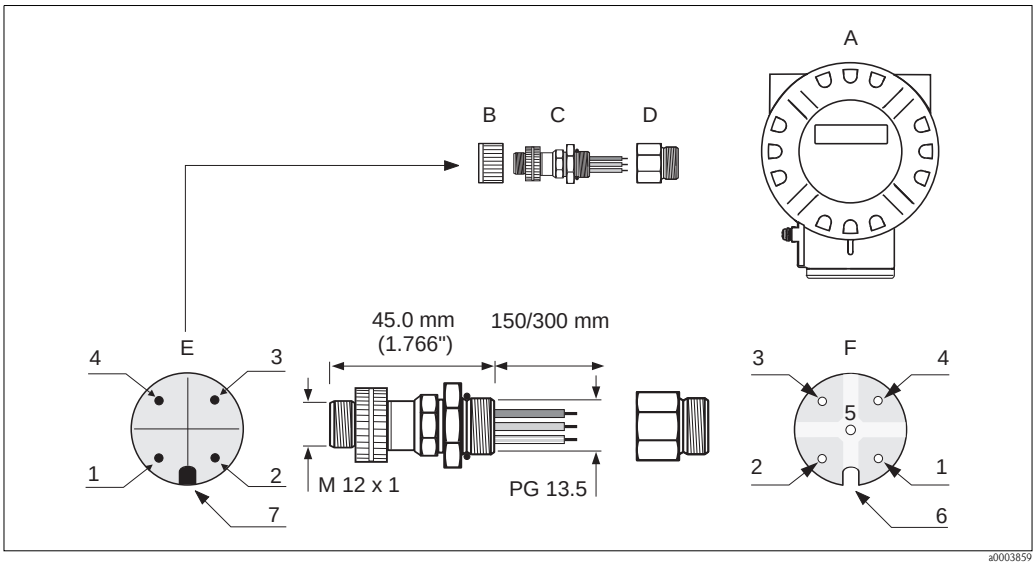



*Fig. 16: Connectors for connecting to the PROFIBUS PA*

**Description**

A = Aluminum field housing
B = Protection cap for connector
C = Fieldbus connector
D = Adapter PG 13.5 / M20.5
E = Connector at housing (male)
F = Female connector

**Pin assignment/color codes**

1 = Brown wire: PA + (terminal 1)
2 = Not connected
3 = Blue wire: PA – (terminal 2)
4 = Black wire: ground
5 = Middle female connector: not assigned
6 = Positioning groove
7 = Positioning key

### Technical data (connector)

| | | | |
|---|---|---|---|
| Connection cross section | 0.75 mm² (AWG 19) | Ambient temperature | –40 to +150 °C (–40 to +302 °F) |
| Connector thread | PG 13.5 | Nominal current per contact | 3 A |
| Degree of protection | IP 67 in accordance with DIN 40 050 IEC 529 | Nominal voltage | 125 to 150 V DC in accordance with the VDE Standard 91 10 / ISO Group 10 |
| Contact surface | Cu Zn Au | | |
| Housing material | Cu Zn, surface Ni | Resistance to tracking | KC 600 |
| Flammability | V - 2 in accordance with UL - 94 | Volume resistance | ≤ 8 mΩ in accordance with IEC 512 Part 2 |
| Operating temperature | –40 to +85 °C (–40 to +185 °F) | Insulation resistance | ≤ 10 mΩ in accordance with IEC 512 Part 2 |

**Supply line/T-box shielding**

Use cable glands with good EMC properties, if possible with all-round contact of the cable shielding (Iris spring). This requires small differences in potential, poss. potential matching.

- The PA cable shielding must be intact.
- The shielding connection must always be kept as short as possible.

Ideally, cable glands with Iris springs should be used for the shielding connection. The shielding is connected to the T-box housing by means of the Iris spring located inside the gland. The shielding braid is located beneath the Iris spring. When the armored thread is tightened, the Iris spring is pressed against the shielding, thereby creating a conductive connection between the shielding and the metal housing.

A connection box or a plug-in connection is to be seen as part of the shielding (Faraday shield). This applies, in particular, to separate boxes if these are connected to a PROFIBUS PA measuring device by means of a pluggable cable. In such instances, a metallic connector must be used where the cable shielding is connected to the connector housing (e.g. prefabricated cables).

## 4.4 Degree of protection

The devices fulfill all the requirements for IP 67 (optional IP 68) degree of protection. Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All housing screws and screw caps must be firmly tightened.
- The cables used for connection must be of the specified outside diameter → 19.
- Firmly tighten the cable entries.
- The cables must loop down before they enter the cable entries ("water trap").
  This arrangement prevents moisture penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Replace all unused cable entries with dummy plugs.
- Do not remove the grommet from the cable entry.

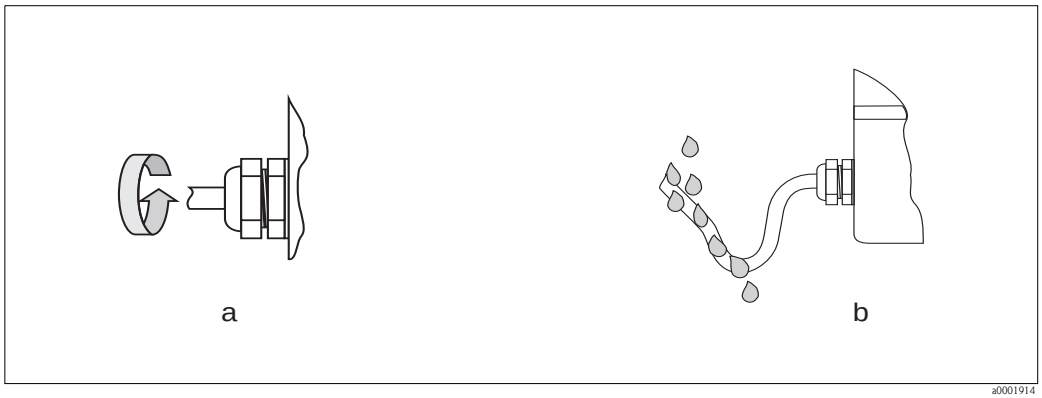



*Fig. 17: Installation instructions for cable entries*

Caution!
The cable glands of the sensor housing must not be released as the degree of protection guaranteed by Endress+Hauser would no longer apply.

Note!
The Prosonic Flow 92F can be supplied with IP 68 rating (permanent immersion in water to a depth of 3 meters (10 ft)). In this case the transmitter must be installed remote from the sensor.

## 4.5 Post-connection check

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

| **Device condition and specifications** | **Notes** |
|---|---|
| Are cables or the device damaged (visual inspection)? | – |
| **Electrical connection in general** | **Notes** |
| Does the supply voltage match the specifications on the nameplate? | 9 to 32 V DC |
| Does the current consumption match the specifications on the nameplate? | 16 mA |
| Do the cables used comply with the specifications? | → 🖹 16 or → 🖹 19 |
| Do the cables have adequate strain relief? | – |
| Are the PROFIBUS cable and the grounding correctly connected? | → 🖹 20 |
| Remote version only:<br>Is the remote transmitter cable between the sensor and transmitter connected correctly? | → 🖹 19 |
| Remote version only:<br>Are the sensor and transmitter connected to the same potential matching? | → 🖹 19 |
| Are all terminals firmly tightened? | – |
| Are all the cable entries installed, tightened and sealed?<br>Cable run with "water trap"? | → 🖹 24 |
| Are all the housing covers installed and tightened? | – |
| **Electrical connection, PROFIBUS PA** | **Notes** |
| Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly? | – |
| Has each fieldbus segment been terminated at both ends with a bus terminator? | – |
| Has the max. length of the fieldbus cable been observed in accordance with the PROFIBUS specifications? | → 🖹 16 |
| Has the max. length of the spurs been observed in accordance with the PROFIBUS specifications? | → 🖹 17 |
| Is the fieldbus cable fully shielded and correctly grounded? | → 🖹 17 |

# 5 Operation

## 5.1 Quick operation guide

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

1. **Operating programs** → 28
   The configuration of profile and device-specific parameters is primarily done via the PROFIBUS interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.
2. **Miniature switches for hardware settings** → 30
   You can make the following HW settings using miniature switches on the board:
   - Hardware write protection enabling/disabling
   - Choose the addressing mode (software or hardware addressing)
   - Device bus address configuration (for hardware addressing)

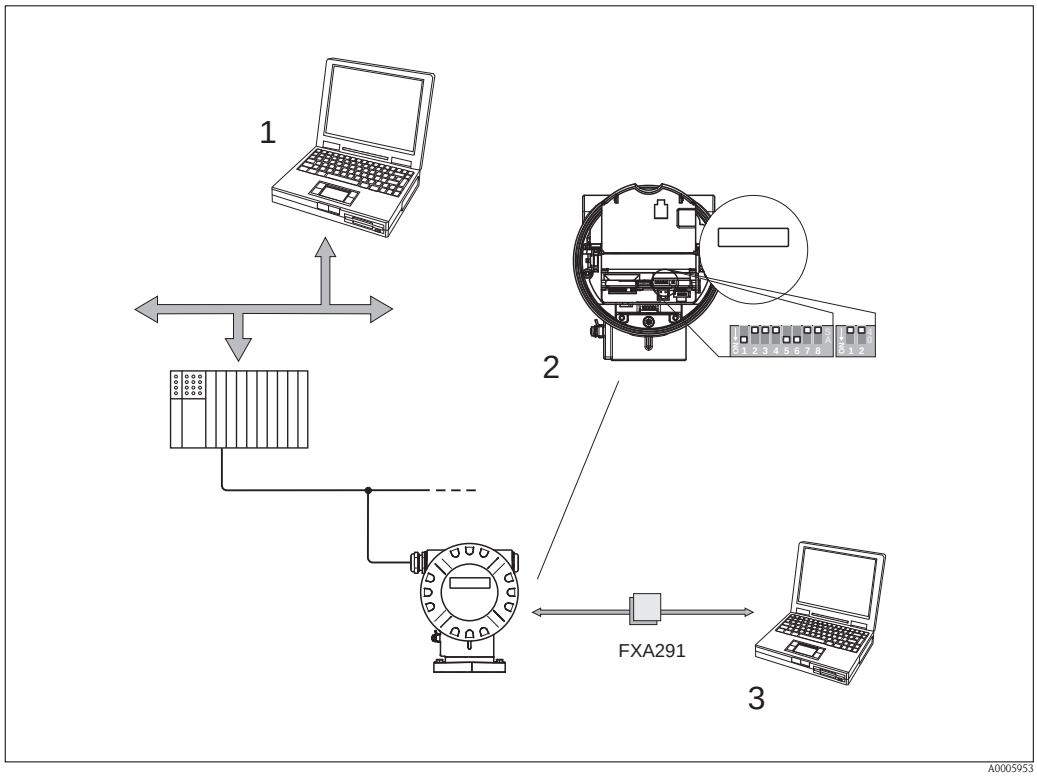



*Fig. 18: Operating options*

*1 Configuration/operating programs (e.g. FieldCare) for operating via PROFIBUS DP/PA*
*2 Miniature switches for hardware settings (write protection, device address, addressing mode)*
*3 Configuration/operating program for operating via the Commubox FXA291 (e.g. FieldCare)*

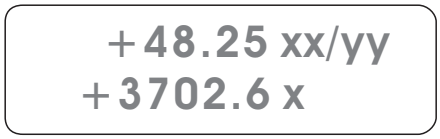
# 5.2 Display elements

## 5.2.1 Display

### Local display

The local display enables you to read important parameters directly at the measuring point. The display consists of two lines; this is where measured values and/or status variables (e.g. bar graph) are displayed.

You can change the assignment of the display lines to suit your needs and preferences (→ 81).




A0005945

*Fig. 19: Liquid crystal display*

*The two-line liquid-crystal display shows measured values and diagnosis messages.*
- *Top line: shows main measured values, e.g. volume flow in [dm³/h] or in [%].*
- *Bottom line: shows additional measured variables and status variables, e.g. totalizer reading in [dm³], bar graph, tag name.*
- *During commissioning or in the event of a fault in normal measuring operation, a diagnosis message flashes on the screen.*
  *The first line shows the diagnosis code beginning with the letters F, C, S or M (see also the following section "Icons") and a short text containing the diagnosis message appears on the second line*

## 5.2.2 Icons

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

| Icon | Meaning |
|---|---|
| F | Failure |
| M | Maintenance required |
| C | Function check |
| S | Outside specification |
|  a0001206 | Acyclic communication via PROFIBUS active (e.g. via FieldCare) |
| ←<br>→<br>(alternating display) | Cyclic communication via PROFIBUS active, e.g. via PLC (Class 1 master) |

# 5.3 Operating options

## 5.3.1 Operating program "FieldCare"

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices.

## 5.3.2 Operating program "FieldCare"

A modular software package consisting of the service program "FieldCare" for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and pressure measuring instruments (evolution series) as well as the "Fieldtool" service program for the configuration and diagnosis of Proline flowmeters. The Proline flowmeters are accessed via a service interface or via the Commubox FXA291.

Contents of the "FieldCare":
- Commissioning, maintenance analysis
- Measuring device configuration
- Service functions
- Visualization of process data
- Troubleshooting
- Select the verification data and update the software of the flow-simulator "Fieldcheck"

## 5.3.3 Operating program "SIMATIC PDM" (Siemens)

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

### 5.3.4 Device description files for operating programs

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

**PROFIBUS PA**

| | | |
|---|---|---|
| **Valid for device software:** | 1.01.XX | → Function DEVICE SOFTWARE |
| **Device data PROFIBUS PA:** | | |
| Profile Version: | 3.01 | → Function PROFILE VERSION |
| ID No.: | 154C (Hex) | → Function DEVICE ID |
| Profile ID No.: | 9740 (Hex) | |
| **GSD file information:** | | |
| GSD file: | Extended format (recommended): eh3x154C.gsd<br>Standard format: eh3_154C.gsd | |
| | ✎ Note!<br>Please follow the information on using GSD files when configuring the PROFIBUS network → 📄 36 | |
| Profile GSD file: | PA139740.gsd | |
| Bitmaps: | EH_154C_d.bmp/.dib<br>EH_154C_n.bmp/.dib<br>EH_154C_s.bmp/.dib | |
| Software release: | 12.2010 | |

| Operation via PROFIBUS DP/PA | Sources for obtaining device descriptions/program updates: |
|---|---|
| GSD file | ■ www.endress.com (→ Download → Software → Driver)<br>■ CD–ROM (Endress+Hauser order number: 56003894) |
| Profile GSD file | ■ www.profibus.com |
| FieldCare/DTM | ■ www.endress.com (→ Download → Software → Driver)<br>■ CD-ROM (Endress+Hauser order number: 56004088)<br>■ DVD (Endress+Hauser Order -Number: 70100690) |
| SIMATIC PDM | ■ www.endress.com (→ Download → Software → Driver)<br>■ www.felddevices.com |
| Operation via service interface FXA291 | Sources for obtaining device descriptions/program updates: |
| FieldCare<br>(via Commubox FXA291) | ■ www.tof-fieldtool.endress.com<br>■ Update CD-ROM (Endress+Hauser order number: 50099820) |

| **Tester/simulator:** | |
|---|---|
| **Device:** | **How to acquire:** |
| Fieldcheck | ■ Update by means of FieldCare with the Flow device FXA 193/291 DTM in Fieldflash Module |

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

## 5.4 Hardware settings

### 5.4.1 Switching write protection on/off (→ 20 → 31)

Write protection can be activated or deactivated via switch block 2 (e/D).
When write protection is active, it is **not** possible to write-access the device functions via PROFIBUS (acyclic data transmission, e.g. via "FieldCare" operating program).
The current status is displayed in the WRITE PROTECT function (→ 85).

1. Unscrew the cover of the electronics compartment from the transmitter housing.
2. Remove the display module (a) from the retaining rails (b) and refit onto the right retaining rail with the left side of the display (this secures the display module).
3. Fold up the plastic cover (c).
4. At switch block 2 (e), move miniature switch 2 (D) to the desired position:
   **OFF** position, miniature switch moved up = write protection deactivated (factory setting)
   **ON** position, miniature switch moved down = write protection active
5. Installation is the reverse of the removal procedure.

### 5.4.2 Configuring the device address (→ 20 → 31)

The device address must always be configured for a PROFIBUS PA device. The valid address range is between 1 and 126, whereby the address 126 is only used for commissioning and for service purposes.

In a PROFIBUS PA network, each address can only be assigned once. If an address is not configured correctly, the device is not recognized by the master.

All measuring devices are delivered from the factory with the device address 126 and with the software addressing method. The device address can be entered in the software addressing mode by means of the BUS ADDRESS function (→ 85). If the device address is to be configured using hardware addressing, however, please proceed as follows:

1. Unscrew the cover of the electronics compartment from the transmitter housing.
2. Remove the display module (a) from the retaining rails (b) and refit onto the right retaining rail with the left side of the display (this secures the display module).
3. Fold up the plastic cover (c).
4. Activate the hardware addressing addressing mode by means of switch block 2 (e), switching miniature switch 1 (C) ON.
5. Set the device address via miniature switches 1 to 7 (A) of switch block 1 (d).
6. Installation is the reverse of the removal procedure.

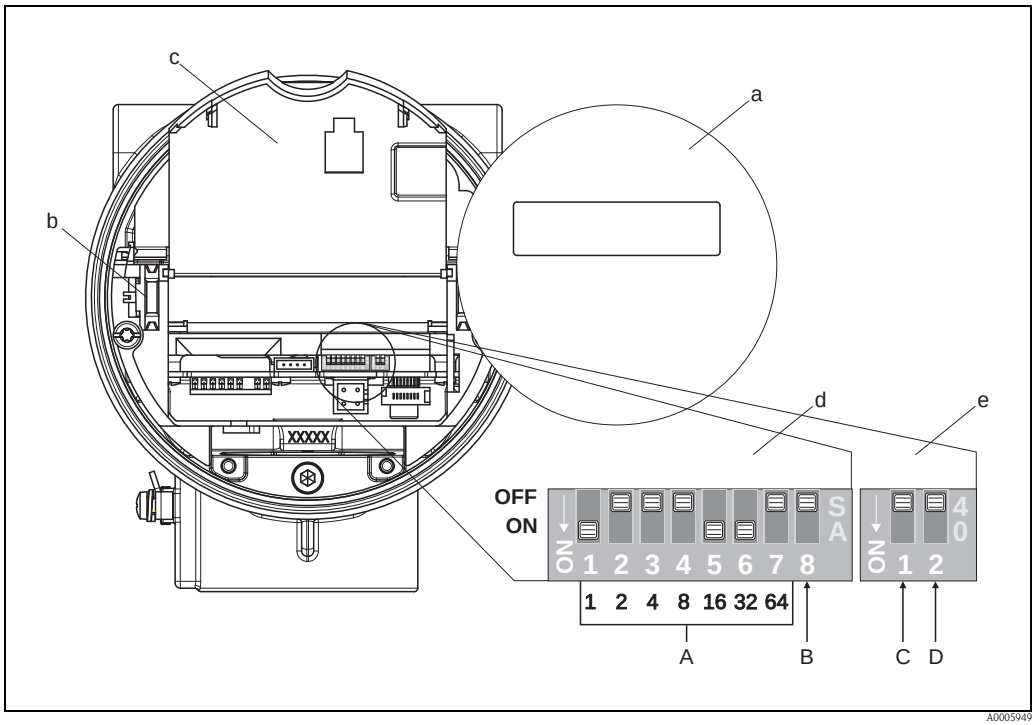



*Fig. 20: Miniature switches for configuring the device address, the addressing mode and the write protection*

*a Display module*
*b Retaining rails for the display module*
*c Plastic cover*

*d Switch block 1:*
- ***A** (miniature switches 1 to 7):*
  *Device address configuration (only possible if addressing mode = hardware addressing, see e/C)*
  *Example for device address 49, see switch position in graphic:*
  *Miniature switch 1 = ON = 1*
  *Miniature switch 2 = OFF = 0*
  *Miniature switch 3 = OFF = 0*
  *Miniature switch 4 = OFF = 0*
  *Miniature switch 5 = ON = 16*
  *Miniature switch 6 = ON = 32*
  *Miniature switch 7 = OFF = 0*
  *Device address = 1 + 16 + 32 = 49*

- ***B** (miniature switch 8:)*
  *not assigned*

*e Switch block 2:*
- ***C** (miniature switch 1):*
  *Select addressing mode (type of addressing)*
  *OFF = software addressing via operating program (factory setting)*
  *ON = hardware addressing via miniature switches*

- ***D** (miniature switch 2):*
  *Switching write protection on and off:*
  *OFF = deactivated Write access possible via PROFIBUS (acyclic data transmission, e.g. using FieldCare) (factory setting)*

  *ON = activated*
  *Write access not possible via PROFIBUS (acyclic data transmission e.g. using FieldCare)*
  *(the current write protection status is displayed in the WRITE PROTECT function → 85)*

# 6 Commissioning

## 6.1 Function check

Make sure that the following function checks have been performed successfully before switching on the supply voltage for the measuring device:
- Checklist for "Post-installation check" → 15
- Checklist for "Post-connection check" → 25

## 6.2 Switching on the measuring device

Once the function check has been performed successfully, the device is operational and can be switched on via the supply voltage. The device then performs internal test functions and the following messages are shown on the local display:

| | |
|---|---|
| **PROSONIC FLOW 92<br>V XX.XX.XX** | Displays the current software |
| **PROFIBUS PA** | Displays the input/output modules installed |
| **FIELDBUS ADDRESS<br>XXX** | Displays the fieldbus address |

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

Note!
If startup fails, an appropriate diagnosis code appears on the local display, depending on the cause (→ 54).

## 6.3 Managing data using the T-DAT SAVE/LOAD function

By means of the T-DAT SAVE/LOAD function, the configuration of the transmitter can be saved to a transmitter DAT (T-DAT) or a configuration can be loaded from the T-DAT into the EEPROM. Please refer to → 79 for a description of this function and the exact procedure for managing data.

## 6.4 Commissioning the PROFIBUS interface

Note!
- A detailed description of all the functions required for commissioning is provided in → 📄 73 "Description of device functions".
- A code (factory setting: 92) must be entered to change device functions, numerical values or factory settings → 📄 80.

### 6.4.1 PROFIBUS PA commissioning

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

1. **Check the hardware write protection:**
   The WRITE PROTECT parameter indicates whether it is possible to write-access the device via PROFIBUS (acyclic data transmission, e.g. via "FieldCare" operating program):
   COMMUNICATION → OPERATION → WRITE PROTECT
   One of the following options is displayed:
   – OFF (factory setting) = write access via PROFIBUS possible
   – ON = write access via PROFIBUS not possible
   Deactivate the write protection if necessary → 📄 30.

2. **Enter the tag name (optional):**
   COMMUNICATION → OPERATION → TAG NAME

3. **Set the bus address:**
   Software addressing via the operating program:
   COMMUNICATION → OPERATION → FIELDBUS ADDRESS
   or
   Hardware addressing via miniature switches → 📄 30

4. **Select the system unit:**
   a. Determine the units via the system units group, e.g.:
      SYSTEM UNITS → UNIT VOLUME FLOW /…
   b. In the UNIT TO BUS function, select the SET UNITS option to transfer the cyclically transmitted measured variables to the PROFIBUS master (Class 1) with the system units set in the measuring device:
      COMMUNICATION → OPERATION → UNIT TO BUS

   Note!
   - The procedure for configuring the system units for the totalizers is explained separately in Step 7.
   - If the system unit of a measured variable is altered via an operating program, this initially does not affect the unit that is used to transfer the measured variable to the PROFIBUS master (Class 1). Altered system units for the measured variables are not transferred to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the COMMUNICATION → OPERATION → UNIT TO BUS function.

5. **Configure the Analog Input function blocks 1 to 4:**
   The device has four Analog Input function blocks (AI modules) with which various measured variables can be cyclically transmitted to the PROFIBUS master (Class 1). The following section illustrates the assignment of a measured variable to the Analog Input function block, taking the example of Analog Input function block 1 (AI module, slot 1).
   In the CHANNEL function, you can determine the measured variable (e.g. VOLUME FLOW) that should be cyclically transmitted to the PROFIBUS master (Class 1):
   a. Go to COMMUNICATION → ANALOG INPUT 1 → CHANNEL
   b. Here, select the VOLUME FLOW option

Possible settings

| Measured variable | | ID for CHANNEL function |
|---|---|---|
| VOLUME FLOW | (factory setting AI function block 1) | 273 |
| CALCULATED MASS FLOW | (factory setting AI function block 1) | 277 |
| SOUND VELOCITY | (factory setting AI function block 2) | 293 |
| SIGNAL STRENGTH | (factory setting AI function block 3) | 310 |
| FLOW VELOCITY | (factory setting AI function block 4) | 315 |

✎ Note!
If the AI module was integrated in slot 1 to 4 during PROFIBUS network configuration, the measured variable selected in the CHANNEL function is cyclically transmitted to the PROFIBUS master (Class 1) for the Analog Input function block 1 to 4 in question → 📄 87.

6. **Configure the measuring mode:**
In the MEASURING MODE function, select the way in which the flow components are recorded by the measuring device.
SYSTEM PARAMETER → MEASURING MODE → select one of the following options:
– UNIDIRECTIONAL = only the positive flow components
– BIDIRECTIONAL = (factory setting) positive and negative flow components

7. **Configure Totalizers 1 to 2:**
The device has two totalizers. The following section describes the configuration taking Totalizer 1/volume flow as the example:

In the CHANNEL function, you can determine the measured variable that should be cyclically transmitted to the PROFIBUS master (Class 1) as the totalizer value:

a. Go to TOTALIZER 1 → CHANNEL
b. Here, select the VOLUME FLOW option

- Enter the desired unit for the totalizer:
  TOTALIZER 1 → UNIT TOTALIZER

- Configure totalizer status, (e.g. totalize):
  TOTALIZER 1 → SET TOTALIZER → TOTALIZE option

- Set the totalizer mode:
  TOTALIZER 1 → TOTALIZER MODE → select one of the following options:
  – BALANCE (factory setting): balances the positive and negative flow components
  – POSITIVE: only calculates the positive flow components
  – NEGATIVE: only calculates the negative flow components
  – HOLD: the totalizer stops at the last value

  ✎ Note!
  To properly calculate the positive and negative flow components (BALANCE) or just the negative flow components (NEGATIVE), the BIDIRECTIONAL option must be activated in the SYSTEM PARAMETER → MEASURING MODE function.

Possible settings

| Totalizer value/measured variable | ID for CHANNEL function |
|---|---|
| VOLUME FLOW (factory setting, Totalizers 1 to 2) | 273 |
| OFF | 0 |
| ✎ Note!<br>If the module or the TOTAL function was integrated in slot 5 or 6 during PROFIBUS network configuration, the measured variable selected in the CHANNEL function is cyclically transmitted to the PROFIBUS master (Class 1) for Totalizer 1 or 2 in question.→ 🗎 83 | |

8. **Select the operating mode**
   Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master (class 1).

   COMMUNICATION → OPERATION → SELECTION GSD → select:
   – MANUFACTURER SPEC. (factory setting)
     The complete device functionality is available
   – GSD PROFILE
     The measuring device is operated in the PROFIBUS Profile mode

✎ Note!
For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 🗎 29

9. **Configure cyclic data transmission in the PROFIBUS master**
   A detailed description of the system integration can be found in the following section.

# 6.5 PROFIBUS system integration

## 6.5.1 Device master file (GSD file)

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

The measuring device supports the following GSD files:
- GSD file (manufacturer-specific GSD file, complete device functionality)
- PROFIBUS Profile GSD file

The GSD files supported are described in detail below:

**GSD file (manufacturer-specific GSD file, complete device functionality)**

Use this GSD file to access the complete functionality of the measuring device. In this way, device-specific measured variables and functionalities are completely available in the PROFIBUS master system. An overview of the modules available (input and output data) can be found on → 📄 38

*GSD file with standard or extended format:*

The GSD file with either the standard or the extended format must be used depending on the configuration software used. When installing the GSD file, the GSD file with the extended format (EH3**x**15xx.gsd) should always be used first.
However, if the installation or the configuration of the measuring device fails with this format, then use the standard GSD (EH3_15xx.gsd). This differentiation is the result of different implementation of the GSD formats in the master systems. Note the specifications of the configuration software.

*Name of the GSD file*

| | ID No. | GSD file | | Type file | Bitmaps |
|---|---|---|---|---|---|
| **PROFIBUS PA** | 154C (Hex) | Extended format (recommended):<br>Standard format: | EH3x154C.gsd<br>EH3_154C.gsd | EH_154C.200 | EH_154C_d.bmp/.dib<br>EH_154C_n.bmp/.dib<br>EH_154C_s.bmp/.dib |

*How to acquire:*

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

*Contents of the download file from the Internet and the CD-ROM:*

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

**PROFIBUS Profile GSD file**

The function of the profile GSD file is defined by the PROFIBUS Profile Specification 3.01. The function is restricted compared to the manufacturer-specific GSD file (complete functionality). However, similar devices from different manufacturers can be interchanged with the profile GSD file without the need to reconfigure (interchangeability).

The following modules are supported with the Profile GSD file:

| | | |
|---|---|---|
| "AI Flow" module | → | Analog Input function block 1 / output variable: volume flow |
| "Totalizer" module | → | Totalizer function block / output variable: totalized volume flow |

*Name of the PROFIBUS Profile GSD file*

| | ID No. | Profile GSD file |
|---|---|---|
| **PROFIBUS PA** | 9740 (Hex) | PA139740.gsd |

*How to acquire*

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

## 6.5.2 Selecting the GSD file in the measuring device

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

COMMUNICATION → OPERATION → SELECTION GSD

| | | |
|---|---|---|
| GSD file | → | Select: MANUFACT. SPEC. (factory setting) |
| Profile GSD file | → | Select: GSD PROFILE |

**Example**

For configuring the manufacturer-specific GSD file (complete device functionality):

1. In the measuring device, select the manufacturer-specific GSD file: COMMUNICATION → OPERATION → SELECTION GSD → select: MANUFACTURER SPEC.
2. Before configuring the network, load the appropriate GSD file into the configuration system/ master system.

   ✎ Note!
   When installing the GSD file, always first use the GSD file with the extended format (EH3x154C.gsd). However, if the installation or the configuration of the device fails with this format, then use the standard GSD (EH3_154C.gsd).

   Example for the configuration software Siemens STEP 7 of the Siemens PLC family S7-300/400: Use the GSD file with the extended format (EH3x154C.gsd). Copy the file to the subdirectory "...\siemens\step7\s7data\gsd". The GSD files also have bitmap files. These bitmap files are used to display the measuring points in image form. The bitmap files must be saved to the directory "...\ siemens \ step7 \ s7data \ nsbmp".

   If you are using configuration software other than that referred to above, ask your PROFIBUS master system manufacturer which directory you should use.
3. The measuring device is a modular PROFIBUS slave, i.e. the desired module configuration (input and output data) must be performed in the next step. This can be done directly by means of the configuration software. A detailed description of the modules supported by the measuring device can be found as of → 38.

### 6.5.3 Maximum number of write cycles

If a non-volatile device parameter is modified via cyclic or acyclic data transmission, this change is saved in the EEPROM of the measuring device.
The number of writes to the EEPROM is technically restricted to a maximum of 1 million. Attention must be paid to this limit since, if exceeded, it results in data loss and measuring device failure. For this reason, avoid constantly writing non-volatile device parameters via PROFIBUS!

## 6.6 PROFIBUS cyclic data transmission

The following section describes cyclic data transmission when using the GSD file (complete device functionality).

### 6.6.1 Block model

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

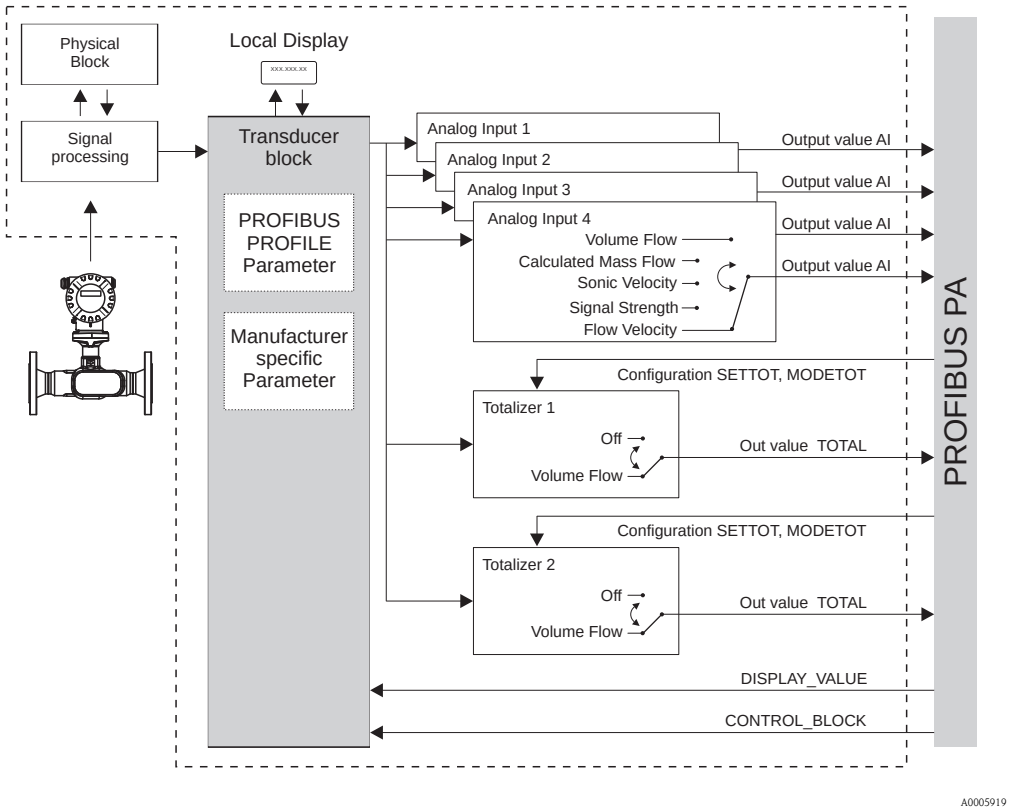



*Fig. 21: Block model for Prosonic Flow 92 PROFIBUS PA Profile 3.01*

### 6.6.2 Modules for cyclic data transmission

The measuring device is a modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the "EMPTY_MODULE" module.
To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

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

| Sequence<br>Slot | Module | Description |
|---|---|---|
| 1 | AI | **Analog Input function block 1**<br>Output variable<br>→ Volume flow (factory setting) |
| 2 | AI | **Analog Input function block 2**<br>Output variable<br>→ Sound velocity (factory setting) |
| 3 | AI | **Analog Input function block 3**<br>Output variable<br>→ Signal strength (factory setting) |
| 4 | AI | **Analog Input function block 4**<br>Output variable<br>→ Flow velocity (factory setting) |
| 5 | TOTAL or<br>SETTOT_TOTAL or<br>SETTOT_MODETOT_TOTAL | **Totalizer function block 1**<br>TOTAL → output variable =<br>totalized volume flow (factory setting)<br>SETTOT → set totalizer<br>MODETOT → totalizer configuration |
| 6 | TOTAL or<br>SETTOT_TOTAL or<br>SETTOT_MODETOT_TOTAL | **Totalizer function block 2**<br>TOTAL → output variable =<br>totalized volume flow (factory setting)<br>SETTOT → set totalizer<br>MODETOT → totalizer configuration |
| 7 | DISPLAY_VALUE | Default value for local display |
| 8 | CONTROL_BLOCK | Control of device functions |

Note!
- The assignment of the measured variables for the Analog Input function blocks (1 to 4) and the Totalizer function blocks (1 to 2) can be changed by means of the "CHANNEL" function.
  A detailed description of the individual modules can be found in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system.
  This can be effected as follows:
  – By means of an operating program (e.g. FieldCare)
  – By switching the supply voltage off and then on again.

## 6.6.3 Description of the modules

### AI module (Analog Input)

By means of the AI module (slot 1 to 4), the appropriate measured variable incl. status is cyclically transmitted to the PROFIBUS master (Class 1). The measured variable is portrayed in the first four bytes in the form of a floating-point number in accordance with IEEE 754 standard. The fifth byte contains standardized status information pertaining to the measured value (device status → 51).

*Input data*

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 |
|---|---|---|---|---|
| Measured variable (IEEE 754 floating-point number) | | | | Status |

*Assignment of the measured variables to the AI module*

The AI module can transmit different measured variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Analog Input function blocks 1 to 4 by means of an operating program (e.g. FieldCare) in the CHANNEL function, e.g.:
COMMUNICATION → ANALOG INPUT 1 → CHANNEL → select the measured variable

*Possible settings*

| Measured variable | ID for CHANNEL function |
|---|---|
| VOLUME FLOW | 273 |
| CALCULATED MASS FLOW | 277 |
| SOUND VELOCITY | 293 |
| SIGNAL STRENGTH | 310 |
| FLOW VELOCITY | 315 |

*Factory setting*

| Module | Analog Input function block | Factory setting Measured variable | Unit | ID for CHANNEL function |
|---|---|---|---|---|
| AI (slot 1) | 1 | VOLUME FLOW | l/s | 273 |
| AI (slot 2) | 2 | SOUND VELOCITY | m/s | 293 |
| AI (slot 3) | 3 | SIGNAL STRENGTH | dB | 310 |
| AI (slot 4) | 4 | FLOW VELOCITY | m/s | 315 |

*Example*

You want to cyclically transmit the volume flow and signal strength respectively to the PROFIBUS master (Class 1) by means of Analog Input function block 1 (AI module, slot 1) and Analog Input function block 2 (AI module, slot 2) respectively:

1. COMMUNICATION → ANALOG INPUT 1 → CHANNEL → select: VOLUME FLOW
2. COMMUNICATION → ANALOG INPUT 2 → CHANNEL → select: SIGNAL STRENGTH

### TOTAL module

The measuring device has two totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS master (Class 1) by means of the TOTAL module (slot 5 to 6). The totalizer value is portrayed in the first four bytes in the form of a floating-point number in accordance with IEEE 754 standard. The fifth byte contains standardized status information pertaining to the totalizer value (device status → 53)

*Input data*

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

*Assignment of the measured variables to the TOTAL module*

The TOTAL module can transmit different totalizer values to the PROFIBUS master (Class 1). The measured variable is assigned to the Totalizer function blocks 1 to 2 by means of an operating program (e.g. FieldCare) in the CHANNEL function, e.g.:
TOTALIZER 1 → CHANNEL → select the measured variable

*Possible settings*

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

*Factory setting*

| Module | Totalizer function block | Totalizer value/ measured variable | Unit | ID for CHANNEL function |
|---|---|---|---|---|
| TOTAL (slot 5) | 1 | VOLUME FLOW | $m^3$ | 273 |
| TOTAL (slot 6) | 2 | CALCULATED MASS FLOW | kg | 277 |

*Example*

You want to cyclically transmit the totalized volume flow to the PROFIBUS master (Class 1) by means of Totalizer function block 1 (TOTAL module, slot 5):
TOTALIZER 1 → CHANNEL → select VOLUME FLOW

### SETTOT_TOTAL module

The SETTOT_TOTAL module combination (slot 5 to 6) consists of the SETTOT and TOTAL functions. With this module combination:
- The totalizer can be controlled via the automation system (SETTOT)
- The totalizer value incl. status can be transmitted (TOTAL)

*SETTOT function*

In the SETTOT function, the totalizer can be controlled by means of control variables.
The following control variables are supported:
- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer presetting

*TOTAL function*

For the description of the TOTAL function, see TOTAL module → 📄 40

*Data structure of the SETTOT_TOTAL module combination*

Output data

| SETTOT |
|---|
| Byte 1 |
| Control |

Input data

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

### SETTOT_MODETOT_TOTAL module

The SETTOT_MODETOT_TOTAL module combination (slot 5 to 6) consists of the SETTOT, MODETOT and TOTAL functions. With this module combination:
- The totalizer can be controlled via the automation system (SETTOT)
- The totalizer can be configured via the automation system (MODETOT)
- The totalizer value incl. status can be transmitted (TOTAL)

*SETTOT function*

For the description of the SETTOT function, see SETTOT_TOTAL module → 📄 41

*MODETOT function*

In the MODETOT function, the totalizer can be configured by means of control variables.
The following settings are possible:
- 0 = Balancing (factory setting), balances the positive and negative flow components
- 1 = Calculates the positive flow components
- 2 = Calculates the negative flow components
- 3 = Totalizing is stopped

Note!
To properly calculate the positive and negative flow components (control variable 0) or just the negative flow components (control variable 2), the BIDIRECTIONAL option must be activated in the SYSTEM PARAMETER * MEASURING MODE function.

*TOTAL function*

For the description of the TOTAL function, see TOTAL module → 📄 40

*Data structure of the SETTOT_ MODETOT_ TOTAL module combination*

Output data

| SETTOT | MODETOT |
|---|---|
| Byte 1 | Byte 2 |
| Control | Configuration |

Input data

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

### DISPLAY_VALUE module

Any value (IEEE 754 floating-point number) incl. status can be cyclically transmitted directly to the local display of the device via the PROFIBUS master (Class 1) using the DISPLAY_VALUE module (slot 7). It is possible to assign this display value to the appropriate line of the local display by means of an operating program (e.g. FieldCare).

*Output data*

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

*Status*

The status is not evaluated by the device.

### CONTROL_BLOCK module

With the CONTROL_BLOCK module (slot 8), the device can process device-specific control variables from the PROFIBUS master (Class 1) during cyclic data transmission (e.g. switching on positive zero return).

*Supported control variables of the CONTROL_BLOCK module*

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

| Module | Control variable |
|---|---|
| CONTROL_BLOCK | 0 → 2: Positive zero return ON<br>0 → 3: Positive zero return OFF<br>0 → 4: Run zero point adjustment<br>0 → 8: UNIDIRECTIONAL measuring mode<br>0 → 9: BIDIRECTIONAL measuring mode<br>0 → 24: Run SET UNIT TO BUS function |

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

*Example (change the output byte)*

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

*Output data*

| Byte 1 |
|---|
| Control |

### EMPTY_MODULE module

The measuring device is a modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties.
The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules.
Gaps between configured modules have to be assigned the "EMPTY_MODULE" module. For a more detailed description, see → 43.

### 6.6.4 Configuration examples with Simatic S7 HW-Config

**Example 1:**

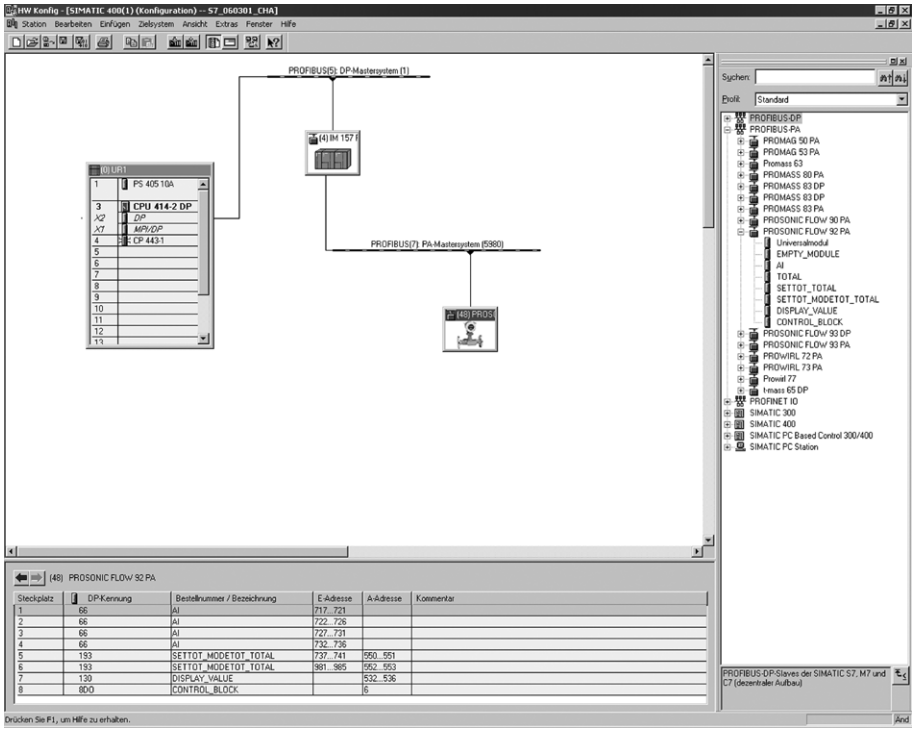



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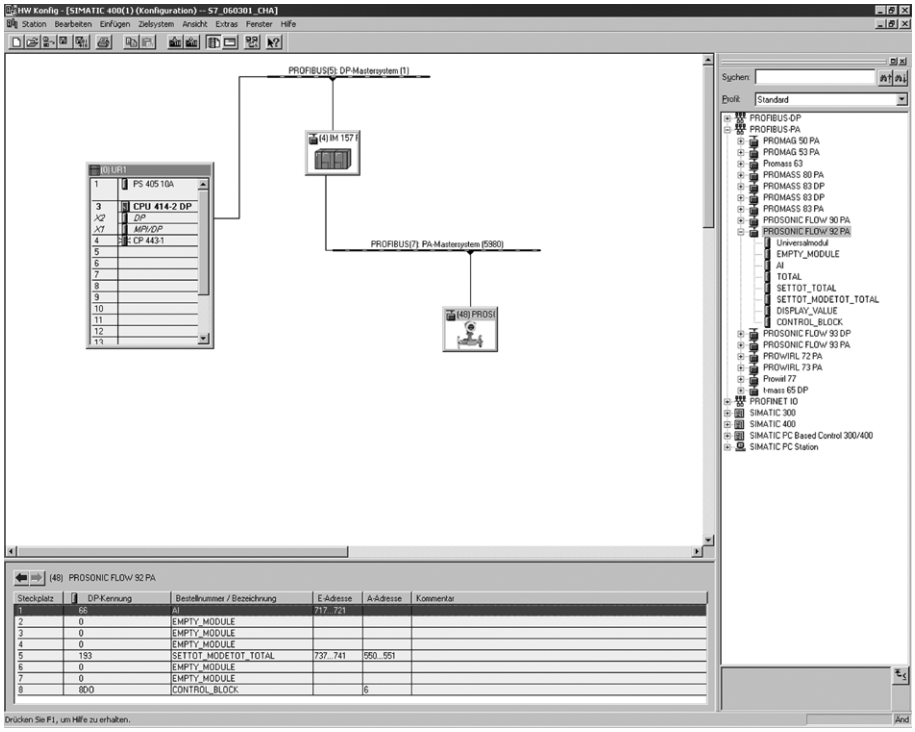
*Fig. 22: Full configuration using the Prosonic Flow 92 PROFIBUS PA GSD file.*

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

| Slot sequence | Module | Byte length input data | Byte length output data | Description |
|---|---|---|---|---|
| 1 | AI | 5 | – | **Analog Input function block 1**<br>Output variable → volume flow (factory setting) |
| 2 | AI | 5 | – | **Analog Input function block 2**<br>Output variable → Calculated mass flow (factory setting) |
| 3 | AI | 5 | – | **Analog Input function block 3**<br>Output variable → sound velocity (factory setting) |
| 4 | AI | 5 | – | **Analog Input function block 4**<br>Output variable → signal strength (factory setting) |
| 5 | AI | 5 | – | **Analog Input function block 5**<br>Output variable → flow velocity (factory setting) |
| 6 | SETTOT_MODETOT_TOTAL | 5 | 2 | **Totalizer function block 1**<br>TOTAL → output variable = totalized volume flow (factory setting)<br>SETTOT → set totalizer<br>MODETOT → totalizer configuration |
| 7 | SETTOT_MODETOT_TOTAL | 5 | 2 | **Totalizer function block 2**<br>TOTAL → output variable = totalized volume flow (factory setting)<br>SETTOT → set totalizer<br>MODETOT → totalizer configuration |
| 8 | DISPLAY_VALUE | – | 5 | Default value for local display |
| 9 | CONTROL_BLOCK | – | 1 | Control of device functions |

**Example 2:**




a0006185

*Fig. 23: In this configuration example, modules that are not needed are replaced by the EMPTY_MODULE. The Prosonic Flow 92 PROFIBUS PA GSD file is used.*

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 5) and the cyclic control of device functions CONTROL_BLOCK (slot 8) are activated. The volume flow (factory setting) is read out cyclically by the measuring device by means of the Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the volume flow (factory setting) by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

| Slot sequence | Module | Byte length input data | Byte length output data | Description |
|---|---|---|---|---|
| 1 | AI | 5 | – | **Analog Input function block 1**<br>Output variable → volume flow (factory setting) |
| 2 | EMPTY_MODULE | – | – | Empty |
| 3 | EMPTY_MODULE | – | – | Empty |
| 4 | EMPTY_MODULE | – | – | Empty |
| 5 | TOTAL | 5 | – | **Totalizer function block 1**<br>TOTAL → output variable =<br>totalized volume flow (factory setting) |
| 6 | EMPTY_MODULE | – | – | Empty |
| 7 | EMPTY_MODULE | – | – | Empty |
| 8 | CONTROL_BLOCK | – | 1 | Control of device functions |

## 6.7 PROFIBUS PA acyclic data transmission

Acyclic data transmission is used to transfer parameters during commissioning and maintenance or to display other measured variables that are not contained in the useful cyclic data traffic. Thus, parameters for recognizing, for controlling or for calibrating can be changed in the various blocks (Physical Block, Transducer Block, function block) while the device is involved in cyclic data transmission with a PLC.

The device supports the following basic types of acyclic data transmission:
- MS2AC communication with 2 available SAPs

### 6.7.1 Master Class 2 acyclic (MS2AC)

MS2AC deals with acyclic data transmission between a field device and a Class 2 master (e.g. FieldCare, Siemens PDM etc.). Here, the master opens a communication channel by means of an SAP (service access point) to access the device.
A Class 2 master must be made aware of all the parameters which should be exchanged with a device by means of PROFIBUS. This assignment is made to each individual parameter either in a device description (DD), a DTM (Device Type Manager) or within a software component in the master via slot and index addressing.

The following should be noted with MS2AC communication:
- As already explained, a Class 2 master accesses a device by means of special SAPs. Thus, the number of Class 2 masters that can simultaneously communicate with a device is restricted to the number of SAPs made available for this data transmission.
- When a Class 2 master is used, the cycle time of the bus system increases. This should be taken into account when programming the control system used.

# 6.8 Adjust

## 6.8.1 Zero point adjustment

All 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 → 68.

Consequently, the zero point adjustment is generally **not** necessary!

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small 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 that contain no gas or solid contents.
- 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

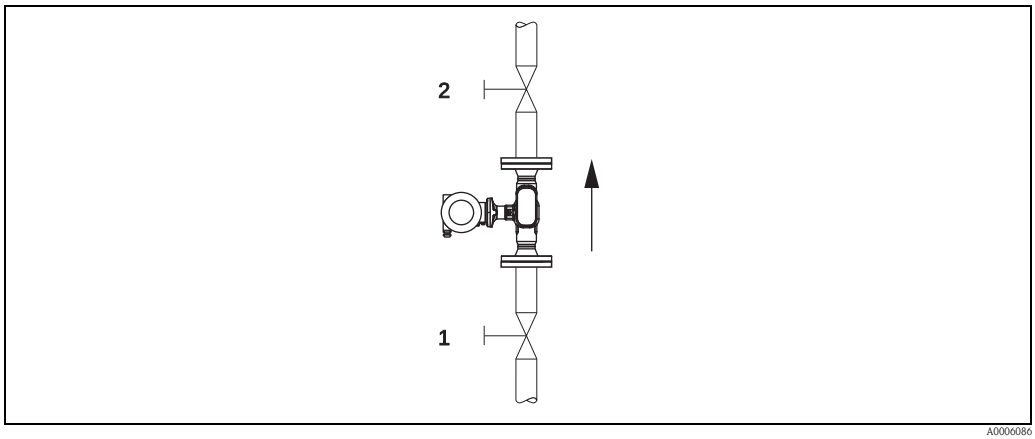



*Fig. 24: Zero point adjustment and shutoff valves*

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 Endress+Hauser representative.

### Performing a zero point adjustment

1. Operate the system until operating conditions have settled.
2. Stop the flow (v = 0 m/s).
3. Check the shutoff valves for leaks.
4. Check that operating pressure is correct.
5. Start the zero point adjustment (function description, see → 91):
   PROCESSPARAMETER → ZERO POINT ADJUSTMENT → START

Note!
The zero point value currently valid is displayed in the ZEROPOINT function (→ 91).

## 6.9 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.

### 6.9.1 HistoROM/T-DAT (transmitter–DAT)

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

Storing of specific parameter settings from the EEPROM to the T-DAT and vice versa has to be carried out by the user (= manual save function). Please refer to → 79 for a description of the related function (T-DAT SAVE/LOAD) and the exact procedure for managing data.

# 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

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.

# 8 Accessories

Various accessories, which can be ordered separately from Endress +Hauser, are available for the transmitter and the sensor. Your Endress+Hauser representative can provide detailed information on the order codes in question.

## 8.1 Device-specific accessories

| Accessory | Description | Order code |
|---|---|---|
| Transmitter<br>Proline Prosonic Flow 92 | Transmitter for replacement or for stock. Use the order code to define the following specifications:<br>– Approvals<br>– Degree of protection / version<br>– Cable entry<br>– Display / power supply / operation<br>– Software<br>– Outputs / inputs | 92XXXX - XXXXX * * * * * * |

## 8.2 Measuring principle-specific accessories

| Accessory | Description | Order code |
|---|---|---|
| Mounting kit for transmitter | Mounting kit for remote version, suitable for:<br>– Wall mounting<br>– Pipe mounting | DK8WM - B |

## 8.3 Service-specific accessories

| Accessory | Description | Order code |
|---|---|---|
| Applicator | Software for selecting and planning 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 – * |
| FieldCare | A modular software package consisting of the service program "FieldCare" for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and pressure measuring instruments (evolution series) as well as the "Fieldtool" service program for the configuration and diagnosis of Proline flowmeters.<br>The Proline flowmeters are accessed via a service interface or via the Commubox FXA291.<br>Contents of the "ToF Tool – Fieldtool Package":<br>– Commissioning, maintenance analysis<br>– Measuring device configuration<br>– Service functions<br>– Visualization of process data<br>– Troubleshooting<br>– Access to the verification data and software update for the "Fieldcheck" flow simulator<br>Contact your Endress+Hauser representative for more information. | DXS10 – * * * * * |

| Accessory | Description | Order code |
|---|---|---|
| Fieldcheck | Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification.<br><br>Contact your Endress+Hauser representative for more information. | 50098801 |
| FieldCare | FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. | See the product page on the Endress+Hauser website: www.endress.com |
| Commubox FXA291 | The Commubox FXA291 connects Endress+Hauser field devices with a CDI (= Endress+Hauser Common Data Interface) to the USB port of a computer or laptop. This makes it possible to remotely operate and execute service functions of field devices with the aid of an Endress+Hauser operating program, e.g. FieldCare software platform for plant-specific asset management. | 51516983 |

# 9 Troubleshooting

## 9.1 Troubleshooting instructions

Always start troubleshooting with the following checklist if faults occur after commissioning or during operation. This takes you directly (via various queries) 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<br>2. Electronics defective → order spare part |
| 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<br>2. Display module defective → order spare part<br>3. Electronics defective → order spare part |
| 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. |
| No signal output despite measured value display | Electronics board defective → order spare part |

▼

**Diagnosis code on the display**

The measuring device is monitored during commissioning and operation. The results are shown on the display in the form of diagnosis code messages. Diagnosis code messages help the user to detect current conditions and faults and errors. In accordance with the diagnosis code displayed, it is then possible to maintain the measuring device.

Displaying the device status/diagnosis code on PROFIBUS PA → 53

There are 4 categories of diagnosis code messages: F, C, S, and M:

**Category F (failure):**
The device does not function as it should such that the measured values cannot be used. This also includes some process errors.

**Category C (function check):**
The device is being serviced, assembled, configured or is in the simulation mode.
The output signals do not correspond to the actual process values and thus cannot be used.

**Category S (outside specification):**
One or more measured values (e.g. flow etc.) are outside the specified limit values that were specified at the factory or by the users themselves. Diagnosis messages of this category are also displayed during measuring device startup or during cleaning processes.

**Category M (maintenance):**
The measuring signals are still valid but are affected by factors such as wear, corrosion or fouling.

The diagnosis code messages are grouped as follows within the F, C, S and M categories.

| | |
|---|---|
| **No. 000 – 199:** | Messages affecting the sensor. |
| **No. 200 – 399:** | Messages affecting the transmitter. |
| **No. 400 – 599:** | Configuration-related messages (simulation, download, data storage etc.) |
| **No. 800 – 999:** | Process-specific messages |

▼

| | |
|---|---|
| **Faulty connection to control system** | |
| No connection can be made between the control system and the device. Check the following points: | |
| Fieldbus connection | Check the data cable<br>Terminal 1 = PA +<br>Terminal 2 = PA – |
| Fieldbus connector | ■ Check pin assignment/wiring<br>■ Check connection between connector/fieldbus port.<br>Is the coupling ring tightened correctly? |
| Fieldbus voltage | Check that a min. bus voltage of 9 V DC is present at terminals 1/2.<br>Permissible range: 9 to 32 V DC |
| Network structure | Check permissible fieldbus length and number of spurs. |
| Basic current | Is there a basic current of min. 16 mA? |
| Bus address | Check bus address: make sure there are no double assignments |
| Bus termination | Has the PROFIBUS network been terminated correctly?<br>Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in data transmission. |
| Current consumption, permissible feed current | Check the current consumption of the bus segment:<br>The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply. |
| **Other errors (without error message)** | |
| Some other error has occurred. | Diagnosis and remedial measures, see → 59. |

# 9.2 Displaying the device status on PROFIBUS PA

## 9.2.1 Display in the operating program (acyclic data transmission)

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

SUPERVISION → ACTUAL SYS. COND (→ 94)

## 9.2.2 Display in the PROFIBUS master system (cyclic data transmission)

If the AI or TOTAL modules are configured for cyclic data transmission, the device status is coded in accordance with PROFIBUS Profile Specification 3.01 and transmitted with the measured value to the PROFIBUS master (Class 1) by means of the quality byte (byte 5). The quality byte is split into the "quality status", "quality substatus" and "limits" segments.

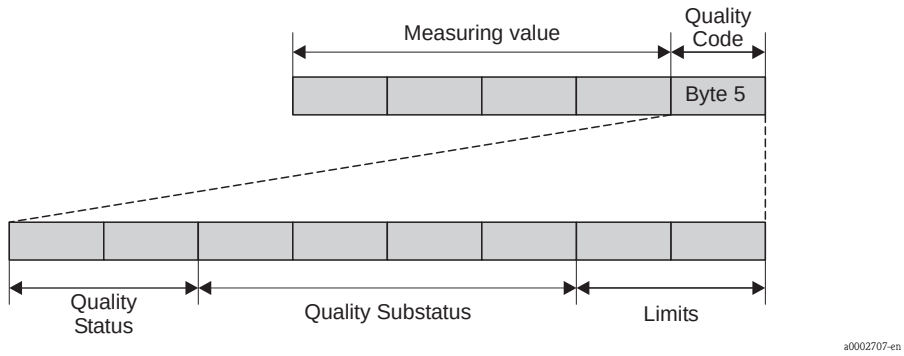



*Fig. 25: Structure of the quality byte*

The contents of a quality byte of an Analog Input function block depends on the failsafe mode that has been configured for it. Depending on which failsafe mode has been set in the FAILSAFE MODE function, the following status information is transmitted to the PROFIBUS master (Class 1) by means of the quality byte:

- For FAILSAFE MODE → FAILSAFE VALUE :

| Quality code (HEX) | Quality status | Quality substatus | Limits |
|---|---|---|---|
| 0x48<br>0x49<br>0x4A | UNCERTAIN | Substitute set | OK<br>Low<br>High |

- For FAILSAFE MODE → LAST GOOD VALUE (factory setting)

| A valid output value was available before the failure | | | | A valid output value was not available before the failure | | | |
|---|---|---|---|---|---|---|---|
| Quality code (hex) | Quality Status | Quality Substatus | Limits | Quality code (hex) | Quality Status | Quality substatus | Limits |
| 0x44<br>0x45<br>0x46 | UNCERTAIN | Last usable value | OK<br>Low<br>High | 0x4C<br>0x4D<br>0x4E | UNCERTAIN | Initial Value | OK<br>Low<br>High |

- For FAILSAFE MODE → WRONG VALUE: status information (→ 54).

Note!
The FAILSAFE MODE function can be configured by means of an operating program (e.g. FieldCare) in the appropriate Analog Input function block 1 to 4.

## 9.3 Diagnosis code messages

### 9.3.1 Category F diagnosis code messages

| **Code**<br>**Local display** | **PROFIBUS measured value status**<br>**1 = Quality code (hex)**<br>**2 = Quality status**<br>**3 = Quality substatus**<br>**4 = Limits**<br>**5 = Advanced diagnosis message** | **Cause** | **Remedy:** |
|---|---|---|---|
| **F 001**<br>Device fault | 1 = 0x0C<br>2 = BAD<br>3 = Device fault<br>4 = Constant<br>5 = Device failure | Serious device error | Replace the amplifier board |
| **F 062 - 1**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection down CH1 | Connection between "channel 1 down" sensor and transmitter interrupted. | ■ Check cable connection between the sensor and transmitter<br>■ Sensor possibly defective |
| **F 062 - 2**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection up CH1 | Connection between "channel 1 up" sensor and transmitter interrupted. | |
| **F 062 - 3**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection down CH2 | Connection between "channel 2 down" sensor and transmitter interrupted. | |
| **F 062 - 4**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection up CH2 | Connection between "channel 2 up" sensor and transmitter interrupted. | |
| **F 062 - 5**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection down CH3 | Connection between "channel 3 down" sensor and transmitter interrupted. | |
| **F 062 - 6**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection up CH3 | Connection between "channel 3 up" sensor and transmitter interrupted. | |
| **F 062 - 7**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection down CH4 | Connection between "channel 4 down" sensor and transmitter interrupted. | |
| **F 062 - 8**<br>Sensor connection | 1 = 0x0C<br>2 = BAD<br>3 = Sensor connection<br>4 = Constant<br>5 = Sensor connection up CH4 | Connection between "channel 4 up" sensor and transmitter interrupted. | |
| **F 242**<br>Incompatible software | 1 = 0x0C<br>2 = BAD<br>3 = Incompatible software<br>4 = Constant<br>5 = Software incompatible | The I/O board and the amplifier board are not compatible | Replace the amplifier board |

| **Code**<br>**Local display** | **PROFIBUS measured value status**<br>**1 = Quality code (hex)**<br>**2 = Quality status**<br>**3 = Quality substatus**<br>**4 = Limits**<br>**5 = Advanced diagnosis message** | **Cause** | **Remedy:** |
|---|---|---|---|
| **F 262**<br>Module connection | 1 = 0x0C<br>2 = BAD<br>3 = Module connection<br>4 = Constant<br>5 = Module connection com I/O | Internal communication error on the amplifier board | Replace the amplifier board |
| **F 282 - 1**<br>Data storage | 1 = 0x0C<br>2 = BAD<br>3 = Data storage<br>4 = Constant<br>5 = Data storage amplifier | Amplifier:<br>Faulty EEPROM | Replace the amplifier board |
| **F 282 - 2**<br>Data storage | 1 = 0x0C<br>2 = BAD<br>3 = Data storage<br>4 = Constant<br>5 = Data storage com | COM module:<br>Faulty EEPROM | Replace COM module |
| **F 282 - 3**<br>Data storage | 1 = 0x0C<br>2 = BAD<br>3 = Data storage<br>4 = Constant<br>5 = Data storage T-DAT | HistoROM/T-DAT is not plugged into the amplifier board or is defective | Plug HistoROM/T-DAT into the amplifier board or replace it. |
| **F 283 - 1**<br>Checksum error | 1 = 0x0C<br>2 = BAD<br>3 = Checksum error<br>4 = Constant<br>5 = Memory content com | Amplifier:<br>Error when accessing data of the EEPROM | ■ See TROUBLESHOOTING function, → 🖹 51<br>■ Contact your Endress+Hauser representative. |
| **F 283 - 2**<br>Checksum error | 1 = 0x0C<br>2 = BAD<br>3 = Checksum error<br>4 = Constant<br>5 = Memory content amplifier | COM module:<br>Error when accessing data of the EEPROM | ■ See TROUBLESHOOTING function, → 🖹 51<br>■ Contact your Endress+Hauser representative. |
| **F 283 - 3**<br>Checksum error | 1 = 0x0C<br>2 = BAD<br>3 = Checksum error<br>4 = Constant<br>5 = Memory content T-DAT | Error accessing the values of the HistoROM/ T-DAT<br>■ HistoROM/T-DAT is not plugged into the amplifier board or is defective<br>■ Amplifier board defective | ■ Run the T-DAT LOAD function, select SAVE, see → 🖹 79<br>■ Plug HistoROM/T-DAT into the amplifier board or replace it.<br>■ Replace the amplifier board. |
| **F 283 - 4**<br>Checksum error | 1 = 0x0C<br>2 = BAD<br>3 = Checksum error<br>4 = Constant<br>5 = Memory content powerfail | Totalizer checksum error | ■ See TROUBLESHOOTING function, → 🖹 51<br>■ Restart measuring device<br>■ Replace the amplifier board if necessary |
| **F 881 - 1**<br>Sensor signal | 1 = 0x0C<br>2 = BAD<br>3 = Sensor signal<br>4 = Constant<br>5 = Sensor signal low CH1 | Attenuation of acoustic measurement section is too high | ■ It is possible that the fluid exhibits too much attenuation<br>■ The measuring pipe is possibly only slightly full<br>■ Buildup<br>■ Fouling<br>■ Solids content to high<br>■ Air /gas content to high |
| **F 881- 2**<br>Sensor signal | 1 = 0x0C<br>2 = BAD<br>3 = Sensor signal<br>4 = Constant<br>5 = Sensor signal low CH2 | | |
| **F 881- 3**<br>Sensor signal | 1 = 0x0C<br>2 = BAD<br>3 = Sensor signal<br>4 = Constant<br>5 = Sensor signal low CH3 | | |
| **F 881- 4**<br>Sensor signal | 1 = 0x0C<br>2 = BAD<br>3 = Sensor signal<br>4 = Constant<br>5 = Sensor signal low CH4 | | |

### 9.3.2 Category C diagnosis code messages

| **Code**<br>**Local display** | **PROFIBUS measured value status**<br>**1 = Quality code (hex)**<br>**2 = Quality status**<br>**3 = Quality substatus**<br>**4 = Limits**<br>**5 = Advanced diagnosis message** | **Cause** | **Remedy:** |
|---|---|---|---|
| **C 281**<br>Initialization | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Initialization<br>4 = High/low limits<br>5 = Initialization | Initialization of channel 1/2 in progress.<br>All outputs are set to 0. | Wait until process is finished. |
| **C 284**<br>Software update | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Software update<br>4 = High/low limits<br>5 = Software update | New amplifier or communication module software version is being loaded to the device. Currently no other functions are possible. | Wait until process is finished.<br>The device is restarted automatically. |
| **C 411**<br>Upload/download | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Upload/download<br>4 = High/low limits<br>5 = Upload/download | Up- or downloading the device data via configuration program. Currently no other functions are possible. | Wait until process is finished. |
| **C 412**<br>Write backup | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Write backup<br>4 = High/low limits<br>5 = Write backup T-DAT | DAT transmitter:<br>Data back-up (download) to T-DAT failed or error when accessing (uploading) the values saved in the T-DAT. | ▪ Check whether the T-DAT is correctly plugged into the amplifier board.<br>▪ Replace T-DAT if defective.<br>▪ Replace measuring electronics boards if necessary. |
| **C 413**<br>Read backup | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Read backup<br>4 = High/low limits<br>5 = Read backup T-DAT | | |
| **C 431 – 1**<br>Adjust | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Adjustment<br>4 = High/low limits<br>5 = Zero point adjust fail cust. | Static zero point adjustment is not possible or has been canceled. | Check whether there is zero flow (flow velocity = 0 m/s). |
| **C 431 – 2**<br>Adjust | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Adjustment<br>4 = High/low limits<br>5 = Zero point adjust fail CH1 | Static zero point adjustment for channel 1 is not possible or has been canceled. | Check whether there is zero flow (flow velocity = 0 m/s). |
| **C 431 – 3**<br>Adjust | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Adjustment<br>4 = High/low limits<br>5 = Zero point adjust fail CH2 | Static zero point adjustment for channel 2 is not possible or has been canceled. | Check whether there is zero flow (flow velocity = 0 m/s). |
| **C 431 – 4**<br>Adjust | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Adjustment<br>4 = High/low limits<br>5 = Zero point adjust fail CH3 | Static zero point adjustment for channel 3 is not possible or has been canceled. | Check whether there is zero flow (flow velocity = 0 m/s). |
| **C 431 – 5**<br>Adjust | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Adjustment<br>4 = High/low limits<br>5 = Zero point adjust fail CH4 | Static zero point adjustment for channel 4 is not possible or has been canceled. | Check whether there is zero flow (flow velocity = 0 m/s). |
| **C 431 – 6**<br>Adjust | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Adjustment<br>4 = High/low limits<br>5 = Zero point adjust running | Zero point adjustment is being carried out. | – |

| **Code**<br>**Local display** | **PROFIBUS measured value status**<br>**1 = Quality code (hex)**<br>**2 = Quality status**<br>**3 = Quality substatus**<br>**4 = Limits**<br>**5 = Advanced diagnosis message** | **Cause** | **Remedy:** |
|---|---|---|---|
| **C 453**<br>Value suppression | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Value suppression<br>4 = High/low limits<br>5 = Meas. value suppression | Positive zero return active. | Switch off positive zero return. |
| **C 481**<br>Diagnostic active | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Diagnostic active<br>4 = High/low limits<br>5 = Diagnostic active | The measuring device is being checked on site via the test and simulation device. | – |
| **C 485**<br>Simulation value | 1 = 0x60<br>2 = UNCERTAIN - simulated value<br>3 = Simulation value<br>4 = High/low limits<br>5 = Simulation value | Simulation of a measured variable active (e.g. volume flow) | Switch off simulation |

### 9.3.3 Category S diagnosis code messages

| Code<br>Local display | PROFIBUS measured value status<br>1 = Quality code (hex)<br>2 = Quality status<br>3 = Quality substatus<br>4 = Limits<br>5 = Advanced diagnosis message | Cause | Remedy: |
|---|---|---|---|
| **S 823 – 1**<br>Ambient temp. | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Ambient temp.<br>4 = High/low limits<br>5 = Amb. air temperature low | The limit value for the minimum permissible ambient temperature is undershot. | ■ Check whether the device has been correctly insulated.<br>■ Check whether the transmitter is pointing downwards or to the side.<br>■ Increase the ambient temperature. |
| **S 823 – 2**<br>Ambient temp. | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Ambient temp.<br>4 = High/low limits<br>5 = Amb. air temperature high | The limit value for the maximum permissible ambient temperature is overshot. | ■ Check whether the device has been correctly insulated.<br>■ Check whether the transmitter is pointing upwards or to the side.<br>■ Reduce the ambient temperature. |
| **S 861 – 1**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium volume flow | Advanced diagnostics:<br>The volume flow is outside the range set in the diagnosis functions (service). | – |
| **S 861 – 2**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium flow velocity | Advanced diagnostics:<br>The flow velocity is outside the range set in the diagnosis functions (service). | – |
| **S 861 – 3**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium signal strength | Advanced diagnostics:<br>The signal strength is outside the range set in the diagnosis functions (service). | – |
| **S 861 – 4**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium sound velocity | Advanced diagnostics:<br>The sound velocity is outside the range set in the diagnosis functions (service). | – |
| **S 861 – 5**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium acceptance rate | Advanced diagnostics:<br>The acceptance rate is outside the range set in the diagnosis functions (service). | – |
| **S 861 – 6**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium profile factor | Advanced diagnostics:<br>The profile factor is outside the range set in the diagnosis functions (service). | – |
| **S 861 – 7**<br>Medium | 1 = 0x40<br>2 = UNCERTAIN - non specific<br>3 = Medium<br>4 = High/low limits<br>5 = Meas. medium symmetry | Advanced diagnostics:<br>The symmetry is outside the range set in the diagnosis functions (service). | – |

## 9.4 Process errors without messages

| Symptoms | Remedial measures |
|---|---|
| ✎ Note!<br>You may have to change or correct settings in certain functions of the function matrix in order to rectify faults. The functions outlined below, such as FLOW DAMPING etc., are described in detail in the "Description of device functions" section. | |
| Measured value reading fluctuates even though flow is steady. | 1. Check the fluid for presence of gas bubbles.<br>2. "FLOW DAMPING" function → increase value (→ SYSTEM PARAMETER)<br>3. "DISPLAY DAMPING" function → increase value (→ USER INTERFACE) |
| Flow values are negative, even though the fluid is flowing forwards through the pipe. | ▪ Remote version: check wiring → 📄 19.<br>4. Change the setting in the "INSTALLATION DIRECTION SENSOR" function accordingly (change sign) |
| The measured value display or measured value output pulsates or fluctuates, e.g. because of reciprocating pump, peristaltic pump, diaphragm pump or pump with similar conveying characteristics. | 1. "FLOW DAMPING" function → increase value (→ SYSTEM PARAMETER)<br>2. "DISPLAY DAMPING" function → increase value (→ USER INTERFACE)<br>3. If the problem persists despite these measures, a pulsation damper will have to be installed between the pump and the flowmeter. |
| 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.<br>2. Activate "ON-VALUE LF CUTOFF", i.e. enter or increase the value for the low flow cutoff (→ PROCESSPARAMETER). |
| The measured variable for the flow is always 0, irrespective of the current flow signal. | Low flow cutoff too high. Reduce corresponding value in the "LOW FLOW CUTOFF" function. |
| No flow signal. | 1. Check whether the piping is completely filled. The piping must always be completely filled for accurate and reliable flow measurement.<br>2. Check whether all the packaging material, including the meter body protective covers, was completely removed before mounting the device.<br>3. Check whether the desired electrical output signal was connected correctly. |
| The fault cannot be rectified or some other fault not described above has occurred.<br>In these instances, please contact your Endress+Hauser representative. | The following options are available for tackling problems of this nature:<br>**Request the services of an Endress+Hauser service technician**<br>If you contact our service organization to have a service technician sent out, please be ready with the following information:<br>– Brief description of the fault<br>– Nameplate specifications: order code and serial number<br>**Return devices to Endress+Hauser**<br>The procedures on must be carried out before you return a measuring device requiring repair or calibration to Endress+Hauser.<br>Always enclose a fully completed "Declaration of Contamination" form with the flowmeter. A copy of the Dangerous Goods Sheet can be found at the end of these Operating Instructions.<br>**Replace transmitter electronics**<br>Components in the electronics defective → order spare part |

## 9.5 Spare parts

The previous sections contain a detailed troubleshooting guide.
The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.
Troubleshooting 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 representative by providing the serial number printed on the transmitter's nameplate.

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

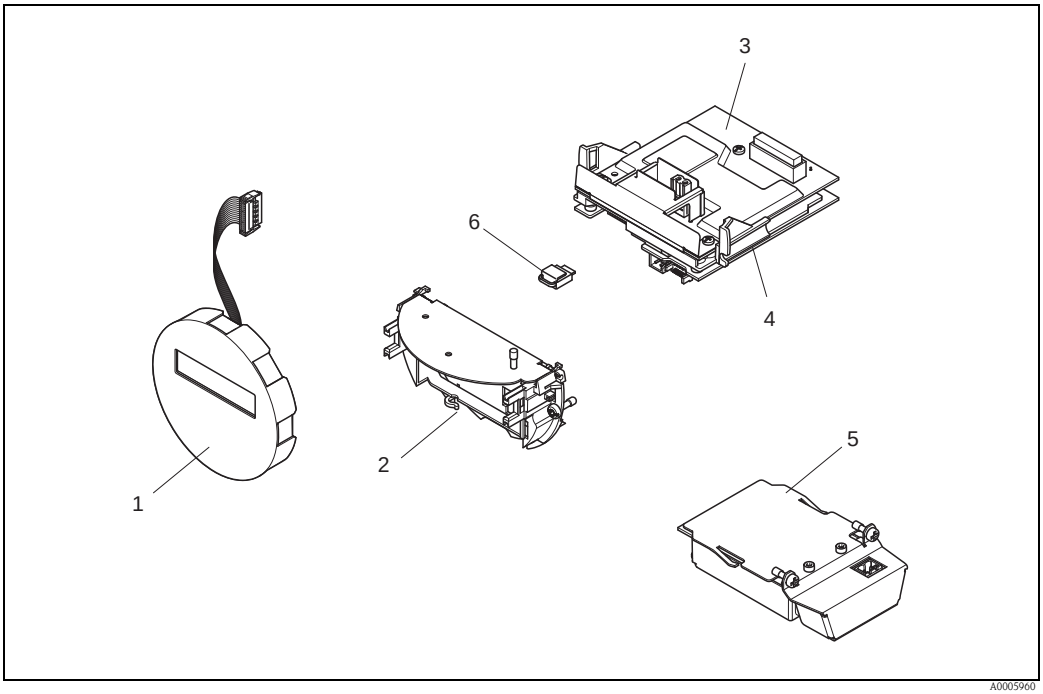



*Fig. 26: Spare parts for Prosonic Flow 92F PROFIBUS PA transmitter*

*1 Display module*
*2 Board holder*
*3 I/O board (COM module), non-Ex/Ex i version*
*4 Amplifier board*
*5 I/O board (COM module), Ex d version*
*6 HistoROM/T-DAT data storage device*

### 9.5.1 Installing and removing electronics boards

**Non-Ex/Ex i version**

Warning!
- Risk of damaging electronic components (ESD protection).
  Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface, purpose-built for electrostatically sensitive devices!
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Caution!
Use only genuine Endress+Hauser parts.

*Procedure when installing/removing electronics boards* → *27:*

1. Unscrew the cover (1) of the electronics compartment from the transmitter housing.
2. Remove the display module (2) from the retaining rails (3) and refit onto right retaining rail with the left side (this secures the display module).
3. Loosen the fixing screw (4) of the cover of the connection compartment (5) and fold down the cover.
4. Disconnect terminal connector (6) from the I/O board (COM module).
5. Fold up the plastic cover (7).
6. Remove the signal cable connector (8) from the amplifier board and release from the cable holder.
7. Remove the ribbon-cable connector (9) from the amplifier board and release from the cable holder (10).
8. Remove the display module (2) from the retaining rail (3) and put it to the side.
9. Fold down the plastic cover (7) again.
10. Release both screws (11) of the board holder (12).
11. Pull the board holder (12) out completely.
12. Press the side latches (13) of the board holder (12) and separate the board holder (12) from the board body (14).
13. Replace the I/O board (COM module) (16):
    – Loosen the three fixing screws (15) of the I/O board (COM module).
    – Remove the I/O board (COM module) (16) from the board body (14).
    – Set a new I/O board (COM module) on the board body and screw tight.
14. Replace the amplifier board (18):
    – Loosen the fixing screws (17) of the amplifier board.
    – Remove the amplifier board (18) from the board body (14).
    – Set the new amplifier board onto board body and screw tight.
15. Installation is the reverse of the removal procedure.

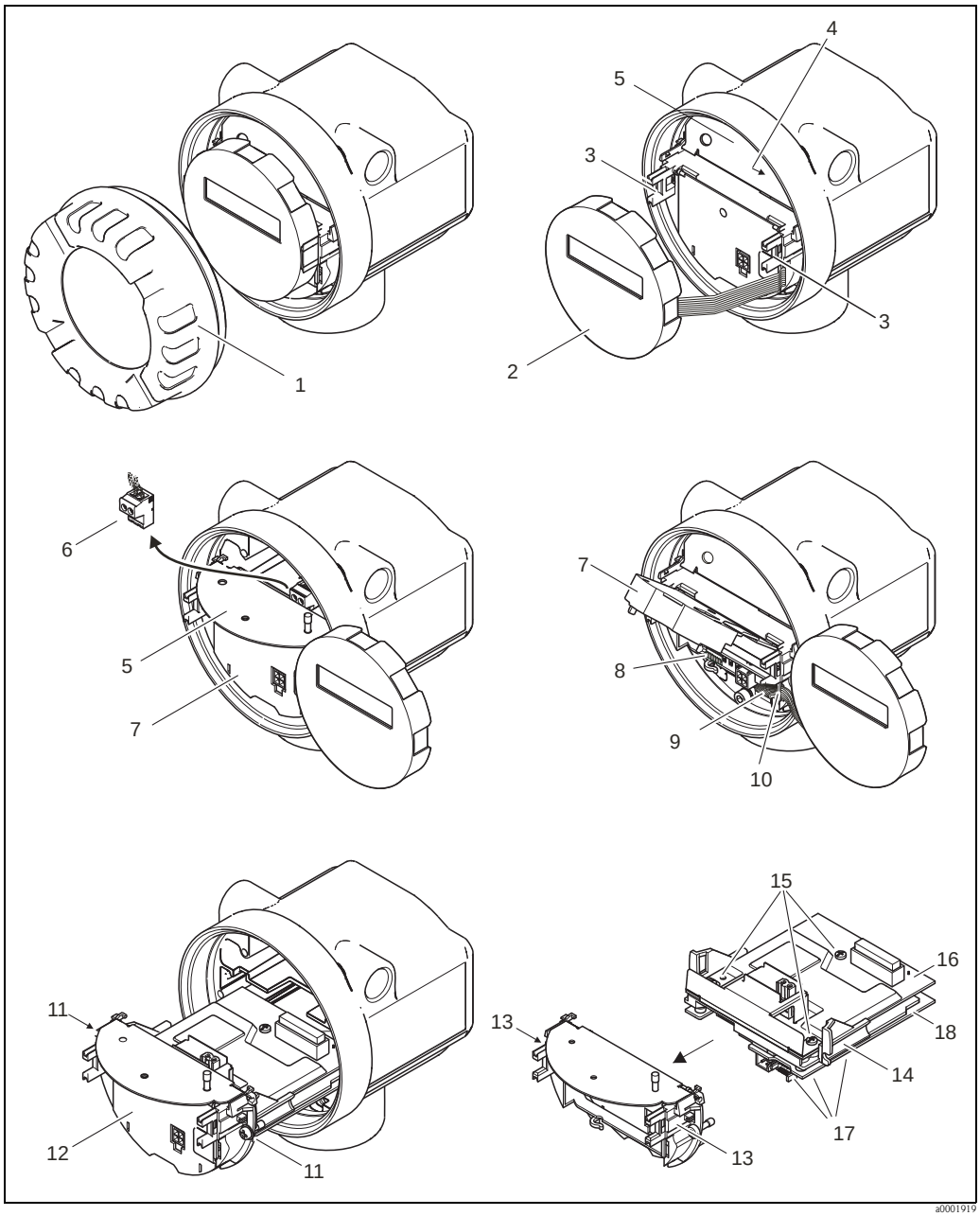



*Fig. 27: Installing and removing electronics boards, non-Ex/Ex-i version*

*1 Electronics compartment cover*
*2 Display module*
*3 Display module retaining rails*
*4 Fixing screws for cover of connection compartment*
*5 Connection compartment*
*6 Terminal connector*
*7 Plastic cover*
*8 Signal cable connector*
*9 Ribbon cable retainer*
*10 Display module ribbon-cable connector*
*11 Board holder threaded connection*
*12 Board holder*
*13 Board holder latches*
*14 Board body*
*15 I/O board (COM module) threaded connection*
*16 I/O board (COM module)*
*17 Amplifier board threaded connection*
*18 Amplifier board*

**Ex d version**

Warning!
- Risk of damaging electronic components (ESD protection).
  Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface, purpose-built for electrostatically sensitive devices!
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Caution!
Use only genuine Endress+Hauser parts.

*Procedure when installing/removing electronics boards* → *28:*

**Installing/removing the I/O board (COM module)**

1. Release securing clamp (1) of the connection compartment cover (2).
2. Unscrew the connection compartment cover (2) from the transmitter housing.
3. Disconnect terminal connector (3) from the I/O board (COM module) (5).
4. Release the threaded joint (4) of the I/O board (COM module) (5) and pull it out slightly.
5. Disconnect the connecting cable connector (6) from the I/O board (COM module) (5).
6. Completely remove the I/O board (COM module) (5).
7. Installation is the reverse of the removal procedure.

**Installing/removing the amplifier board**

1. Unscrew the cover (7) of the electronics compartment from the transmitter housing.
2. Remove the display module (8) from the retaining rails (7) and refit onto right retaining rail with the left side (this secures the display module).
3. Fold up the plastic cover (10).
4. Remove the ribbon-cable connector of the display module (8) from the amplifier board and release from the cable holder.
5. Remove the signal cable connector (11) from the amplifier board and release from the cable holder.
6. Release the fixing screw (12) and fold down the cover (13).
7. Release both screws (14) of the board holder (15).
8. Pull out the board holder (15) slightly and disconnect connecting cable connector (16) from the board body.
9. Pull the board holder (15) out completely.
10. Press the side latches (17) of the board holder and separate the board holder (15) from the board body (18).
11. Replace the amplifier board (20):
    – Loosen the fixing screws (19) of the amplifier board.
    – Remove the amplifier board (20) from the board body (18).
    – Set the new amplifier board onto board body and screw tight.
12. Installation is the reverse of the removal procedure.

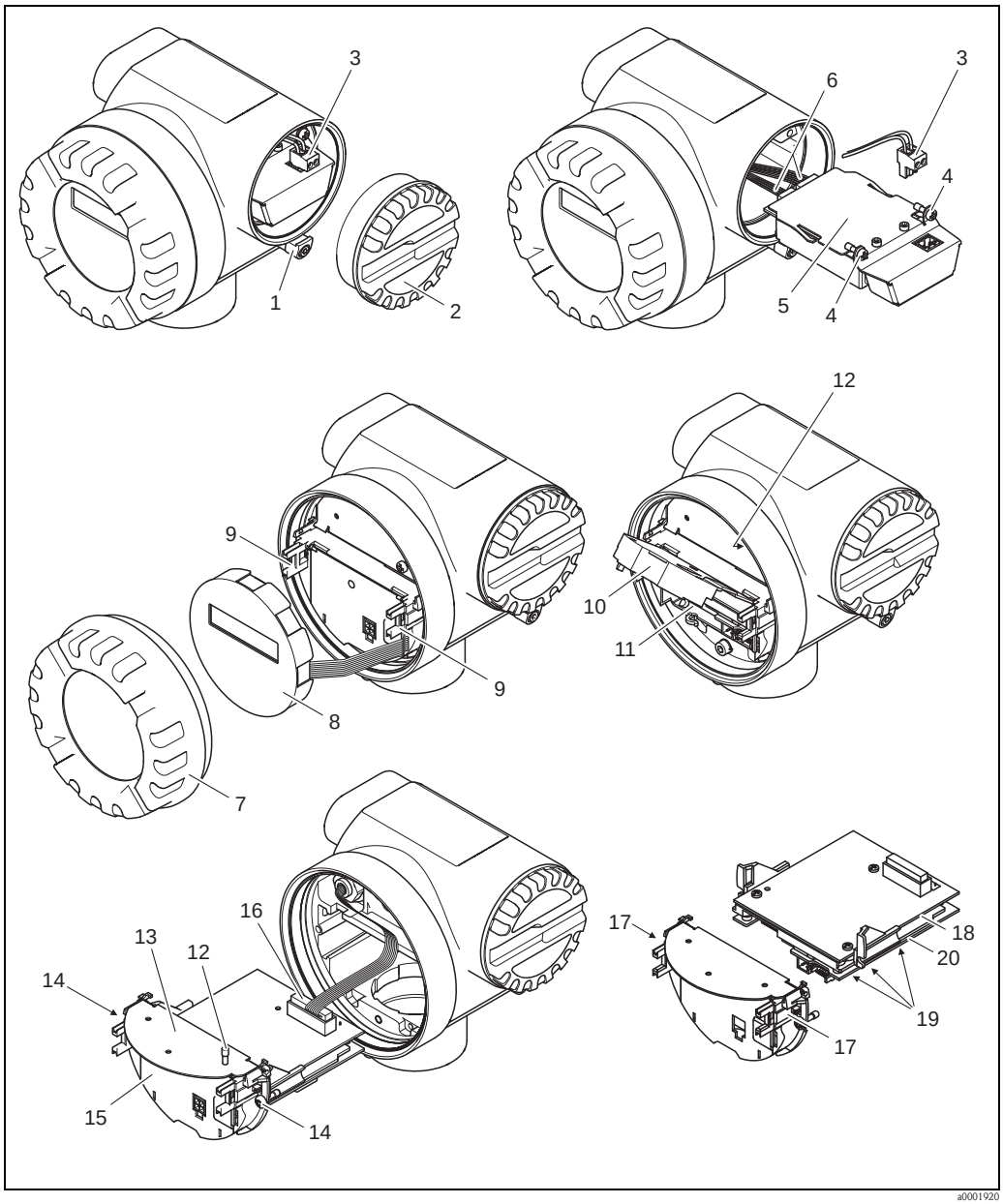



*Fig. 28: Installing and removing electronics boards Ex d version*

*1 Clamp for cover of connection compartment*
*2 Cover of connection compartment*
*3 Terminal connector*
*4 I/O board (COM module) threaded connection*
*5 I/O board (COM module)*
*6 Connecting cable connector, I/O module*
*7 Electronics compartment cover*
*8 Display module*
*9 Display module retaining rails*
*10 Plastic cover*
*11 Signal cable connector*
*12 Fixing screws for cover of connection compartment*
*13 Connection compartment cover*
*14 Board holder threaded connection*
*15 Board holder*
*16 Connecting cable connector*
*17 Board holder latches*
*18 Board body*
*19 Amplifier board threaded connection*
*20 Amplifier board*

## 9.6 Return

Caution!
Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.
The following steps must be taken before returning a flow measuring device to Endress+Hauser, e.g. for repair or calibration:

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

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

## 9.7 Disposal

Observe the regulations applicable in your country!

## 9.8 Software history

| Date | Software version | Changes to software | Operating Instructions |
|---|---|---|---|
| 12.2010 | PROFIBUS PA<br>1.01.XX | Software Update:<br>– DN 150 to 300 | 71125109/12.10 |
| 06.2006 | PROFIBUS PA<br>1.00.XX | Original software, can be operated via:<br>– FieldCare<br>– Simatic PDM | 71027174/06.06 |

# 10 Technical data

## 10.1 Technical data at a glance

### 10.1.1 Application

→ 📄 5

### 10.1.2 Function and system design

Measuring principle

Prosonic Flow operates on the principle of transit time difference.

Measuring system

→ 📄 7

### 10.1.3 Input

Measured variable

Flow velocity (transit time difference proportional to flow velocity)

Measuring range

Typically v = –10 to 10 m/s with the specified accuracy

| Nominal diameter | | Range for full scale values (liquids) $m_{min(F)}$...$m_{max(F)}$ | |
|---|---|---|---|
| mm | inch | SI-Unit | US-Unit |
| 25 | 1" | 0 to 300 $dm^3$/min | 0 to 80 gal/min |
| 40 | 1½" | 0 to 750 $dm^3$/min | 0 to 200 gal/min |
| 50 | 2" | 0 to 1100 $dm^3$/min | 0 to 300 gal/min |
| 80 | 3" | 0 to 3000 $dm^3$/min | 0 to 800 gal/min |
| 100 | 4" | 0 to 4700 $dm^3$/min | 0 to 1250 gal/min |
| 150 | 6" | 0 to 10 $m^3$/min | 0 to 2800 gal/min |
| 200 | 8" | 0 to 20 $m^3$/min | 0 to 5280 gal/min |
| 250 | 10" | 0 to 30 $m^3$/min | 0 to 7930 gal/min |
| 300 | 12" | 0 to 40 $m^3$/min | 0 to 10570 gal/min |

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.

### 10.1.4 Output

Output signal

*PROFIBUS PA interface*

- PROFIBUS PA in accordance with IEC 61158 (MBP), galvanically isolated
- Profile Version 3.01
- Data transmission rate: 31.25 kBaud
- Current consumption: 16 mA
- Permitted supply voltage: 9 to 32 V; 0.5 W
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Signal coding: Manchester II
- Bus address can be configured via miniature switches at the device or operating program

| | |
|---|---|
| Signal on alarm | *PROFIBUS PA*<br>Status and alarm messages in accordance with PROFIBUS Profile Version 3.01 |
| Low flow cutoff | Switch points for low flow cutoff can be selected as required. |
| Galvanic isolation | All circuits for inputs, outputs, and power supply are galvanically isolated from each other. |

### 10.1.5 Power supply

| | |
|---|---|
| Electrical connections | ■ → 📄 19 |
| Supply voltage | 9 to 32 V DC |
| Cable entry | *Fieldbus cable*<br>■ Cable entry M20 x 1.5 (8 to 12 mm) (0.32" to 0.47")<br>■ Thread for cable entries, 1/2" NPT, G 1/2" (not for threaded version) |
| Cable specifications | ■ Use a connecting cable with a continuous service temperature range of at least:<br>–40 °C to (permitted max. ambient temperature plus 10 °C) or<br>–40 °F to (permitted max. ambient temperature plus 18 °F).<br>■ Remote version connecting cable → 📄 19 |
| Power supply failure | ■ Totalizer stops at the last value determined (can be configured).<br>■ EEPROM and T-DAT save measuring system data if power supply fails.<br>■ Error messages (incl. value of operated hours counter) are stored. |

### 10.1.6 Performance characteristics

| | |
|---|---|
| Reference operating conditions | *Error limits following ISO/DIS 11631:*<br>■ 20 to 30 °C (68 to 86 °F); 2 to 4 bar (30 to 60 psi)<br>■ Calibration systems as per national norms<br>■ Zero point calibrated under operating conditions |
| Maximum measured error | **DN 25 to DN 300 (1 to 12")**<br>0.5 to 10 m/s (1.6 ft to 33 ft/s): ±0.5% of reading *<br><br>**Optional for DN 80 to DN 300 (3 to 12")**<br>0.5 to 10 m/s (1.6 ft to 33 ft/s): ±0.3% of reading *<br>* For a Reynolds number > 10000 |
| Repeatability | ± 0.2% o.r. (of reading) |

### 10.1.7 Operating conditions: Installation

| | |
|---|---|
| Installation instructions | → 📄 11 |
| Inlet and outlet run | → 📄 13 |
| Length of connecting cable (remote version) | → 📄 19 |

### 10.1.8 Operating conditions: Environment

**Ambient temperature**

*Compact*

- Standard: –40 to +60 °C (–40 to +140 °F)
- EEx-d / EEx-i version: –40 to +60°C (–40 to +140 °F)

Display can be read between –20 °C and +70 °C (–4 to +158 °F)

*Remote version*

- Sensor
  - Standard: –40 to +80 °C (–40 to +176 °F)
  - EEx-d / EEx-i version: –40 to +80°C (–40 to +176 °F)
- Transmitter:
  - Standard: –40 to +60 °C (–40 to +1406 °F)
  - EEx-i version: –40 to +60°C (–40 to +140 °F)
  - EEx-d version: –40 to +60°C (–40 to +140 °F)

Display can be read between –20 °C and +70 °C (–4 to +158 °F)

Note!
When mounting outside, we recommend you protect from direct sunlight with a protective cover (order number 543199), especially in warmer climates with high ambient temperatures.

| | |
|---|---|
| Storage temperature | Standard: –40 to +80 °C (–40 to +176 °F)<br>EEx-d / EEx-i version: –40 to +80°C (–40 to +176 °F) |
| Degree of protection | ■ Prosonic Flow 92 transmitter: IP 67 (NEMA 4X)<br>■ Prosonic Flow F Inline sensor: IP 67 (NEMA 4X)<br>Optional: IP 68 (NEMA 6P) |
| Shock resistance | In accordance with IEC 68-2-31 |
| Vibration resistance | Acceleration up to 1 g by analogy with IEC 68-2-6 |
| Electromagnetic compatibility (EMC) | To IEC/EN1326 and NAMUR recommendation NE 21 |

### 10.1.9 Operating conditions: Process

Fluid temperature range

| Size Range | DN 25 to 100 (1 to 4") | DN 150 to 300 (6 to 12") | | |
|---|---|---|---|---|
| Standard | ASME & AD2000 | ASME & AD2000 | ASME | AD2000 |
| Version | Stainless Steel | Stainless Steel | Carbon Steel | Carbon Steel |
| Standard | –40 to 150 °C (–40 to 302 °F) | –40 to 150 °C (–40 to 302 °F) | –29 to 130 °C* (–84 to 266 °F) | –10 to 130 °C (–14 to 266 °F) |
| Optional | –40 to 200 °C (–40 to 392 °F) | –40 to 200 °C (–40 to 392 °F) | –29 to 200 °C* (–20 to 392 °F) | –10 to 200 °C (–14 to 392 °F) |

*For PED device minimum temperature is –10 °C (14 °F)

Limiting medium pressure range (rated pressure)

The material load diagrams (pressure-temperature diagrams) for the process connections can be found in the separate "Technical Information" documentation on the device in question which you can download in PDF format at www.endress.com.

■ A list of the "Technical Information" available can be found on → 72.

Limiting flow

■ Refer to "Measuring range" on → 66.

Pressure loss

No pressure loss if the sensor is installed in a pipe of the same nominal diameter.

### 10.1.10 Mechanical construction

Design, dimensions

The dimensions and lengths of the sensor and transmitter can be found in the separate "Technical Information" documentation on the device in question which you can download in PDF format at www.endress.com.

■ A list of the "Technical Information" available can be found on → 72.

Weight (SI units)

| **DN** | **Weight [kg]** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Compact version** | | | **Remote version (without a cable)** | | | |
| | | | | Sensor | | | Transmitter |
| | EN | JIS | ASME | EN | JIS | ASME | |
| 25 | 10 | 10 | 10 | 8 | 8 | 8 | 6.0 |
| 40 | 12 | 13 | 12 | 11 | 11 | 10 | 6.0 |
| 50 | 14 | 15 | 13 | 12 | 13 | 11 | 6.0 |
| 80 | 24 | 28 | 28 | 22 | 26 | 26 | 6.0 |
| 100 | 35 | 44 | 44 | 32 | 42 | 42 | 6.0 |
| 150 | 54 | – | 57 | 48 | – | 51 | 6.0 |
| 200 | 92 | – | 83 | 86 | – | 77 | 6.0 |
| 250 | 131 | – | 118 | 125 | – | 112 | 6.0 |
| 300 | 174 | – | 165 | 168 | – | 159 | 6.0 |

Weight (US units)

| DN (inch) | Weight [lbs] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Compact version | | | Remote version (without a cable) | | | |
| | | | | Sensor | | | Transmitter |
| | EN | JIS | ANSI | EN | JIS | ANSI | |
| 1" | 22 | 22 | 22 | 18 | 18 | 18 | 13.0 |
| 1 ½" | 26 | 29 | 26 | 24 | 24 | 22 | 13.0 |
| 2" | 31 | 33 | 29 | 26 | 29 | 24 | 13.0 |
| 3" | 53 | 62 | 62 | 49 | 57 | 57 | 13.0 |
| 4" | 77 | 97 | 97 | 71 | 93 | 93 | 13.0 |
| 6" | 119 | – | 125 | 113 | – | 119 | 13.0 |
| 8" | 202 | – | 183 | 196 | – | 177 | 13.0 |
| 10" | 288 | – | 260 | 282 | – | 254 | 13.0 |
| 12" | 383 | – | 363 | 377 | – | 357 | 13.0 |

Material

*Transmitter housing and connection housing, sensor (remote version):*

Compact housing: powder coated die cast aluminium

| | DN25 to 100 | DN150 to 300 | | |
|---|---|---|---|---|
| Standard | ASME & AD2000 | ASME & AD2000 | ASME | AD2000 |
| Meter body | A351-CF3M | 1.4404+TP316+TP316L | A106 Grd. B | A106 Grd. B |
| Sensor | 1.4404+316L+316 | 1.4462<br>1.4404+316L+316 | 1.4462<br>1.4404+316L+316 | 1.4462<br>1.4404+316L+316 |
| Flanges | 1.4404+F316+F316L | 1.4404+F316+F316L | A105+1.0432 | 1.0426 |
| Designed for NACE MR0175/ISO 15156 and NACE MR0103<br>It is the equipment user's responsibility to select the materials suitable for the intended services. | | | | |

**Carbon steel with outer protective painting to 130 °C (266 °F) or optional 200 °C (392 °F)**

Material load diagram

The material load diagrams (pressure-temperature diagrams) for the process connections can be found in the separate "Technical Information" documentation on the device in question which you can download in PDF format at www.endress.com.

- A list of the "Technical Information" available can be found on → 📄 72.

## 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 (–68 °F) the readability of the display may be impaired

Operating elements

No local operating elements, remote operation possible

Remote operation

- PROFIBUS PA
- FieldCare
- FieldCare
  (Endress+Hauser software package for configuration, commissioning and diagnosis)
- SIMATIC PDM
  (Operating program from Siemens)

## 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 mark

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

Ex approval

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

Certification PROFIBUS PA

The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the following specifications:

- Certified to PROFIBUS Profile Version 3.01 (device certification number: available on request)
- The measuring device can also be operated with certified devices of other manufacturers (interoperability).

Pressure Equipment Directive

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

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

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  "Emission in accordance with requirements for Class A"
  Electromagnetic compatibility (EMC requirements)
- 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
- ANSI/ISA-S.61010-1(82.02.01) CSA-C22.2 No. 1010.1 ANSI/UL 61010-1
  Safety Requirements for Electrical Equipment for Measurement and Control and Laboratory Use
  Pollution degree 2
- NACE Standard MR0103
  Standard Material Requirements - Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments
- NACE Standard MR0175
  Standard Material Requirements - Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment.

### 10.1.13 Ordering information

Your Endress+Hauser representative can provide detailed ordering information and information on the order codes on request.

### 10.1.14 Accessories

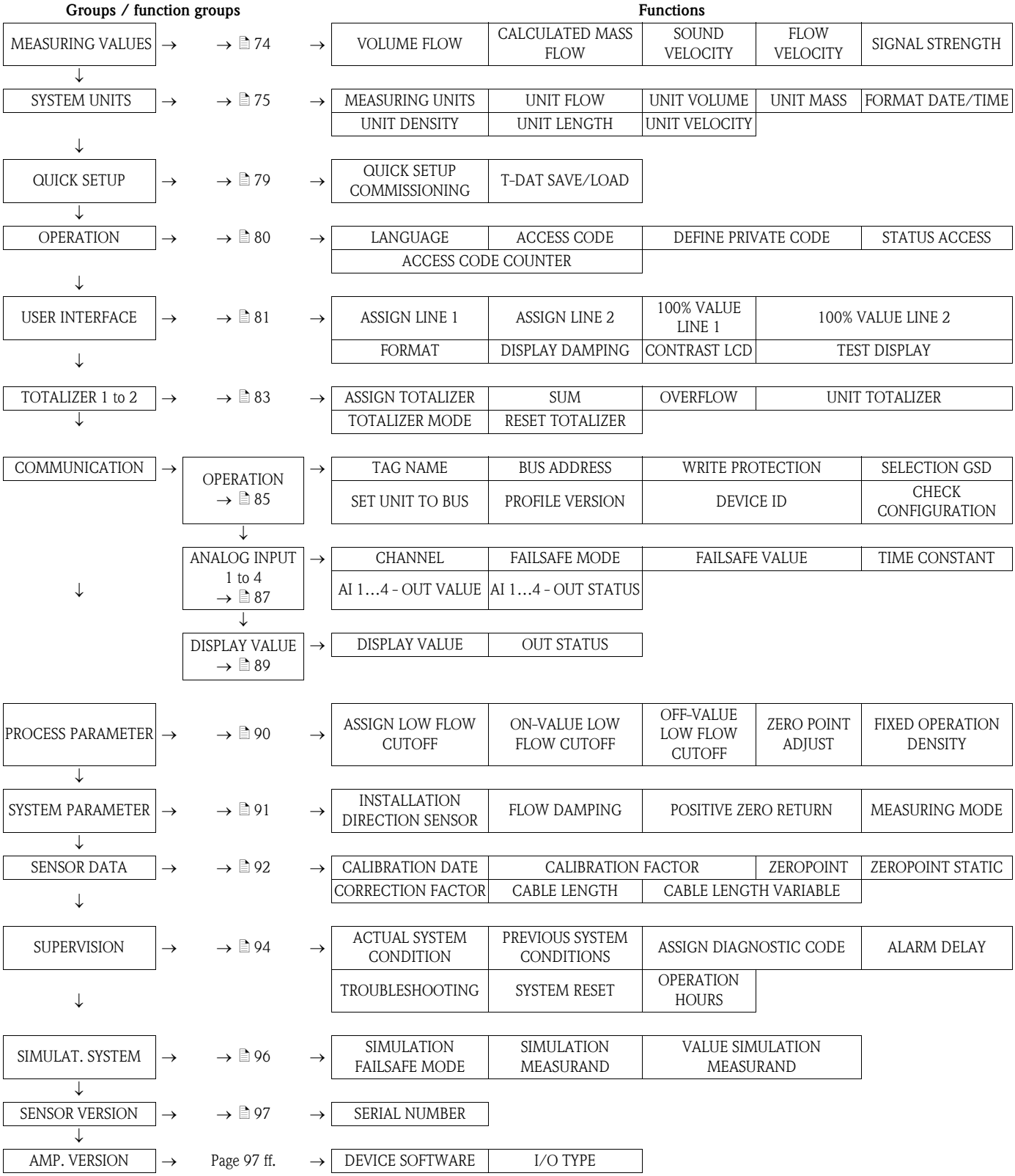
Various accessories, which can be ordered separately from Endress +Hauser, are available for the transmitter and the sensor → 📄 49.

### 10.1.15 Documentation

- Flow measuring technology (FA005D/06/en)
- Technical Information, Prosonic Flow 92F (TI072D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA

# 11 Description of device functions

## 11.1 Illustration of the function matrix



## 11.2 Group MEASURING VALUES

| Function description, MEASURING VALUES group | |
|---|---|
| VOLUME FLOW | The flow currently measured appears on the display.<br>**Display:**<br>5-digit floating-point number, including unit<br>(e.g. 5.545 dm³/m; 1.4359 kg/h; 731.63 gal/d etc.)<br>✎ Note!<br>The appropriate unit is taken from the UNIT VOLUME FLOW function (see → 🖹 75). |
| CALCULATED MASS FLOW | The mass flow (input variable for the Analog Input function block) appears on the display.<br>**Display:**<br>5-digit floating-point number, including unit<br>(e.g. 462.87 kg/h; 731.63lb/min, etc.)<br>✎ Note!<br>ls calculated using the measured volume flow and density value. |
| SOUND VELOCITY | The sound velocity currently measured in the liquid appears on the display.<br>**Display:**<br>5-digit fixed-point number, incl. unit<br>(e.g. 1400.0 m/s, 5249.3 ft/s)<br>✎ Note!<br>The appropriate unit is taken from the UNIT VELOCITY function (see → 🖹 78). |
| FLOW VELOCITY | The flow velocity currently measured appears on the display.<br>**Display:**<br>5-digit floating-point number, including unit and sign<br>(e.g. 8.0000 m/s, 26.247 ft/s)<br>✎ Note!<br>The appropriate unit is taken from the UNIT VELOCITY function (see → 🖹 78). |
| SIGNAL STRENGTH | The signal strength appears on the display.<br>**Display:**<br>4-digit fixed-point number, incl. unit<br>(e.g. 80.0 dB)<br>✎ Note!<br>To ensure reliable measurement takes place, Prosonic Flow requires a signal strength of > 30 dB. |

## 11.3 Group SYSTEM UNITS

| Function description, SYSTEM UNITS group | |
|---|---|
| MEASURING UNITS | **Description**<br>Use this function to select the desired type of unit which the measuring device should use to output the flow.<br><br>Unit types:<br>■ Volumetric flow (volume flow)<br>Is measured by the measuring device. No other calculation takes place.<br>■ Calculated mass flow<br>Is calculated using the measured volume flow and the value entered in the FIXED OPERATION DENSITY function (→ 91).<br><br>Note!<br>The "calculated mass flow" unit types are calculated with fixed values for FIXED OPERATION DENSITY.<br>■ If the process conditions are known and do not change, select these two types of unit.<br>■ If the process conditions are not known or if the process conditions could change, we recommend you use a flow computer (e.g. Compart DXF351 or RMC621). Even when the process conditions change, these flow computers can calculate the flow correctly by means of pressure and temperature compensation.<br><br>**Options**<br><br>VOLUME FLOW<br>CALCULATED MASS FLOW<br><br>**Factory setting**<br>See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.<br><br>Note!<br>If the type of unit is changed, you are asked whether the totalizer should be reset to 0. This message has to be confirmed before the measuring device accepts the new type of unit; otherwise the measuring device continues to use the type of unit previously active. |

| Function description, SYSTEM UNITS group | |
|---|---|
| UNIT FLOW | **Description**<br>For selecting the unit required and displayed for the flow. Depending on what is selected in the MEASURING UNIT TYPE (→ 📄 75) function , only the associated units (volume, or calculated mass flow) are displayed here.<br><br>The unit you select here is also valid for:<br>■ Flow display<br>■ Current output (value 20 mA)<br>■ Pulse/status output (pulse value; on-value/off-value)<br>■ On-value low flow cut off<br>■ Simulation measurand<br><br>✎ Note!<br>The unit for the totalizer is independent of the option selected here; it is selected in the UNIT TOTALIZER function (→ 📄 84).<br><br>The following time units can be selected:<br>s = second, m = minute, h = hour, d = day<br><br>**Options (MEASURING UNITS function = VOLUME FLOW)**<br><br>Metric:<br>Cubic centimeter → $cm^3$/time unit<br>Cubic decimeter → $dm^3$/time unit<br>Cubic meter → $m^3$/time unit<br>Milliliter → ml/time unit<br>Liter → l/time unit<br>Hectoliter → hl/time unit<br>Megaliter → Ml/time unit MEGA<br><br>US:<br>Cubic centimeter → cc/time unit<br>Acre foot → af/time unit<br>Cubic foot → $ft^3$/time unit<br>Fluid ounce → ozf/time unit<br>Gallon → US gal/time unit<br>Mega gallon → US Mgal/time unit<br>Barrel (normal fluids: 31.5 gal/bbl) → US bbl/time unit NORM.<br>Barrel (beer: 31.0 gal/bbl) → US bbl/time unit BEER<br>Barrel (petrochemicals: 42.0 gal/bbl) → US bbl/time unit PETR.<br>Barrel (filling tanks: 55.0 gal/bbl) → US bbl/time unit TANK<br><br>Imperial:<br>Gallon → imp. gal/time unit<br>Mega gallon → imp. Mgal/time unit<br>Barrel (beer: 36.0 gal/bbl) → imp. bbl/time unit BEER<br>Barrel (petrochemicals: 34.97 gal/bbl) → imp. bbl/time unit PETR.<br><br>**Factory setting**<br>See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.<br><br>**Options (MEASURING UNITS function = CALCULATED MASS FLOW)**<br><br>Metric:<br>Gram → g/time unit<br>Kilogram → kg/time unit<br>Metric ton → t/time unit<br><br>US:<br>Ounce → oz/time unit (US)<br>Pound → lb/time unit<br>Ton → ton/time unit<br><br>**Factory setting**<br>See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions. |

| Function description, SYSTEM UNITS group | |
|---|---|
| UNIT VOLUME | Use this function to select the unit for displaying the volume.<br>The unit you select here is also valid for:<br>■ Pulse weighting (e.g. $m^3/p$)<br>**Options**<br>Metric:<br>$cm^3$; $dm^3$; $m^3$; ml; l; hl; Ml Mega<br>US:<br>cc; af; $ft^3$; oz f; gal; Kgal; Mgal; bbl (normal fluids); bbl (beer); bbl (petrochemicals); bbl (filling tanks)<br>Imperial:<br>gal; Mgal; bbl (beer); bbl (petrochemicals)<br>**Factory setting**<br>$m^3$<br>Note!<br>■ The unit of the totalizers is independent of your choice here. The unit for each totalizer is selected separately for the totalizer in question. |
| UNIT MASS | Use this function to select the unit for displaying the mass.<br>The unit you select here is also valid for:<br>■ Pulse weighting (e.g. kg/p)<br>**Options**<br>Metric:<br>g; kg; t<br>US:<br>oz; lb; ton;<br>**Factory setting**<br>Country-dependent (kg or US-lb)<br>Note!<br>■ The unit of the totalizers is independent of your choice here. The unit for each totalizer is selected separately for the totalizer in question. |
| FORMAT DATE/TIME | Use this function to select the format for the date and the time.<br>The unit you select here is valid for:<br>Displaying the current calibration date (function CALIBRATION DATE (6808) → 92<br>**Options**<br>DD.MM.YY 24H<br>MM/DD/YY 12H A/P<br>DD.MM.YY 12H A/P<br>MM/DD/YY 24H<br>**Factory setting**<br>DD.MM.YY 24H (SI units)<br>MM/DD/YY 12H A/P (US units) |

| Function description, SYSTEM UNITS group | |
|---|---|
| UNIT DENSITY | **Prerequisite**<br>This function is **only** available if the CALCULATED MASS FLOW values were selected in the MEASURING UNITS function (→ 🖹 75).<br>**Description**<br>For selecting the unit required and displayed for the density. The density is selected in the FIXED OPERATION DENSITY (→ 🖹 91).<br>**Options**<br>Metric:<br>g/cm³<br>g/cc<br>kg/dm³<br>kg/l<br>kg/m³<br>SD* 4 °C, SD 15 °C, SD 20 °C<br>SG* 4 °C, SG 15 °C, SG 20 °C<br>US:<br>lb/ft³<br>lb/US gal<br>lb/US bbl NORM (normal fluids)<br>lb/US bbl BEER (beer)<br>lb/US bbl PETR. (petrochemicals)<br>lb/US bbl TANK (filling tanks)<br>Imperial:<br>lb/imp. gal<br>lb/imp. bbl BEER (beer)<br>lb/imp. bbl PETR. (petrochemicals)<br>**Factory setting**<br>See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.<br>* SD = specific density, SG = specific gravity<br>The specific density is the ratio of fluid density to water density (at water temperature = 4, 15, 20 °C). |
| UNIT LENGTH | For selecting the unit for the length.<br>**Options:**<br>MILLIMETER<br>INCH<br>**Factory setting:**<br>MILLIMETER |
| UNIT VELOCITY | For selecting the unit for the velocity.<br>The unit you select here is also valid for:<br>■ Sound velocity<br>■ Flow velocity<br>**Options:**<br>m/s<br>ft/s<br>**Factory setting:**<br>m/s |

## 11.4 Group QUICK SETUP

| Function description, QUICK SETUP group | |
|---|---|
| QUICK SETUP COMMISSIONING | By means of this function, you can access a range of instrument functions with which you can put the measuring device into operation quickly.<br>**Options:**<br>YES<br>NO<br>**Factory setting:**<br>NO<br>✎ Note!<br>Further information on Quick Setups is provided on → 🖹 79 |
| T-DAT SAVE/LOAD | In this function, the configuration/settings of the transmitter can be saved to a transmitter DAT (T-DAT) or uploading a configuration from the T-DAT to the EEPROM can be activated (manual safety function).<br>Application examples:<br>■ After commissioning, the current measuring point parameters can be saved to the T-DAT as a backup.<br>■ When replacing the transmitter, it is possible to load the data from the T-DAT into the new transmitter (EEPROM).<br>**Options:**<br>CANCEL<br>SAVE (from EEPROM to T-DAT)<br>LOAD (from the T-DAT to the EEPROM)<br>**Factory setting:**<br>CANCEL |

## 11.5 Group OPERATION

| Function description, OPERATION group | |
|---|---|
| LANGUAGE | For selecting the language in which all messages are shown on the local display.<br>**Options:**<br>ENGLISH<br>DEUTSCH<br>FRANCAIS<br>ESPANOL<br>ITALIANO<br>NEDERLANDS<br>NORSK<br>SVENSKA<br>SUOMI<br>PORTUGUES<br>POLSKI<br>CESKI<br>**Factory setting:**<br>Depends on country (metric system units, → 98, or US units, → 98 ) |
| ACCESS CODE | All data of the measuring system are protected against inadvertent change. Programming is disabled and the settings cannot be changed until a code is entered in this function. You can enable programming by entering the private code (factory setting = 92, see DEFINE PRIVATE CODE function).<br>Application examples:<br>■ After commissioning, the current measuring point parameters can be saved to the HistoROM/T-DAT as a backup.<br>■ If the transmitter is replaced for some reason, the data can be loaded from the HistoROM/T-DAT to the new transmitter (EEPROM).<br>**User input:**<br>Input limits: 0 to 9999<br>Note!<br>■ You can also disable programming in this function by entering any number (other than the private code).<br>■ Your Endress+Hauser representative can be of assistance if you mislay your private code. |
| DEFINE PRIVATE CODE | Use this function to specify the private code for enabling programming.<br>**User input:**<br>Input limits: 0 to 9999<br>**Factory setting:**<br>92<br>Note!<br>■ Programming is always enabled if the code defined = 0.<br>■ Programming has to be enabled before this code can be changed.<br>When programming is disabled this function cannot be edited, thus preventing others from accessing your personal code. |
| STATUS ACCESS | The access status for the function matrix appears on the display.<br>**Display:**<br>ACCESS CUSTOMER (parameters can be modified)<br>LOCKED (parameters cannot be modified) |
| ACCESS CODE COUNTER | The number of times the private and service code was entered to access the device appears on the display.<br>**Display:**<br>Integer (delivery status: 0) |

## 11.6 Group USER INTERFACE

| Function description, USER INTERFACE group | |
|---|---|
| ASSIGN LINE 1 | For assigning a display value to the main line (top line of the local display).<br>This value is displayed during normal operation.<br>**Options:**<br>OFF<br>VOLUME FLOW<br>VOLUME FLOW IN %<br>AI1 - OUT VALUE<br>AI2 - OUT VALUE<br>AI3 - OUT VALUE<br>AI4 - OUT VALUE<br>TOTALIZER 1<br>TOTALIZER 2<br>AO - DISP. VALUE<br>**Factory setting:**<br>VOLUME FLOW |
| ASSIGN LINE 2 | For assigning a display value to the additional line (bottom line of the local display).<br>This value is displayed during normal operation.<br>**Options:**<br>OFF<br>VOLUME FLOW<br>VOLUME FLOW IN %<br>VOLUME FLOW BAR GRAPH IN %<br>SOUND VELOCITY<br>FLOW VELOCITY<br>FLOW DIRECTION<br>SIGNAL STRENGTH<br>SIGNAL STRENGTH BAR GRAPH IN %<br>TAG NAME<br>OPERATING/SYSTEM CONDITIONS<br>AI1 - OUT VALUE<br>AI2 - OUT VALUE<br>AI3 - OUT VALUE<br>AI4 - OUT VALUE<br>TOTALIZER 1<br>TOTALIZER 2<br>AO - DISP. VALUE<br>**Factory setting:**<br>TOTALIZER 1 |
| 100% VALUE LINE 1 | ✎ Note!<br>This function is not available unless the VOLUME FLOW IN % option was selected in the ASSIGN LINE 1 function.<br>For specifying the value which should be shown on the display as the 100% value.<br>**User input:**<br>5-digit floating-point number<br>**Factory setting:**<br>10 l/s |
| 100% VALUE LINE 2 | ✎ Note!<br>This function is not available unless the VOLUME FLOW IN %, VOLUME FLOW BAR GRAPH IN % or SIGNAL STRENGTH BAR GRAPH IN % option was selected in the ASSIGN LINE 2 function.<br>For specifying the value which should be shown on the display as the 100% value.<br>**User input:**<br>5-digit floating-point number<br>**Factory setting:**<br>10 l/s (for volume flow); 100 dB (for signal strength) |

| Function description, USER INTERFACE group | |
|---|---|
| FORMAT | For selecting the number of places displayed after the decimal point for the display value in the main line.<br>**Options:**<br>XXXXX. - XXXX.X - XXX.XX - XX.XXX -X.XXXX<br>**Factory setting:**<br>XX.XXX<br>✎ Note!<br>■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations.<br>■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In these instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → l/h), indicating that the measuring system is computing with more decimal places than can be shown on the display. |
| DISPLAY DAMPING | For entering a time constant used to define how the display reacts to severely fluctuating flow variables, either very quickly (enter a low time constant) or with damping (enter a high time constant).<br>**User input:**<br>0 to 100 seconds<br>**Factory setting:**<br>0 seconds<br>✎ Note!<br>The setting 0 seconds switches off damping. |
| CONTRAST LCD | For adjusting the display contrast to suit local operating conditions.<br>**User input:**<br>10 to 100%<br>**Factory setting:**<br>50% |
| TEST DISPLAY | Use this function to test the operability of the local display and its pixels.<br>**Options:**<br>OFF<br>ON<br>**Factory setting:**<br>OFF<br>Test sequence:<br>1. Start the test by selecting ON.<br>2. All pixels of the main line and additional line are darkened for minimum 0.75 seconds.<br>3. The main line and additional line show an "8" in each field for minimum 0.75 seconds.<br>4. The main line and additional line show a "0" in each field for minimum 0.75 seconds.<br>5. The main line and additional line show nothing (blank display) for minimum 0.75 seconds.<br>6. When the test is completed, the local display returns to its initial state and the displays the option OFF. |

# 11.7 Group TOTALIZER (1 to 2)

| **Function description, TOTALIZER (1 to 2) group** | |
|---|---|
| The following function descriptions apply to Totalizers 1 to 2 which can be configured independently of one another. | |
| ASSIGN TOTALIZER | A measured variable is assigned to the totalizer.<br>**Options (totalizer 1 and 2):**<br>OFF<br>FLOW<br>**Factory setting: (totalizer 1)**<br>FLOW<br>**Factory setting: (totalizer 2)**<br>VOLUME FLOW<br>✎ Note!<br>■ If the selection is changed, you are asked whether the totalizer should be reset. This query first has to be confirmed before the new option is accepted and the totalizer is reset to 0.<br>■ If OFF is selected, the ASSIGN TOTALIZER function is the only function displayed in the totalizer 1 or 2 group. |
| SUM | The total for the totalizer's measured variable aggregated since measuring commenced appears on the display.<br>**Display:**<br>Max. 7-digit floating-point number, including unit (e.g. 15467.04 $m^3$)<br>✎ Note!<br>The totalizer's response to errors is defined in the "FAILSAFE MODE" function. |
| OVERFLOW | The total for the totalizer's overflow aggregated since measuring commenced appears on the display.<br>Total flow is represented by a floating-point number consisting of max. 7 digits. You can use this function to view higher numerical values (>9,999,999) as overflows. The effective quantity is thus the total of the SUM function plus the value displayed in the OVERFLOW function.<br>Example:<br>Reading after 2 overflows: 2 E7 kg (= 20,000,000 kg)<br>The value displayed in the SUM function = 196,845.7 kg<br>Effective total quantity = 20,196,845.7 kg<br>**Display:**<br>Integer with exponent, including unit, e.g. 2 E7 kg |

| Function description, TOTALIZER (1 to 2) group | |
|---|---|
| UNIT TOTALIZER | **Description**<br>For selecting the unit for the measured variable assigned to the totalizer.<br>**Options (MEASURING UNITS assigned to VOLUME FLOW)**<br>Metric:<br>Cubic centimeter → $cm^3$<br>Cubic decimeter → $dm^3$<br>Cubic meter → $m^3$<br>Milliliter → ml<br>Liter → l<br>Hectoliter → hl<br>Megaliter → Ml MEGA<br>US:<br>Cubic centimeter → cc<br>Acre foot → af<br>Cubic foot → $ft^3$<br>Fluid ounce → oz f<br>Gallon → US gal<br>Mega gallon → US Mgal<br>Barrel (normal fluids: 31.5 gal/bbl) → US bbl NORM.FL.<br>Barrel (beer: 31.0 gal/bbl) → US bbl BEER<br>Barrel (petrochemicals: 42.0 gal/bbl) → US bbl PETROCH.<br>Barrel (filling tanks: 55.0 gal/bbl) → US bbl TANK<br>Imperial:<br>Gallon → imp. gal<br>Mega gallon → imp. Mgal<br>Barrel (beer: 36.0 gal/bbl) → imp. bbl BEER<br>Barrel (petrochemicals: 34.97 gal/bbl) → imp. bbl PETROCH.<br>**Factory setting**<br>Depends on country → 🖹 98<br>**Options (MEASURING UNIT TYPE assigned to CALCULATED MASS FLOW)**<br>Metric:<br>Gram → g<br>Kilogram → kg<br>Metric ton → t<br>US:<br>Ounce → oz (US)<br>Pound → lb<br>Ton → ton<br>**Factory setting**<br>Depends on country → 🖹 98 |
| TOTALIZER MODE | For selecting how the flow components should be totalized.<br>**Options:**<br>BALANCE<br>Positive and negative flow components. The positive and negative flow components are balanced. In other words, net flow in the flow direction is registered.<br>FORWARD<br>Only positive flow components are recorded.<br>REVERSE<br>Only negative flow components are recorded.<br>**Factory setting:**<br>Totalizer 1 = FORWARD<br>Totalizer 2 = FORWARD |
| RESET TOTALIZER | Resets the sum and overflow in the totalizer selected.<br>**Options:**<br>NO<br>YES<br>**Factory setting:**<br>NO |

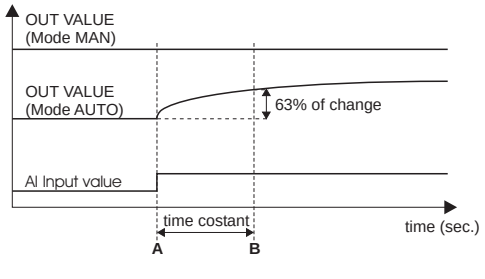
# 11.8 Group COMMUNICATION

## 11.8.1 Function group OPERATION

| Function description, COMMUNICATION group→ OPERATION function group | |
|---|---|
| TAG NAME | For entering a tag name for the device. The tag name can be edited and read by means of an operating program (e.g. FieldCare).<br>**User input:**<br>Max. 16-character text, permitted characters are: A-Z, 0-9, +,–, punctuation marks<br>**Factory setting:**<br>"– – – – – – – – – – – – – – – –" (no text) |
| BUS ADDRESS | For entering the device address.<br>**User input:**<br>1 to 126<br>**Factory setting:**<br>126 |
| WRITE PROTECTION | Indicates whether it is possible to write-access the measuring device via PROFIBUS (acyclic data transmission, e.g. via "FieldCare" operating program).<br>**Display:**<br>OFF = write access via PROFIBUS (acyclic data transmission) possible<br>ON = write access via PROFIBUS (acyclic data transmission) not possible<br>**Factory setting:**<br>OFF<br>Note!<br>Hardware write protection is activated and deactivated by means of a miniature switch (see Page 30). |
| SELECTION GSD | For selecting the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master (Class 1).<br>**Options:**<br>MANUFACT. SPEC.<br>The device is operated with complete device functionality.<br>GSD PROFILE<br>The measuring device is operated in the PROFIBUS Profile mode.<br>**Factory setting:**<br>MANUFACT. SPEC.<br>Note!<br>For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode (see Page 36 ff.). |
| SET UNIT TO BUS | If this function is executed, the measured variables cyclically transmitted (AI modules) to the PROFIBUS master (Class 1) are transmitted with the system units set in the device.<br>**Options:**<br>OFF<br>SET UNITS<br>Caution!<br>Activating this function can cause the measured variables (AI modules) transmitted to the PROFIBUS master (Class 1) to change suddenly; this, in turn, can affect subsequent control routines. |

| Function description, COMMUNICATION group→ OPERATION function group | |
|---|---|
| PROFILE VERSION | The PROFIBUS profile version appears on the display. |
| DEVICE ID | The PROFIBUS device ID appears on the display.<br><br>The elements displayed depend on the option selected in the SELECTION GSD function.<br>**Display:**<br>If MANUFACTURER SPEC. is selected, 154C hex is displayed<br>If GSD PROFILE is selected, 9740 hex is displayed |
| CHECK CONFIGURATION | Indicates whether the configuration for cyclic data transmission of the PROFIBUS master (Class 1) is accepted by the measuring device.<br>**Display:**<br>ACCEPTED (configuration accepted)<br>NOT ACCEPTED (configuration not accepted) |

## 11.8.2 Function group ANALOG INPUT 1 to 4

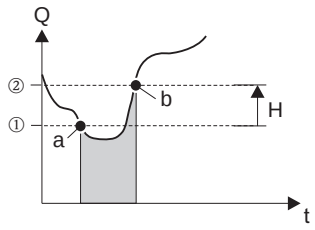
| **Function description, COMMUNICATION group → ANALOG INPUT 1 to 4 function group** | |
|---|---|
| The following function descriptions apply to Analog Input function blocks 1 to 4 which can be configured independently of one another. | |
| CHANNEL | For assigning a measured variable to the Analog Input function block.<br>**Display:**<br>VOLUME FLOW<br>SOUND VELOCITY<br>SIGNAL STRENGTH<br>FLOW VELOCITY<br>**Factory setting:**<br>Analog Input function block 1 = VOLUME FLOW<br>Analog Input function block 2 = SOUND VELOCITY<br>Analog Input function block 3 = SIGNAL STRENGTH<br>Analog Input function block 4 = FLOW VELOCITY |
| FAILSAFE MODE | For specifying the failsafe mode of the Analog Input function block.<br>The Analog Input function block operates with the defined failsafe mode if the status of the input value or simulation value is BAD.<br>**Options:**<br>FAILSAFE VALUE<br>LAST GOOD VALUE<br>WRONG VALUE<br>**Factory setting:**<br>LAST GOOD VALUE<br>✎ Note!<br>An exact description of the individual options can be found on → 53. |
| FAILSAFE VALUE | For specifying the value which the Analog Input function block continues to work with if the FAILSAFE VALUE option is selected in the FAILSAFE MODE function.<br>**User input:**<br>Input limits: $-10^{20}$ to $+10^{20}$<br>**Factory setting:**<br>0 |
| TIME CONSTANT | For entering the filter time constant (in seconds) of 1st order digital filter.<br>This time is required in order for 63% of a change in the input value to have an effect on the output value (OUT VALUE function).<br>  <br>*Fig. 29: Time-dependent signal patterns of the Analog Input function block*<br>A → The input value of the Analog Input function block changes<br>B → The output value (OUT VALUE function) has reacted 63% to a change in the input value<br>**User input:**<br>Input limits: 0 to $10^{20}$ s<br>**Factory setting:**<br>0 s |

| Function description, COMMUNICATION group → ANALOG INPUT 1 to 4 function group | |
|---|---|
| AI 1…4 - OUT VALUE | The measured variable (AI module), incl. the unit, cyclically transmitted **to** the PROFIBUS master (Class 1) appears on the display.<br><br>✎ Note!<br>The measured variable to be transmitted is assigned to the Analog Input function block in the CHANNEL function (→ 87). |
| AI 1…4 - OUT STATUS | The status of the measured variable (AI module) cyclically transmitted **to** the PROFIBUS master (Class 1) appears on the display.<br><br>✎ Note!<br>The measured variable to be transmitted is assigned to the Analog Input function block in the CHANNEL function (→ 87). |

### 11.8.3 Function group DISPLAY VALUE

| Function description, COMMUNICATION group → DISPLAY VALUE function group | |
|---|---|
| DISPLAY VALUE | The measured variable (DISPLAY VALUE module) cyclically transmitted **from** the PROFIBUS master (Class 1) to the device appears on the display. This is the measured variable to be displayed on the local display. |
| OUT STATUS | The status of the variable (DISPLAY VALUE module) cyclically transmitted **from** the PROFIBUS master (Class 1). |

## 11.9 Group PROCESS PARAMETER

| Function description, PROCESS PARAMETER group | |
|---|---|
| ASSIGN LOW FLOW CUTOFF | For selecting the measured variable on which low flow cutoff should act.<br>**Options:**<br>OFF<br>VOLUME FLOW<br>FLOW VELOCITY<br>**Factory setting:**<br>VOLUME FLOW |
| ON-VALUE LOW FLOW CUTOFF | ✎ Note!<br>This function is not available if OFF has been selected in the ASSIGN LOW FLOW CUTOFF function.<br>Use this function to enter the on-value for low flow cutoff.<br>Low flow cutoff is on if the value entered is not equal to 0. As soon as the low flow cutoff is active, an inverted plus sign is shown on the local display.<br>**User input:**<br>Input limits: 0 to $10^{20}$<br>**Factory setting:**<br>0<br>✎ Note!<br>The unit is taken from the VOLUME FLOW function (→ 🖹 74). |
| OFF-VALUE LOW FLOW CUTOFF | Use this function to enter the switch-off point (b) for low flow cutoff. Enter the switch-off point as a positive hysteresis (H) in % from the switch-on point (a).<br>**User input:**<br>Integer 0 to 100%<br>**Factory setting:**<br>50%<br>  <br><br>A0003882<br>*Fig. 30: Example for the behavior of low flow cutoff*<br>*m switch-on point*<br>*n switch-off point*<br>*a low flow cutoff is switched on*<br>*b low flow cutoff is switched off (a + a · H)*<br>*H Hysteresis value: 0 to 100%*<br>■ *low flow cutoff active*<br>*Q Q = Flow* |

| Function description, PROCESS PARAMETER group | |
|---|---|
| ZERO POINT ADJUST | Caution!<br>Please refer to the instructions and the exact procedure on → 47.<br>Start of zero point adjustment.<br>**Options:**<br>CANCEL<br>START<br>**Factory setting:**<br>CANCEL<br>Note!<br>■ Programming is disabled during zero point adjustment. The diagnosis message C 431 - 6 (see → 56) appears on the display.<br>■ If the zero point adjustment is not possible, (e.g. if v > 0.1 m/s), or has been canceled, then a diagnosis message C 431 - 1 to 5 (see → 56) appears on the display. |
| FIXED OPERATION DENSITY | **Prerequisite**<br>This function is **only** available if CALCULATED MASS FLOW was selected in the **MEASURING UNITS** function (→ 75).<br>**Description**<br>Use this function to enter a fixed value for the density at process conditions. This value is used to calculate the calculated mass flow and the corrected volume flow (see MEASURING UNITS function → 75).<br>The appropriate unit is taken from the UNIT DENSITY function (→ 78).<br>If the option selected in the function is changed, you are asked whether the totalizer should be reset to 0. We recommend you confirm this message and reset the totalizer.<br>**User input**<br>5-digit floating-point number<br>**Factory setting**<br>See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions. |

## 11.10 Group SYSTEM PARAMETER

| Function description, SYSTEM PARAMETER group | |
|---|---|
| INSTALLATION DIRECTION SENSOR | Use this function to reverse the sign of the flow measured variable, if necessary.<br>**Options:**<br>NORMAL (flow as indicated by the arrow)<br>INVERSE (flow opposite to direction indicated by the arrow)<br>**Factory setting:**<br>NORMAL<br>Note!<br>Ascertain the actual direction of fluid flow with reference to the direction indicated by the arrow on the sensor (nameplate). |
| FLOW DAMPING | For setting the filter depth of the digital filter. This reduces the sensitivity of the measuring signal to interference peaks (e.g. in the event of high solids content, gas bubbles in the fluid, etc.). The measuring system reaction time increases with the filter setting. The damping acts on all functions and outputs of the measuring device.<br>**User input:**<br>Input limits: 0 to 100 s<br>**Factory setting:**<br>0 s |

| Function description, SYSTEM PARAMETER group | |
|---|---|
| POSITIVE ZERO RETURN | Use this function to interrupt evaluation of measured variables.<br>This is necessary when a pipe is being cleaned, for example.<br>The setting acts on all functions and outputs of the measuring device.<br>**Options:**<br>OFF<br>ON<br>**Factory setting:**<br>OFF |
| MEASURING MODE | For selecting how the flow components should be recorded by the measuring device.<br>**Options:**<br>UNIDIRECTIONAL (only the positive flow components)<br>BIDIRECTIONAL = (the positive and negative flow components)<br>**Factory setting:**<br>BIDIRECTIONAL |

## 11.11 Group SENSOR DATA

| Function description, SENSOR DATA group | |
|---|---|
| CALIBRATION DATE | Use this function to view the current calibration date and time for the sensor..<br>**User interface:**<br>Calibration date and time<br>**Factory setting:**<br>Calibration date and time of the current calibration.<br>✎ Note!<br>The calibration date and time format is defined in the FORMAT DATE/TIME (0429) function,→ 🖹 77 |
| CALIBRATION FACTOR | The calibration factor determined and set at the factory appears on the display.<br>**Display:**<br>5-digit floating-point number 0.5000 to 2.0000<br>**Factory setting:**<br>Depends on nominal diameter and calibration. |

| Function description, SENSOR DATA group | |
|---|---|
| ZEROPOINT | The zero point correction value determined and set at the factory appears on the display.<br>**Display:**<br>Max. 5-digit number: –1000 to +1000<br>**Factory setting:**<br>Depends on nominal diameter and calibration. |
| ZEROPOINT STATIC | The zero point correction value determined and set at the factory is adjusted.<br>The zero point correction value (see ZEROPOINT function) can be adjusted with the value entered here. If the value 0 (factory setting) is entered, the zero point correction value determined and set at the factory is not adjusted.<br>**User input:**<br>Max. 5-digit number: –1000 to +1000<br>**Factory setting:**<br>0 |
| CORRECTION FACTOR | The calibration factor determined and set at the factory is adjusted.<br>The calibration factor (see K-FACTOR function) can be adjusted with the value entered here. If the value 1.0000 (factory setting) is entered, the calibration factor determined and set at the factory is not adjusted.<br>**User input:**<br>5-digit floating-point number 0.5000 to 2.0000<br>**Factory setting:**<br>1.0000 |
| CABLE LENGTH | For selecting the device version (compact version = COMPACT) or the length of the connecting cable for the remote version.<br>**Options:**<br>COMPACT<br>LENGTH 5m/15feet<br>LENGTH 10m/30 feet<br>LENGTH 15m/45 feet<br>LENGTH 30m/90 feet<br>LENGTH 50m/150feet<br>OTHER<br>**Factory setting:**<br>COMPACT<br>✎ Note!<br>If OTHER is selected, the cable length effectively used can be entered in the subsequent CABLE LENGTH VARIABLE function. |
| CABLE LENGTH VARIABLE | If the OTHER option is selected in the CABLE LENGTH function, the effective length of the connecting cable for the remote version can be entered in this function.<br>If a cable length or COMPACT is selected in the CABLE LENGTH function, the corresponding value is displayed here.<br>**User input:**<br>Input limits: 0.00 to 50.00 or 0.00 to 150.00<br>**Factory setting:**<br>0.00 (= compact version)<br>✎ Note!<br>The appropriate unit is taken from the LENGTH function. → 🖹 75 |

## 11.12 Group SUPERVISION

| Function description, SUPERVISION group | |
|---|---|
| ACTUAL SYSTEM CONDITION | The current system status appears on the display.<br>**Display:**<br>SYSTEM OK<br>or<br>The diagnosis messages with the highest priority appear on the display<br>✎ Note!<br>Further information is provided in the "Troubleshooting" section on → 51 |
| PREVIOUS SYSTEM CONDITIONS | Use this function to view the 16 most recent diagnosis messages since measuring last started.<br>**Display:**<br>The last 16 diagnosis messages.<br>✎ Note!<br>Further information is provided in the "Troubleshooting" section on → 51 |
| ASSIGN DIAGNOSTIC CODE | All the diagnosis code messages and their device behavior appear on the display. By selecting the individual diagnosis code messages, the device behavior can be altered provided other options can still be selected.<br>**Display:**<br>CANCEL<br>INITIALIZATION<br>SENSOR CONNECTION<br>AMBIENT TEMPERATURE<br>ADJUST<br>MEDIUM<br>SENSOR SIGNAL<br>SIMULATION ERROR<br>SIMULATION OUTPUT<br>SIGNAL OUTPUT<br>✎ Note!<br>■ If the E key is pressed twice, the ERROR CATEGORY function is called up.<br>■ The function can be exited by using the □+□ key combination, or by selecting the "CANCEL" parameter (in the list of diagnosis code messages).<br>■ List of diagnosis code messages: → 54 |
| ALARM DELAY | For entering a timeframe in which the criteria for an error have to be met continuously before a diagnosis message is generated.<br>This suppression affects:<br>■ Display<br>■ PROFIBUS PA<br>**User input:**<br>Input limits: 0 to 100 s (in steps of one second)<br>**Factory setting:**<br>0 s<br>☝ Caution!<br>If this function is activated, diagnosis messages are delayed before being forwarded to the higher-order controller (PCS, etc.). It is therefore imperative to check in advance whether a delay of this nature could affect the safety requirements of the process. If diagnosis messages may not be suppressed, a value of 0 seconds must be entered here. |

| Function description, SUPERVISION group | |
|---|---|
| TROUBLESHOOTING | For acknowledging the diagnosis messages for data/checksum errors.<br><br>If a data/checksum error occurs (diagnosis messages F283-1, F283-2 or F283-4, see → 📄 55), the associated error block is displayed in this function and the functions of the error block are reset to the factory setting. Only the diagnosis message in question is acknowledged by selecting the error block in this function.<br><br>**Display:**<br>CANCEL<br>The error block in which a data/checksum error was present appears on the display |
| SYSTEM RESET | For restarting (resetting) the device.<br><br>**Options:**<br>NO<br>The device is not restarted.<br><br>MEASURING TUBE DATA<br>Restart without disconnecting main power. In doing so, the sensor data (zero point, cal. factor, etc.) are reset to the factory setting. All the other data (functions) are accepted unchanged.<br><br>RESTART<br>Restart without disconnecting main power. In doing so, all the data (functions) are accepted unchanged.<br><br>RESET DELIVERY<br>Restart without disconnecting main power. In doing so, all the data (functions) apart from the sensor data are reset to the factory setting.<br><br>**Factory setting:**<br>NO |
| OPERATION HOURS | The hours of operation of the device appear on the display.<br><br>**Display:**<br>Depends on the number of hours of operation elapsed:<br>Hours of operation < 10 hours → display format = 0:00:00 (hr:min:sec)<br>Hours of operation 10 to 10 000 hours → display format = 0000:00 (hr:min)<br>Hours of operation < 10 000 hours → display format = 000000 (hr) |

## 11.13 Group SIMULATION SYSTEM

| Function descriptions, SIMULATION SYSTEM group | |
|---|---|
| SIMULATION FAILSAFE MODE | Use this function to set all inputs, outputs and the totalizer to their defined failsafe modes, in order to check whether they respond correctly. During this time, the diagnosis message C 485 "Simulation Error" appears on the local display. → 57<br>**Options:**<br>OFF<br>ON<br>**Factory setting:**<br>OFF |
| SIMULATION MEASURAND | Use this function to set the Analog Input and Totalizer function blocks to their defined flow-response modes, in order to check whether they respond correctly. During this time, the diagnosis message C 485 "Simulation Value" appears on the local display. → 57<br>**Options:**<br>OFF<br>VOLUME FLOW<br>FLOW VELOCITY<br>SIGNAL STRENGTH<br>SOUND VELOCITY<br>**Factory setting:**<br>OFF<br>Note!<br>■ The measuring device can only be used for measuring to a certain extent while the simulation is in progress.<br>■ The setting is not saved if the power supply fails. |
| VALUE SIMULATION MEASURAND | Note!<br>This function is not available if OFF has been selected in the SIMULATION MEASURAND function.<br>For specifying a freely selectable value (e.g. 12 $m^3/s$) to check the assigned functions in the device itself and downstream signal circuits.<br>**User input:**<br>Input limits: $-10^{20}$ to $+10^{20}$<br>**Factory setting:**<br>0<br>Note!<br>■ The measuring device can only be used for measuring to a certain extent while the simulation is in progress.<br>■ The unit is taken from the SYSTEM UNITS group (→ 75). |

## 11.14 Group SENSOR VERSION

| Function descriptions, SENSOR VERSION group | |
|---|---|
| SERIAL NUMBER | The serial number of the sensor appears on the display. |

## 11.15 Group AMPLIFIER VERSION

| Function descriptions, AMPLIFIER VERSION group | |
|---|---|
| DEVICE SOFTWARE | The current device software version appears on the display. |
| I/O TYPE | The configuration of the I/O module appears on the display. |

# 11.16 Factory settings

## 11.16.1 Metric system units (not for USA and Canada)

### Units for volume flow, length, velocity, signal strength

| | Unit | | Unit |
|---|---|---|---|
| Volume flow | l/s | Length | mm |
| Velocity | m/s | Signal strength | dB |

### Language

| Country | Language | Country | Language |
|---|---|---|---|
| Australia | English | Luxembourg | Francais |
| Austria | Deutsch | Malaysia | English |
| Belgium | English | Netherlands | Nederlands |
| Czechia | Ceski | Norway | Norsk |
| Denmark | English | Poland | Polski |
| England | English | Portugal | Portugues |
| Finland | Suomi | Singapore | English |
| France | Francais | South Africa | English |
| Germany | Deutsch | Spain | Espanol |
| Hong Kong | English | Sweden | Svenska |
| Hungary | English | Switzerland | Deutsch |
| India | English | Thailand | English |
| Italy | Italiano | Other countries | English |

### Unit Totalizer 1 + 2

| Assign totalizer | Unit |
|---|---|
| Volume | $m^3$ |

## 11.16.2 US units (only for USA and Canada)

### Units for volume flow, length, velocity, signal strength, language

| | Unit | | Unit |
|---|---|---|---|
| Volume flow | $ft^3/h$ | Length | inch |
| Velocity | ft/s | Signal strength | dB |
| Language | English | | |

### Unit Totalizer 1 + 2

| Assign totalizer | Unit |
|---|---|
| Volume | $ft^3$ |

# Index

## L



## M



## N



## O



## P



## Q



## R

Endress+Hauser

People for Process Automation

# Declaration of Hazardous Material and De-Contamination

## *Erklärung zur Kontamination und Reinigung*

**RA No.** ☐☐☐☐☐☐☐☐

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

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

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

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

**Type of instrument / sensor**
*Geräte-/Sensortyp* _____

**Serial number**
*Seriennummer* _____

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

**Process data/** *Prozessdaten*

Temperature / *Temperatur*_____ [°F] _____ [°C]
Pressure / *Druck* _____ [psi] _____ [ Pa ]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Viscosity / *Viskosität* _____ [cp] _____ [$mm^2/s$]

**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<br>*Medium im Prozess* | | | | | | | | |
| Medium for process cleaning<br>*Medium zur Prozessreinigung* | | | | | | | | |
| Returned part cleaned with<br>*Medium zur Endreinigung* | | | | | | | | |

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

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

**Description of failure /** *Fehlerbeschreibung* _____

_____

_____

**Company data /** *Angaben zum Absender*

Company / *Firma* _____

_____

Address / *Adresse*

_____

_____

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

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

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

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

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

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

_____ Signature / *Unterschrift*

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