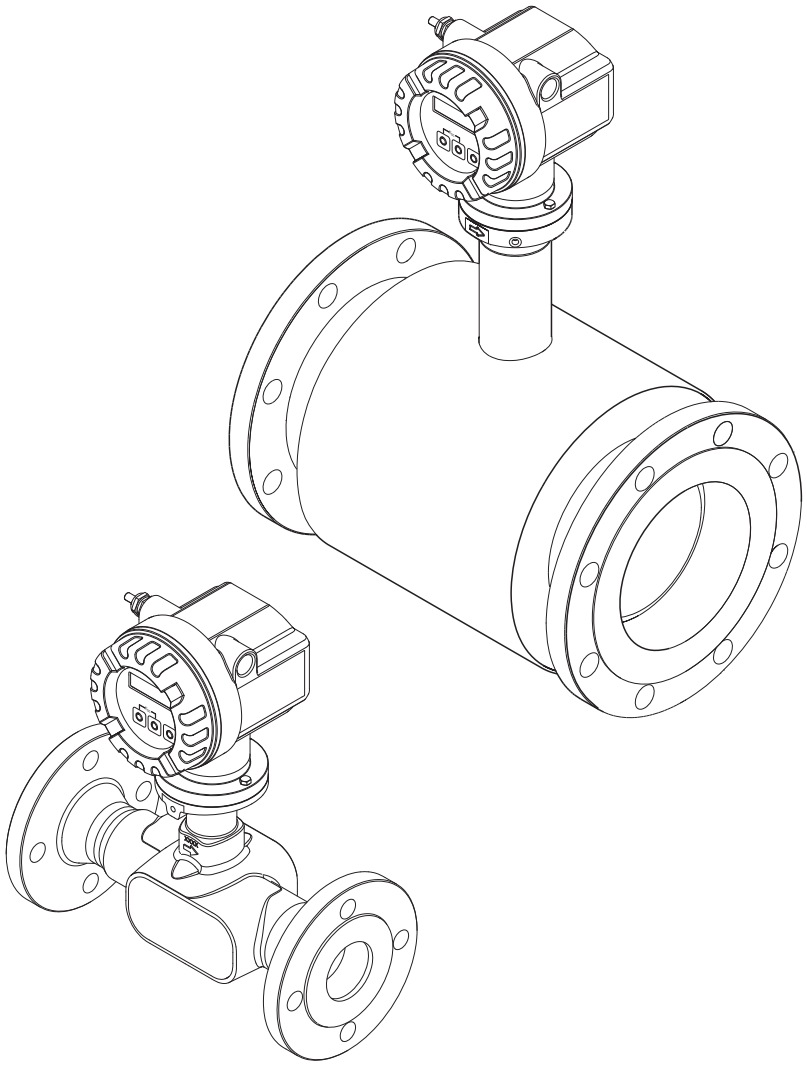
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Operating Instructions

Proline Prosonic Flow 92F FOUNDATION Fieldbus

Ultrasonic Flow Measuring System

Fieldbus™ Foundation



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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: ■ The specifications of the signal and fieldbus cable ■ The terminal assignment ■ The degree of protection	
▼	
Operating options	→ 26
A brief overview of the various operating options.	
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Hardware settings	→ 30
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▼	
Customer-specific configuration	→ 69
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 backup	→ 32
The configuration of the transmitter can be stored on the integrated T–DAT data storage device. ✎ Note! For time-saving commissioning, the settings stored in the T-DAT can be transmitted: – For equivalent measuring points (equivalent configuration,) – In the event of device/board replacement.	

✎ Note!
Always start troubleshooting with the checklist on → 43 if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

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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 61010-1, the EMC requirements of ICE/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 → 59

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 “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

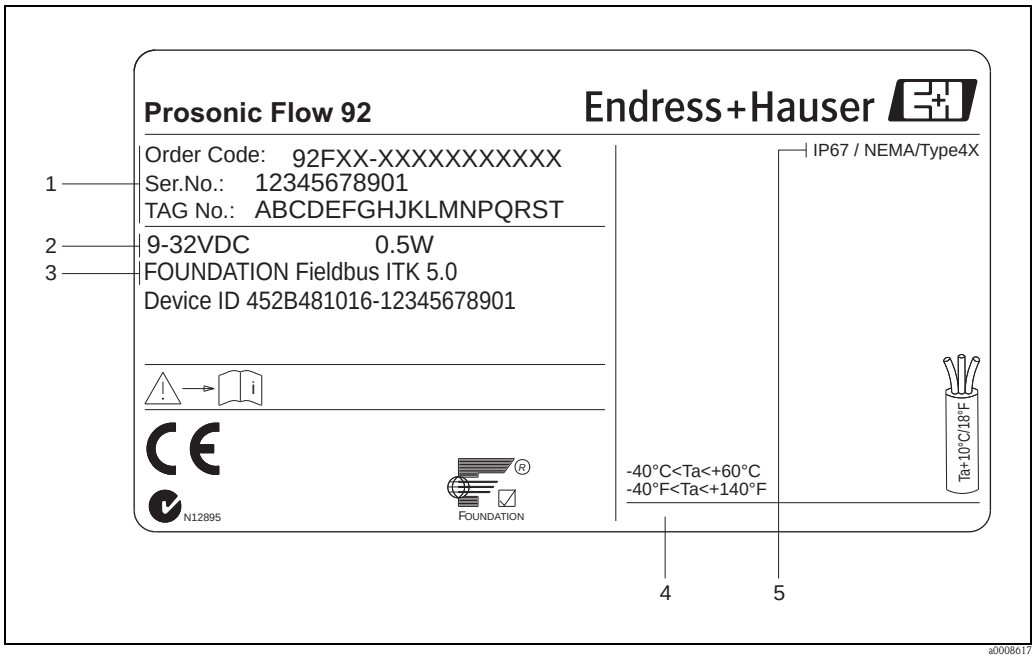

Fig. 1: Nameplate specifications for "Prosonic Flow 92" transmitter, compact version (example)

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

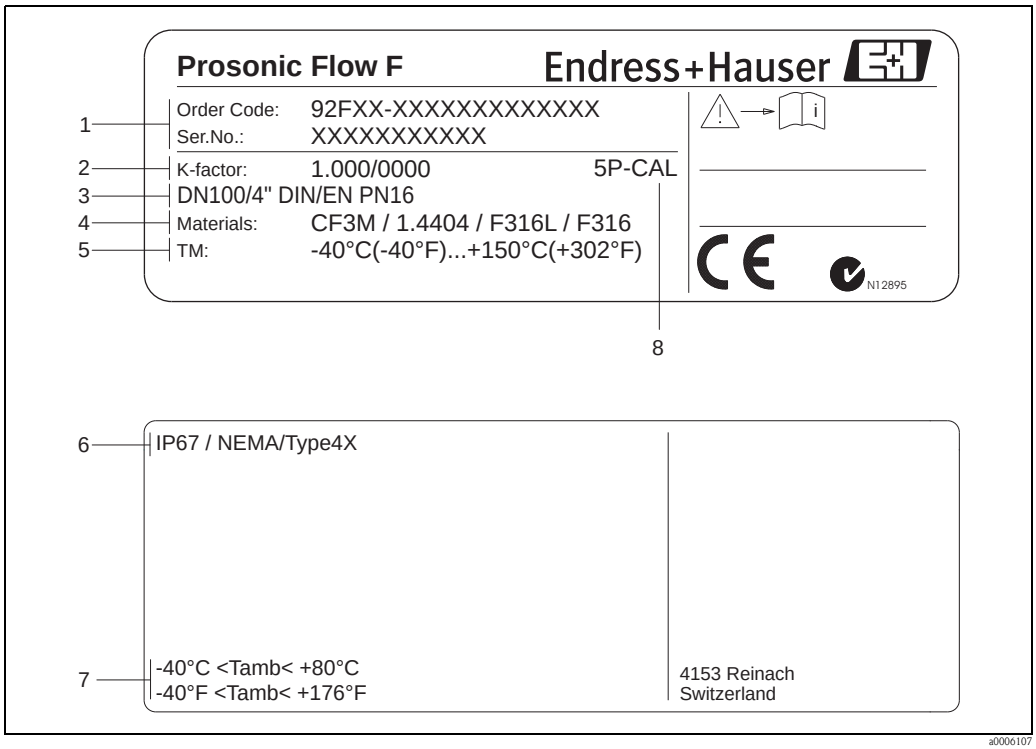

Fig. 2: Nameplate specifications for the "Prosonic Flow F" sensor (example)

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

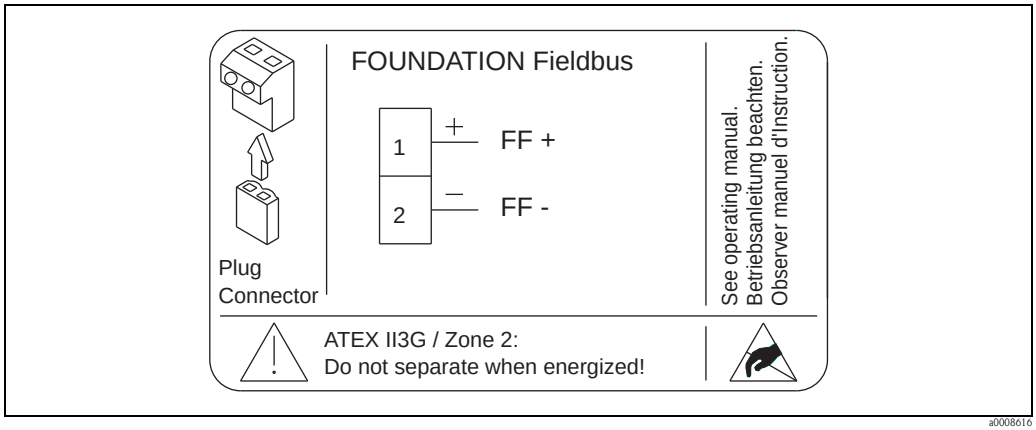

Fig. 3: Nameplate specifications for Proline transmitter (example)

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 devices comply with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and the EMC requirements as per IEC/EN 61326.
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 (ACA).

2.3 FOUNDATION Fieldbus device certification

The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus FOUNDATION. The device thus meets all the requirements of the following specifications:

- Certified to the FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus H1.
- Interoperability Test Kit (ITK), revision 5.0: The device can also be operated in conjunction with other-make certified devices.
- Physical Layer Conformance Test of the Fieldbus Foundation.

2.4 Registered trademarks

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

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

SWAGELOK®
Registered trademark of Swagelok & Co., Solon, USA

FOUNDATION™ Fieldbus
Registered trademark of the Fieldbus FOUNDATION, Austin, USA

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

3 Installation

3.1 Incoming acceptance, transport, 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.

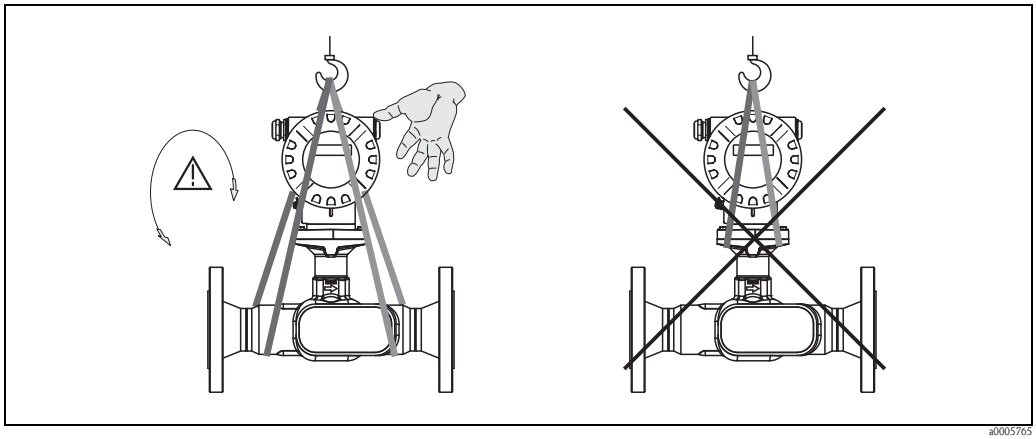

Fig. 4: Instructions for transporting measuring devices with a nominal diameter >DN 40 (>1½")

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.
- The measuring device must be plane-parallel and de-energized when being installed.
- The maximum permitted ambient temperatures (→ 65) and fluid temperatures (→ 64) 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" → 68.

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.

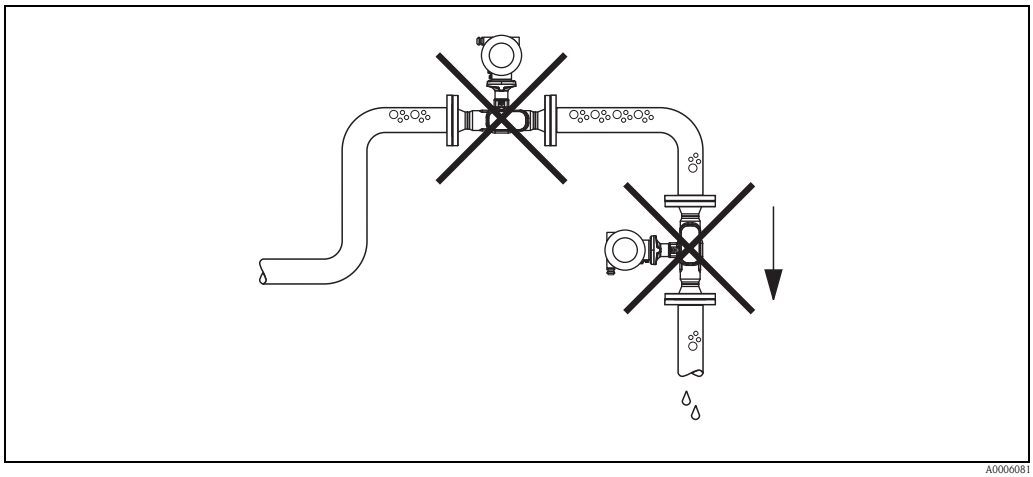

Fig. 5: Mounting location

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.

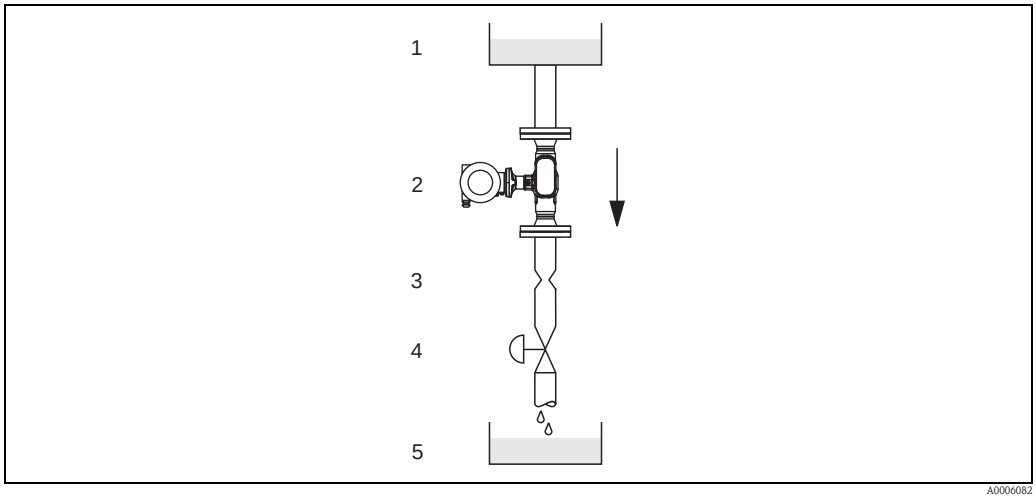

Fig. 6: Installation in a vertical pipe (e.g. for batching applications)

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).

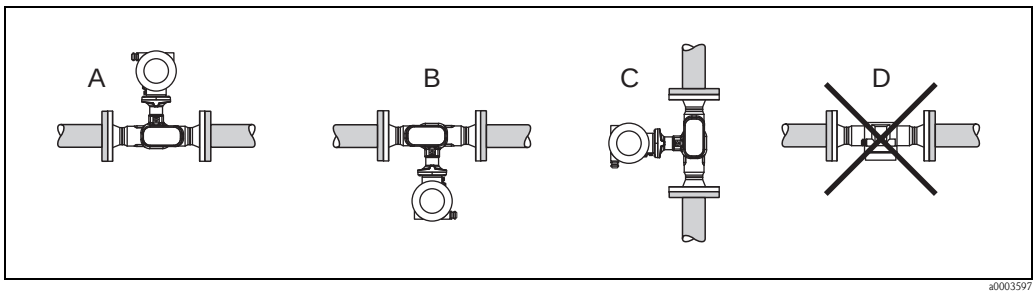

Fig. 7: Orientation A, B and C recommended; orientation D only recommended in certain circumstances

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 by 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 measured values are influenced by magnetic fields which may occur, (i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such cases, the sensor must be magnetically shielded.

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.

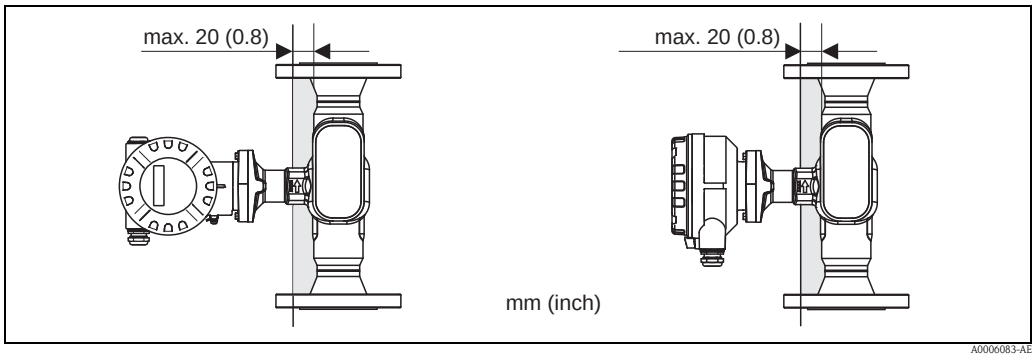

Fig. 8: A maximum insulation thickness of 20 mm (0.8") must be observed in the area of the electronics/neck.

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-sections, elbows, etc. As a minimum, the inlet and outlet runs shown below must be observed to achieve the specific accuracy of the device. The longest inlet run shown must be observed if two or more flow disturbances are present.

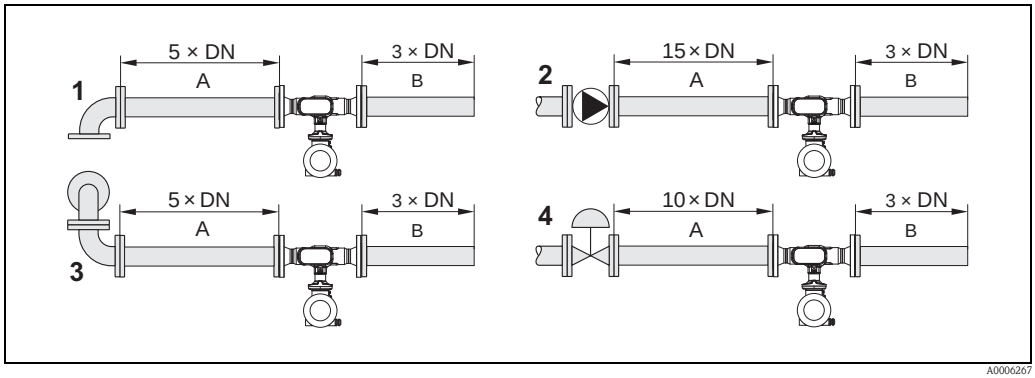

Fig. 9: Minimum inlet and outlet runs with various flow obstructions (values given for 3 and 4 path versions)

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

3.2.7 Vibrations

Information on vibrations is provided under "Vibration resistance" in the technical data section on → 64.

3.2.8 Limiting flow

Information on limiting flow is provided under "Measuring range" in the technical data section on → 60.

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 tube 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.

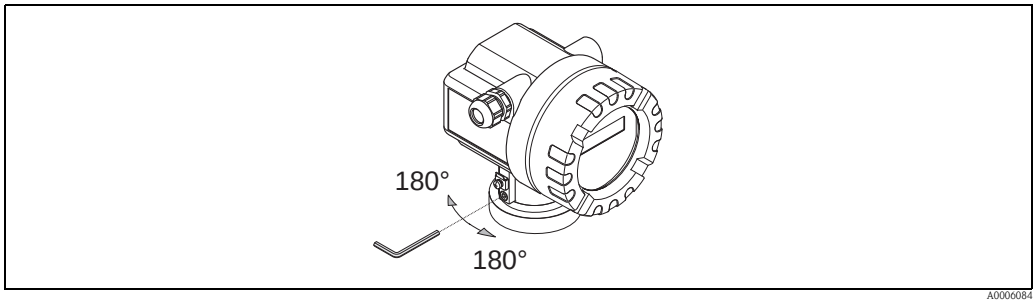

Fig. 10: Turning the transmitter housing

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), → 68

Caution!
When mounting on a pipe, the ambient temperature range may not be exceeded, see → 64.

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.

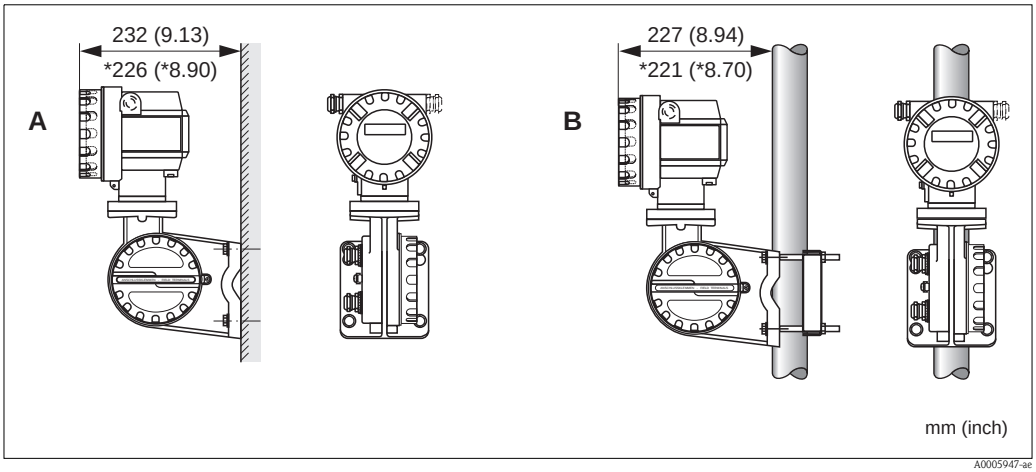

Fig. 11: Mounting the transmitter (remote version)

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?	→ 60
Installation instructions	**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?	→ 64

4 Wiring

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

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

4.1 FOUNDATION Fieldbus cable specification

4.1.1 Cable type

Twin-core cables are recommended for connecting the device to the FOUNDATION Fieldbus-H1. Following IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the FOUNDATION 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 cable type B, several fieldbuses (same degree of protection) may be operated in one cable. No other circuits are permissible in the same cable.
- Practical experience has shown that cable types C and D should not be used due to the lack of shielding, since the freedom from interference generally does not meet the requirements described in the standard.

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

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

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

4.1.2 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/3.28 ft). Note the following points:

- The maximum permissible overall cable length depends on the cable type used (→ 📄 16).
- If repeaters are used, the maximum permissible cable length is doubled.
  A maximum of three repeaters are permitted between user and master.

4.1.3 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/3.28 ft):

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 ft)	90 m (295 ft)	60 m (196 ft)	30 m (98 ft)	1 m (3.28 ft)

4.1.4 Number of field devices

In accordance with IEC 61158-2 (MBP), a maximum of 32 field devices can be connected per fieldbus segment. However, this number may be restricted in certain circumstances (explosion protection, bus power option, current consumption of field device).
A maximum of four field devices can be connected to a spur.

4.1.5 Shielding and grounding

Optimum electromagnetic compatibility of the fieldbus system can only be guaranteed if the system components and, in particular, the cables are shielded and the shield forms as complete a cover as possible. A shield coverage of 90% is ideal.

To ensure an optimum shield effect, connect the shield as often as possible to the reference ground. Where applicable, national installation regulations and guidelines must be observed!
Where there are large differences in potential between the individual grounding points, only one point of the shielding is connected directly with the reference ground. In systems without potential equalization, cable shielding of fieldbus systems should therefore only be grounded on one side, for example at the fieldbus supply unit or at safety barriers.

Caution!
If the cable shielding is grounded at more than one point in systems without potential equalization, network frequency equalization currents can occur that damage the bus cable or the bus shielding and substantially affect signal transmission.

4.1.6 Bus termination

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

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

4.1.7 Further information

General information and further notes on wiring can be found on the website (www.fieldbus.org) of the Fieldbus Foundation or in the Operating Instructions "FOUNDATION Fieldbus Overview" (acquired at: → www.endress.com → Download).

4.2 Connecting the remote version

4.2.1 Connecting the connecting cable for sensor/transmitter

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.

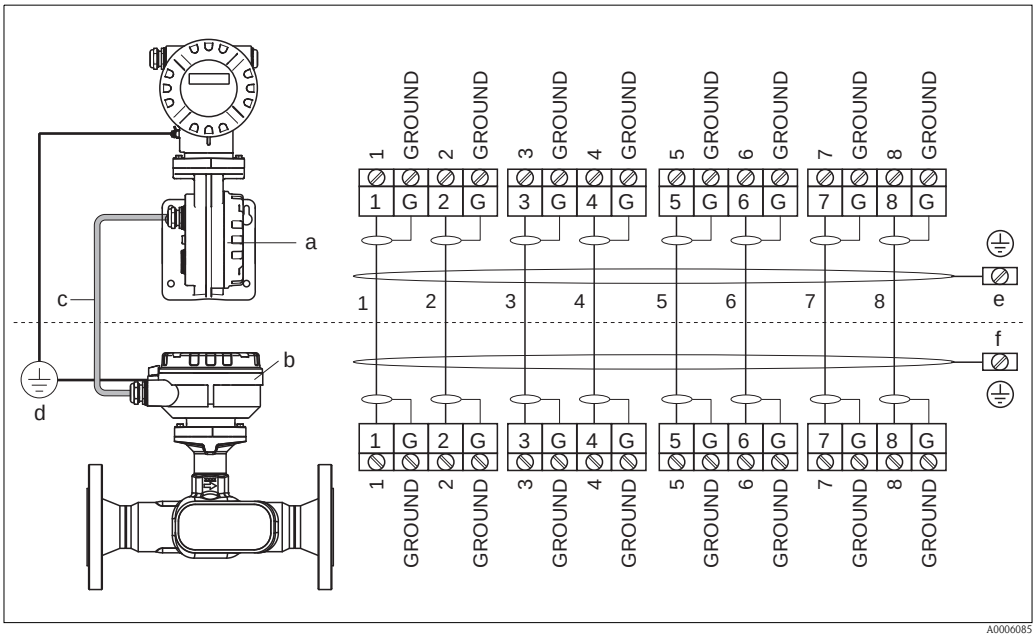

Fig. 12: Connecting the remote version

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 connecting 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 ft) and 30 m (90 ft) and optionally available with variable lengths ranging from 1 m (3 ft) to max. 50 m (150 ft).
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 FOUNDATION Fieldbus connection (terminal 1 = FF +, terminal 2 = FF –) have integrated reverse polarity protection. This ensures correct signal transmission via the fieldbus even if the lines are confused.
- Cable cross-section: max 2.5 mm².

Caution!
- Risk of damaging the FOUNDATION Fieldbus 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 FOUNDATION Fieldbus 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 right retaining rail with the left side (this secures the display module).
3. Loosen screw (d) of the cover of the connection compartment and fold down the cover.
4. Push the cable for the power supply/FOUNDATION Fieldbus through the cable gland (e).
5. Plug the terminal connector (f) out of the transmitter housing.
6. Connect the FOUNDATION Fieldbus cable (see → 15, 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 between the stripped FOUNDATION Fieldbus 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 Page 16).
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.

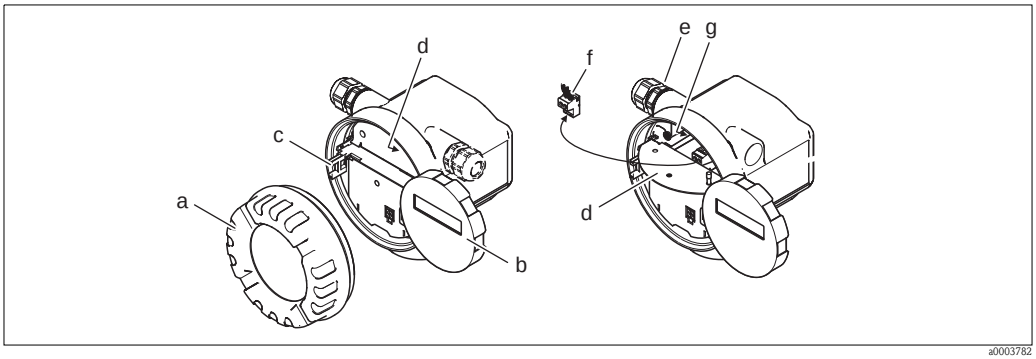

Fig. 13: Connecting the transmitter, non-Ex/Ex i version

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 FOUNDATION Fieldbus cable through the cable gland (c).
4. Plug the terminal connector (d) out of the transmitter housing.
5. Connect the FOUNDATION Fieldbus 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 in) between the stripped FOUNDATION Fieldbus cable and the ground terminal.
8. Tighten the cable glands (c) (see also → 16).
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.

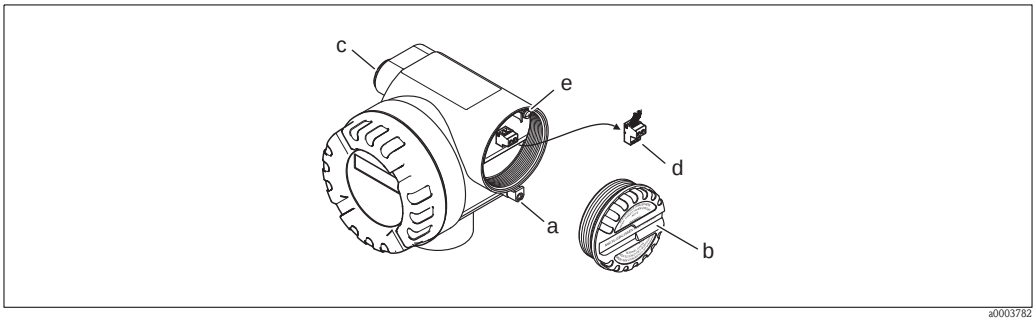

Fig. 14: Connecting the transmitter, Ex d version

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

Wiring diagram

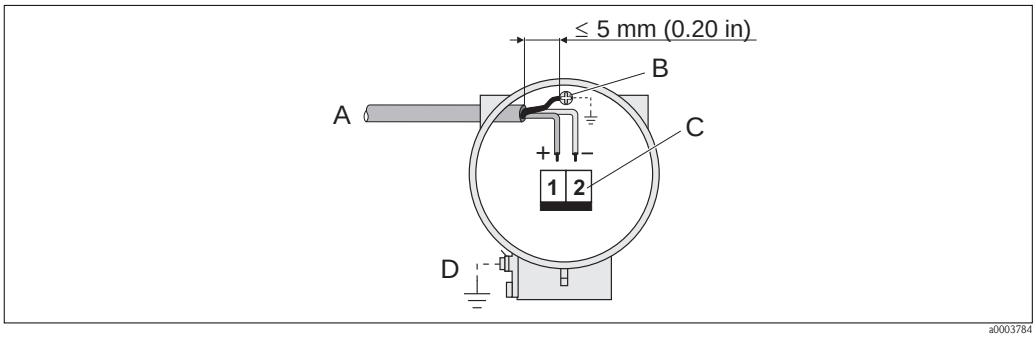

Fig. 15: Connecting the transmitter

A PROFIBUS cable
B Ground terminal for cable shielding
The cable shielding should not exceed a length of 5 mm between the stripped FOUNDATION FIELDBUS cable and the ground terminal!
C Terminal connector (1 = FF +, 2 = FF -)
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**-********** K	FF +	FF –

4.3.3 Fieldbus connector

The connection technology of FOUNDATION Fieldbus 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 (→ 54).

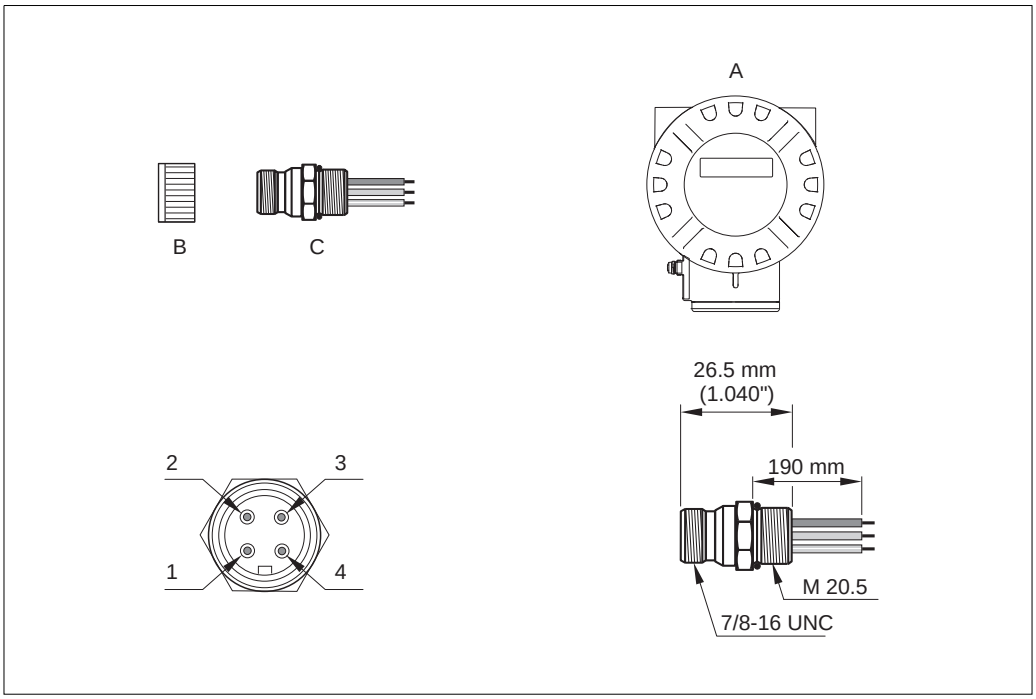

Fig. 16: Connectors for connecting to the FOUNDATION Fieldbus

A = Aluminum field housing
B = Protection cap for connector
C = Fieldbus connector

1 = Brown wire: FF + (terminal 26)
2 = Blue wire: FF – (terminal 27)
3 = Not assigned
4 = Green/yellow: ground (notes on connection → 19)

Technical data

- Degree of protection IP 67
- Ambient temperature range: –40 to +150 °C (–40 to +302 °F)

4.4 Degree of protection

The measuring device meets all the requirements for IP 67.

Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP 67 protection is maintained:
- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- The housing screws and screw caps must be firmly tightened.
- The cables used for connection must be of the specified outside diameter → 63, cable entries.
- The cable entries must be firmly tightened (point **a** → 17).
- The cable must loop down before it enters the cable entry ("water trap") (point **b** → 17). This arrangement prevents moisture penetrating the entry.

Note!

The cable entries should not point upwards.

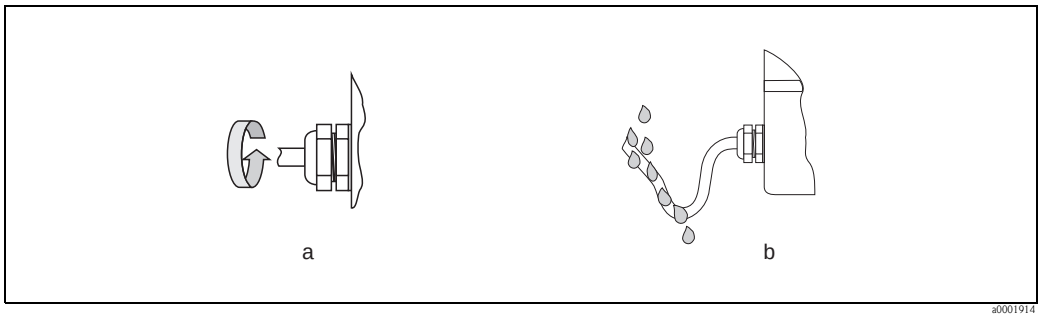

Fig. 17: Installation instructions for cable entries

- Replace all unused cable entries with dummy plugs.
- Do not remove the grommet from the cable entry.

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

Note!
The sensor can also be supplied with IP 68 rating (permanent immersion in water to a depth of 3 m (10 ft)). In this case, the transmitter is installed separate from the sensor!

4.5 Post-connection check

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

Device condition and specifications	**Notes**
Are cables or the device damaged (visual inspection)?	–
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	85 to 260 V AC (45 to 65 Hz) 20 to 55 V AC (45 to 65 Hz) 16 to 62 V DC
Do the cables used comply with the specifications?	→ 16
Do the cables have adequate strain relief?	–
Is the cable type route completely isolated? Without loops and crossovers?	–
Are the power supply and signal cables correctly connected?	See the wiring diagram inside the cover of the connection compartment
Are all screw terminals firmly tightened?	–
Are all the cable entries installed, tightened and sealed? Cable run with “water trap”?	→ 24
Are all the housing covers installed and tightened?	–
Electrical connection of FOUNDATION Fieldbus	**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 FOUNDATION Fieldbus specifications?	→ 17
Has the max. length of the spurs been observed in accordance with the FOUNDATION Fieldbus specifications?	→ 17
Is the fieldbus cable fully shielded (90%) 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
   FOUNDATION Fieldbus functions and device-specific parameters are configured primarily via the fieldbus 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)

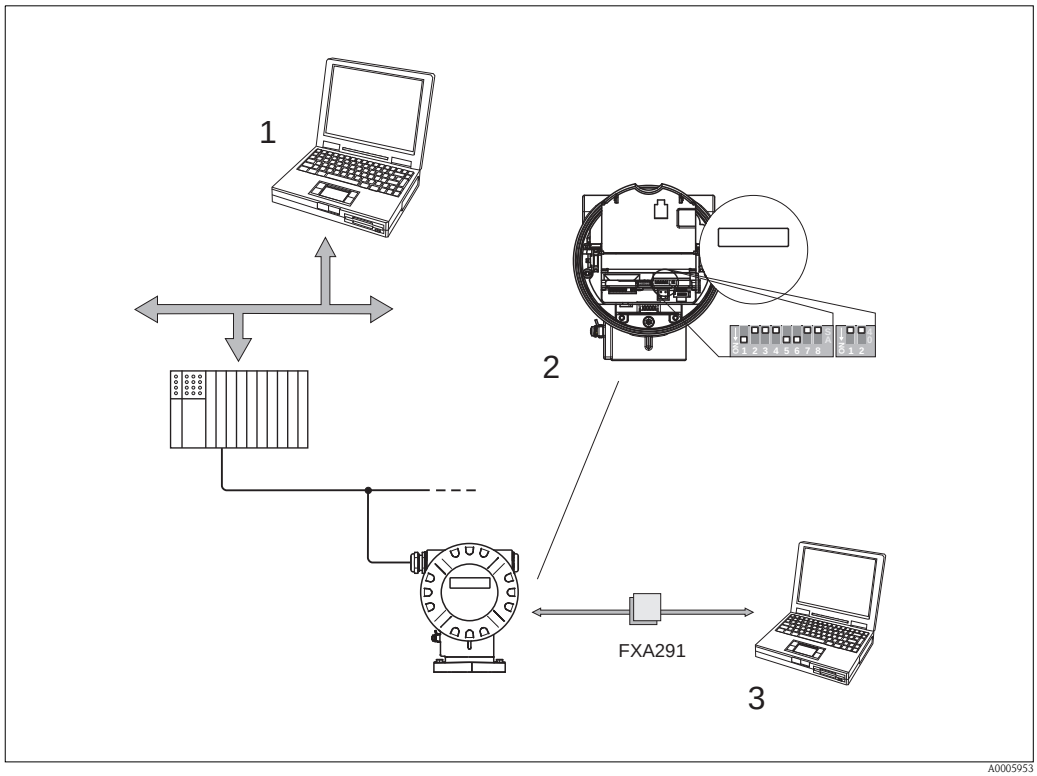

Fig. 18: Operating options

1 Configuration/operating programs (e.g. FieldCare) for operation via FOUNDATION Fieldbus
2 Miniature switches for hardware settings (write protection, device address, addressing mode)
3 Configuration/operating program for operating via the 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 (→ 74).

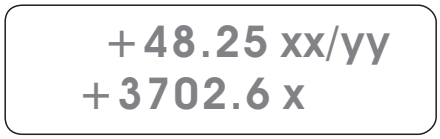

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Fig. 19: Liquid crystal display

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 FOUNDATION Fieldbus active (e.g. via FieldCare)
← → (alternating display)	Cyclic communication via FOUNDATION Fieldbus active, e.g. via PLC (Class 1 master)

5.3 Operating programs

5.3.1 "FieldCare" operating program

FieldCare is Endress+Hauser's FDT-based plant Asset Management Tool. It can configure all the intelligent field units in your system and helps you manage these units. By using the status information, it is also a simple but effective way of checking their status and condition.

5.3.2 Operation via FOUNDATION Fieldbus configuration programs

You can obtain special configuration and operating programs from various manufacturers for the configuration. These can be used for configuring both the FOUNDATION Fieldbus functions and all the device-specific parameters. The predefined function blocks allow uniform access to all the network and fieldbus device data.

A detailed step-by-step description of the procedure for commissioning the FOUNDATION Fieldbus functions is given on Page 33 ff. together with information on configuring device-specific parameters.
General information on FOUNDATION Fieldbus is provided in the Operating Instructions "FOUNDATION Fieldbus Overview" (BA013S) acquired at: → www.endress.com → Download.

System files

You require the following files for commissioning and configuring the network:
- Commissioning → DD (Device Description: *.sym, *.ffo)
- Network configuration → CFF file (Common File Format: *.cff)

These files can be acquired as follows:
- Free of charge via the Internet → www.endress.com / www.endress.com
- From Endress+Hauser stating the order number (No. 56003896)
- Via the Fieldbus Foundation Organization → www.fieldbus.org

Note!
Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up via the following functions/parameters:

FOUNDATION Fieldbus interface:
- Resource Block → DEV_REV parameter
- Resource Block → DD_REV parameter

Example (local display):
Display in the DEVICE REVISION (6243) function → 01
Display in the DD REVISION (6244) function → 01
Device description file (DD) required → 0101.sym / 0101.ffo

5.3.3 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.

Access via FOUNDATION Fieldbus:

Valid for device software	1.01.XX	→ Function "Device software"
Device data FOUNDATION Fieldbus Manufacturer ID: Device ID:	 11_{hex} (ENDRESS+HAUSER) 1061_{hex}	 → Function "Manufact ID" → Function "Device ID"
Version data FOUNDATION Fieldbus	Device Revision 1/DD Revision 1	
Software release	12.2010	
Operating program	**How to acquire:**	
Device Description (DD) and Capability File (CFF)	■ www.endress.com (→ Download → Software → Driver) ■ www.fieldbus.org ■ CD–ROM (Endress+Hauser order number: 56003896)	
Device driver for FF host systems:	**How to acquire:**	
ABB (FieldController 800)	See FF standard device driver	
Allen Bradley (Control Logix)	See FF standard device driver	
Emerson (Delta V)	www.easydeltav.com	
Endress+Hauser (ControlCare)	See FF standard device driver	
Honeywell (Experion PKS)	See FF standard device driver	
SMAR (system 302)	See FF standard device driver	
Yokogawa (CENTUM CS 3000)	www.yokogawa.com	
Device drivers for additional FF operating programs:	**Sources for obtaining updates:**	
Handheld terminal 375	www.fieldcommunicator.com ✎ Note! The device drivers can be added and updated via the update function of the handheld terminal 375.	

Operating program	**Sources for obtaining device descriptions**
Fieldcare	■ www.endress.com → Download ■ Update CD-ROM (Endress+Hauser order number: 56004088) ■ VD (Endress+Hauser Bestellnummer: 70100690
AMS	www.endress.com → Download
SIMATIC PDM	www.endress.com → Download
Tester and simulator	**Sources for obtaining device descriptions**
Fieldcheck	■ Update via Fieldcare with the Flow device FXA 193/291 DTM in the Fieldflash module

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

5.4 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 FOUNDATION Fieldbus (acyclic data transmission, e.g. via "FieldCare" operating program).
The current status is displayed in the WRITE PROTECT function (→ 47).

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 right retaining rail with the left side (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 FOUNDATION Fieldbus 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 FOUNDATION Fieldbus 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” addressing method. The device address can be entered in the software addressing addressing mode by means of the FIELDBUS ADDRESS function (→ 47). 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 right retaining rail with the left side (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.

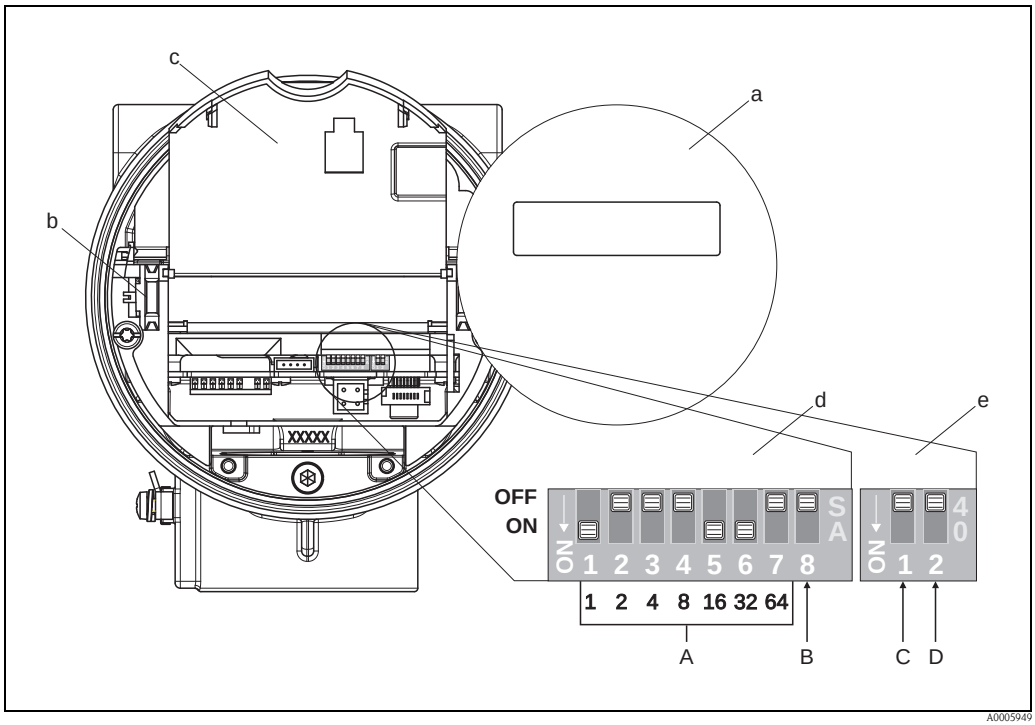


Fig. 20: Miniature switches for configuring the device address, the addressing mode and the write protection

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

d Switch block 1:
- ***A** (miniature switches 1 to 7):*
  not assigned

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

e Switch block 2:
- ***C** (miniature switch 1):*
  selection for simulation mode
  OFF = disabled
  ON = enabled

- ***D** (miniature switch 2):*
  switching write protection on and off:
  OFF = disabled
  ON = enabled

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 V XX.XX.XX	Displays the current software
FOUNDATION FIELDBUS	Displays the input/output modules installed
FIELDBUS ADDRESS 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 (→ 47).

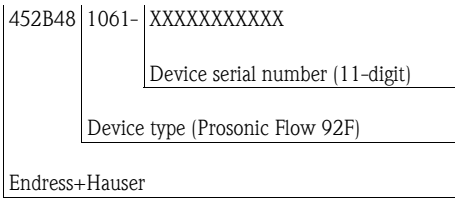
6.3 Managing data using the T-DAT SAVE/LOAD function

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 → 72 for a description of this function and the exact procedure for managing data.

6.4 Commissioning via FOUNDATION Fieldbus

Note the following points:
- The files required for commissioning and network configuration can be obtained as described on → 🖹 28.
- In the case of the FOUNDATION Fieldbus, the device is identified in the host or configuration system by means of the device ID (DEVICE_ID). The DEVICE_ID is a combination of the manufacturer ID and device serial number. It is unique and can never be assigned twice.

  The DEVICE_ID of Prosonic Flow 92F is composed as follows:



Commissioning:

The following description takes you step-by-step through commissioning the device and all the necessary configurations for the FOUNDATION Fieldbus:

1. Switch the device on.
2. Note the DEVICE_ID on the device nameplate (→ 🖹 7).
3. Open the configuration program.
4. Load the device description files or the CFF file into the host system or the configuration program. Make sure you are using the right system files. Refer to the example on → 🖹 28. The first time it is connected the measuring device reports as follows:

   – EH_Prosonic_Flow_92F_xxxxxxxxxxx (tag name PD-TAG)
   – 452B481061- xxxxxxxxxxx (Device_ID)
   – Block structure:

Display text (xxx… = serial number)	Base index	Description
RESOURCE_ xxxxxxxxxxx	400	Resource Block
TRANSDUCER_FLOW_xxxxxxxxxxx	500	"Flow" Transducer Block
TRANSDUCER_DIAG_xxxxxxxxxxx	800	"Diagnosis" Transducer Block
TRANSDUCER_DISP_xxxxxxxxxxx	700	"Display" Transducer Block
TRANSDUCER_TOT_xxxxxxxxxxx	600	"Totalizer" Transducer Block
ANALOG_INPUT_1_xxxxxxxxxxx	900	Analog Input function block 1
ANALOG_INPUT_2_xxxxxxxxxxx	1000	Analog Input function block 2
ANALOG_INPUT_3_xxxxxxxxxxx	1100	Analog Input function block 3
ANALOG_INPUT_4_xxxxxxxxxxx	1200	Analog Input function block 4
DIGITAL_OUTPUT_xxxxxxxxxxx	1500	Digital Output function block (DO)
PID_xxxxxxxxxxx	1600	PID function block (PID)
ARITHMETIC_xxxxxxxxxxx	1700	Arithmetic function block (ARTH)
INPUT_SELECTOR_xxxxxxxxxxx	1900	Input Selector function block (ISEL)
SIGNAL_CHARACT_xxxxxxxxxxx	1800	Signal Characterizer function block (CHAR)
INTEGRATOR_xxxxxxxxxxx	2000	Integrator function block (INTG)
ANALOG_OUTPUT_xxxxxxxxxxx	1300	Analog Output function block (AO)
DIGITAL_INPUT_xxxxxxxxxxx	1400	Discrete Input function block (DI)

Note!
The measuring device is supplied with the bus address "250" and is thus in the address range between 248 and 251 reserved for readdressing field devices. This means that the LAS (Link Active Scheduler) automatically assigns the device a free bus address in the initialization phase.

5. Identify the field device using the DEVICE_ID that you noted down and assign the desired field device tag name (PD_TAG) to the fieldbus device in question.
   Factory setting: E+H_xxxxxxxxxxx

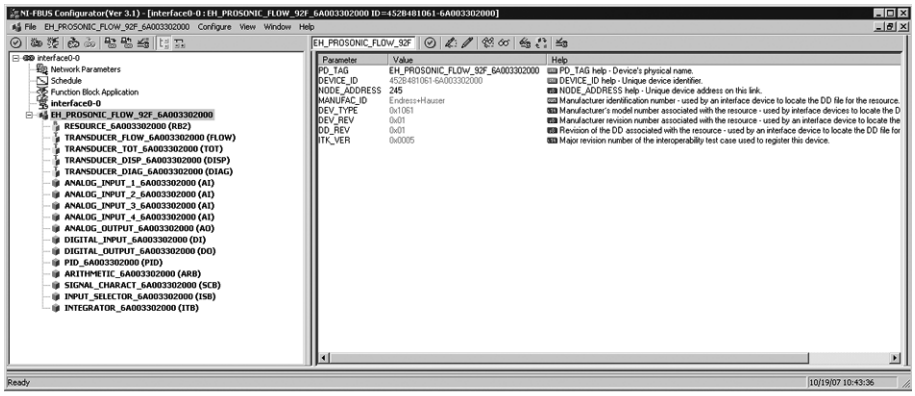


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Fig. 21: Screen display in the configuration program "NI-FBUS Configurator" (National Instruments) after the connection has been established

Configuration of the "Resource Block" (base index 400)

6. Open the Resource Block.
7. On delivery, hardware write protection is disabled so that you can access all the write parameters via FOUNDATION Fieldbus. Check the status via the WRITE_LOCK parameter:
   – Write protection enabled = LOCKED
   – Write protection disabled = NOT LOCKED

   Disable the write protection if necessary → 30.
8. Enter the desired name for the block (optional).
   Factory setting: RESOURCE_xxxxxxxxxxx
9. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to AUTO.

Configuration of the "Transducer Blocks"

The individual Transducer Blocks comprise various parameter groups ordered by device-specific functions:

Transducer Block	Base index	Description
"Flow" Transducer Block	500	Flow measurement
"Diagnosis" Transducer Block	800	Diagnostic functions
"Display" Transducer Block	700	Local display functions
"Totalizer" Transducer Block	600	Totalizer 1 to 2

The following description provides an example for the "Flow" Transducer Block (base index: 1400).

10. Enter the desired name for the block (optional).
    Factory setting: TRANSDUCER_FLOW_xxxxxxxxxxx
11. Open the "Flow" Transducer Block.
12. Now configure the device-specific parameters relevant for your application:

    ✎ Note!
    – Note that changes to the device parameters can only be made after entering a valid release code in the "Access – Code" parameter.
    – The selection of the system units in the "Flow" Transducer Block has no effect on the output value OUT (AI Block). Units of the process variables which are transmitted via the FOUNDATION Fieldbus interface must be specified separately in the Analog Input function block via the XD_SCALE and OUT_SCALE parameter group.
13. Set the "Flow" and "Totalizer" Transducer Blocks to AUTO in the MODE_BLK parameter group (TARGET parameter). Only then is it ensured that the process variables can be processed correctly by the downstream AI function block.

Configuration of the "Analog Input function blocks"

The measuring device has seven Analog Input function blocks that can be assigned to the various process variables as required. The following description provides an example for Analog Input function block 1 (base index: 500).

14. Enter the required name for the Analog Input function block (optional).
    Factory setting: ANALOG_INPUT_1xxxxxxxxxx
15. Open the Analog Input function block 1.
16. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to OOS, i.e. the block is out of service.
17. Using the CHANNEL parameter, select the process variable that is to be used as the input value for the function block algorithm (scaling and limit value monitoring functions). The following settings are possible:

Process variable	Channel parameter
Volume flow	2
Totalizer 1	7
Totalizer 2	8
Sound Velocity	21
Flow Speed	23
Signal Strength	30

18. In the XD_SCALE parameter group, select the desired engineering unit and the block input range (e.g. measurement range of the flow application) for the process variable in question (see the example below).

    ☝ Caution!
    Make sure that the engineering unit selected suits the measured variable of the process variable chosen. Otherwise the BLOCK_ERROR parameter will display the error message "Block Configuration Error"
    and the block operating mode cannot be set to AUTO.

19. In the L_TYPE parameter, select the mode of linearization for the input variable (Direct, Indirect, Indirect Sq Root) → See the "Description of Device Functions" manual.

    ☝ Caution!
    Note that with the "Direct" type of linearization, the configuration of the OUT_SCALE parameter group must agree with the configuration of the XD_SCALE parameter group. Otherwise the block operating mode cannot be set to AUTO. Such incorrect configuration is indicated via the BLOCK_ERROR parameter with the "Block Configuration Error" message.

    Example:
    – The measurement range of the sensor is 0 to 30 m^3/h.
    – The output range to the automation system should be 0 to 30 kg/h also.
    The following settings must be made:
    – Analog Input function block / CHANNEL parameter (selection of input value), selection: 1 → Mass flow
    – L_TYPE parameter → Direct
    – XD_SCALE parameter group
      XD_SCALE 0% = 0
      XD_SCALE 100% = 30
      XD_SCALE UNIT = m^3/h

    – OUT_SCALE parameter group
      OUT_SCALE 0% = 0
      OUT_SCALE 100% = 30
      OUT_SCALE UNIT = m^3/h

20. Use the following parameters to define the limit values for the alarm and early warning messages:
    – HI_HI_LIM → Limit value for the upper alarm
    – HI_LIM → Limit value for the upper warning
    – LO_LIM → Limit value for the lower warning
    – LO_LO_LIM → Limit value for the lower alarm
    The limit values entered must be within the value range specified in the OUT_SCALE parameter group.

21. In addition to the actual limit values you must also specify the action taken if a limit value is exceeded using so-called "alarm priorities" (HI_HI_PRI, HI_PRI, LO_PR, LO_LO_PRI parameters) → See "Description of Device Functions" manual. Reporting to the fieldbus host system only takes place if the alarm priority is higher than 2.

22. System configuration/connection of function blocks (→ 22):
    A concluding "overall system configuration" is essential so that the operating mode of the Analog Input function block can be set to AUTO and so that the field device is integrated into the system application. For this purpose, configuration software, such as the NI-FBUS Configurator from National Instruments, is used to connect the function blocks to the desired control strategy (mostly using graphic display) and then the time for processing the individual process control functions is specified.

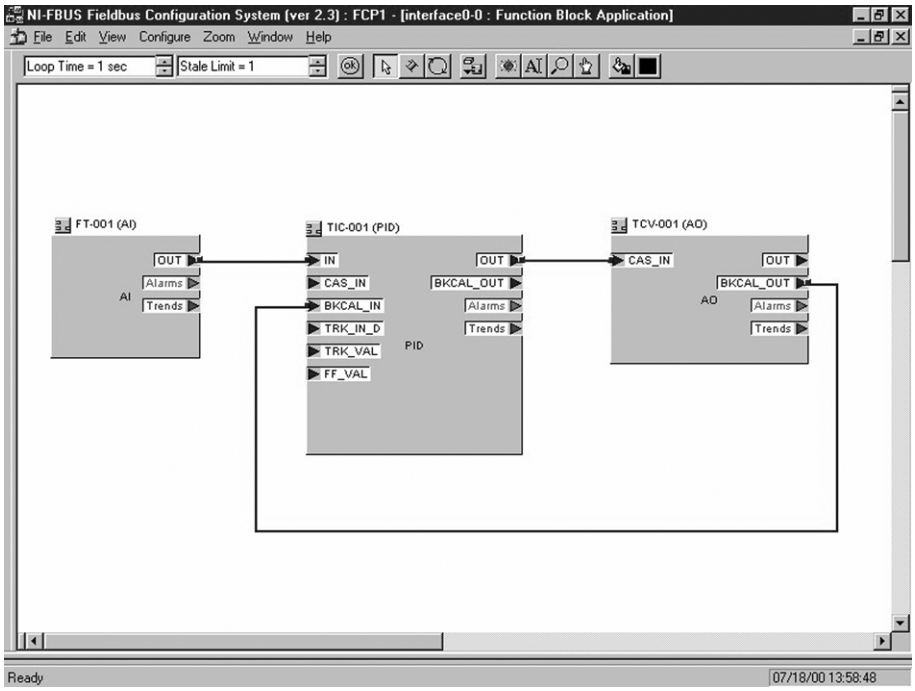


Fig. 22: Connecting function blocks with the aid of the "NI-FBUS Configurator"

23. Once you have specified the active LAS, download all the data and parameters to the field device.
24. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to AUTO. This is only possible under two conditions, however:
    – The function blocks are correctly connected with each other.
    – The Resource Block is in the AUTO operating mode.

6.5 Adjustment

6.5.1 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. → 63
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

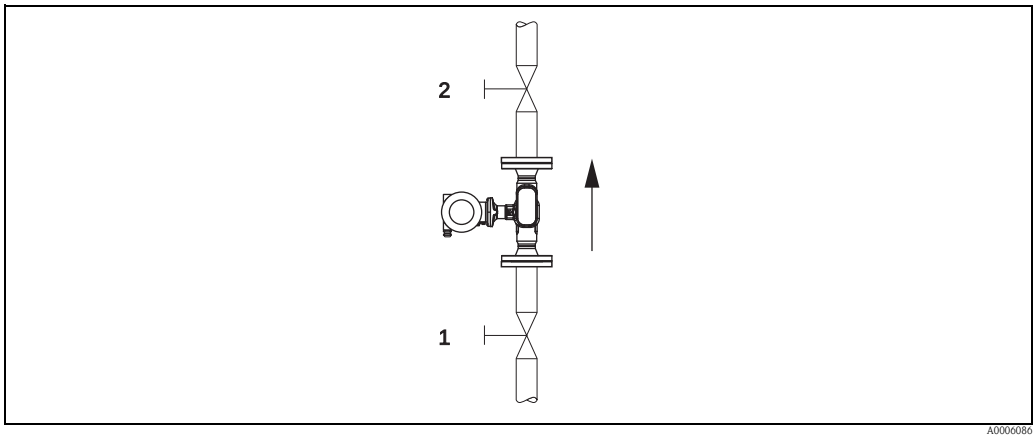


Fig. 23: Zero point adjustment and shutoff valves

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 (functional description, see → 83):
   PROCESSPARAMETER → ZERO POINT ADJUSTMENT → START

Note!
The zero point value currently valid is displayed in the ZEROPOINT function (→ 85).

6.6 Data storage device (HistoROM)

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

6.6.1 HistoROM/S-DAT (sensor–DAT)

The HistoROM/S-DAT is an exchangeable data storage device in which all sensor relevant parameters are stored, i.e., pipe type, diameter, serial number, flow conditoner, zero point.

6.6.2 HistoROM/T-DAT (transmitter–DAT)

The Histi-ROM/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 HistoROM/T-DAT and vice versa has to be carried out by the user (= manual save function). Detailed instructions regarding this can be found in the handbook "Description of Device Functions" (function T-DAT SAVE/LOAD).
Detailed information→ 72

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 Proline Prosonic Flow 92F	Transmitter for replacement or for stock. Use the order code to define the following specifications: – Approvals – Degree of protection / version – Cable entry – Display / power supply / operation – Software – Outputs / inputs	92FXXXX - XXXXX * * * * * *

8.2 Measuring principle-specific accessories:

Accessory	Description	Order code
Mounting kit for transmitter	Mounting kit for remote version, suitable for: – Wall mounting – 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 – *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the “FieldCare” software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant Asset Management Tool. It can configure all the intelligent field units in your system and helps you manage these units. By 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

Accessory	Description	Order code
FXA291	The 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 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 2. Display module defective → order spare part 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 FOUNDATION Fieldbus → 🖹 47.

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 Terminal 1 = FF + Terminal 2 = FF –
Fieldbus connector	■ Check pin assignment/wiring ■ Check connection between connector/fieldbus port. Is the coupling ring tightened correctly?
Fieldbus voltage	Check that a min. bus voltage of 9 V DC is present at terminals 1/2. 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 FOUNDATION Fieldbus HI been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in data transmission.
Current consumption, permissible feed current	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply.
Device Description (DD)	Install the DD if you cannot access the manufacturer-specific parameters. ✎ Note! Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up via the following functions/parameters: FF interface: ■ Resource Block → DEV_REV parameter ■ Resource Block → DD_REV parameter Example: Display in the DEVICE REVISION function → 01 Display in the DD REVISION function → 01 Device description file (DD) required → 0101.sym / 0101.ffo

▼

Problems when configuring function blocks	
Transducer Blocks: The operating mode cannot be set to AUTO.	Check whether the operating mode of the Resource Block is in the AUTO mode → MODE_BLK parameter group / TARGET parameter. *(continued on next page)*

Analog Input fct. block: The operating mode cannot be set to AUTO. *(continued)*	There can be several reasons for this. Check the following points one after another: 1. Check whether the operating mode of the Analog Input function block is in the AUTO mode → MODE_BLK parameter group / TARGET parameter. If not, and if the mode cannot be changed to AUTO, first check the following points. 2. Make sure that the CHANNEL parameter (process variable selection) is already configured in the Analog Input function block → 📄 54. CHANNEL = 0 (uninitialized) is not valid. 3. Make sure that the XD_SCALE parameter group (input range, unit) is configured in the Analog Input function block → 📄 54 (incl. configuration example) ☝ Caution! Make sure that the unit selected suits the process variable selected in the CHANNEL parameter. Otherwise the BLOCK_ERROR parameter will display the error message "Block Configuration Error". In this status, the operating mode cannot be set to AUTO.
Analog Input fct. block: The operating mode cannot be set to AUTO.	4. Make sure that the L_TYPE parameter (type of linearization) is already configured in the Analog Input function block → 📄 54. ☝ Caution! Make sure that with the "Direct" type of linearization, the scaling of the OUT_SCALE parameter group is identical to that of the XD_SCALE parameter group. If set incorrectly the BLOCK_ERROR parameter will display the error message "Block Configuration Error". In this status, the operating mode cannot be set to AUTO. Configuration example → 📄 54. 5. Check whether the operating mode of the Resource Block is in the AUTO mode → MODE_BLK parameter group / TARGET parameter. 6. Make sure that the function blocks are correctly interconnected and that this system configuration has been sent to the fieldbus users → 📄 54.
Analog Input function block: The operating mode is set to AUTO but the status of the AI output value OUT is BAD or UNCERTAIN.	1. Check whether the operating mode of the Transducer Blocks is in the AUTO mode → MODE_BLK parameter group / TARGET parameter. Using the various CHANNEL parameters (→ 📄 60) set the Transducer Blocks to the AUTO operating mode. 2. Check whether an error is pending in the "Flow" (base index: 1400) or "Totalizer" (base index: 1900) Transducer Blocks → "Diagnosis" Transducer Block (base index: 1600) → "Diag. - Act.Sys.Condition" parameter. Error messages → 📄 74
Parameters cannot be modified or no write access to parameters.	1. Parameters that only show values or settings cannot be changed! 2. Hardware write protection is enabled → Disable the write protection → 📄 54 ✎ Note! You can use the WRITE_LOCK parameter in the Resource Block to check whether hardware write protection is enabled or disabled: LOCKED = write protection enabled (activated) UNLOCKED = no write protection (disabled) 3. The block operating mode is set to the wrong mode. Certain parameters can only be changed in the OOS (out of service) or MAN (manual) mode. → Set the operating mode of the block to the necessary mode → MODE_BLK parameter group. 4. The value entered is outside the specified input range for the parameter in question: → Enter a suitable value → Increase input range if necessary 5. Transducer Blocks: The programming level is not enabled → Enable by entering the code in the "Access - Code" parameter or by means of the service code in the service parameters. *(continued on next page)*

Transducer Block: The manufacturer-specific parameters are not visible. *(continued)*	The device description file (Device Description, DD) has not yet been loaded into the host system or the configuration program → Download the file to the configuration system. For information on where to obtain the DD → 📄 54 ✎ Note! Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up in the measuring device via the following functions/parameters: FF interface: ■ Resource Block → DEV_REV parameter ■ Resource Block → DD_REV parameter Example (local display): Display in the DEVICE REVISION function → 01 Display in the DD REVISION function → 01 Required device description file (DD) → 0101.sym / 0101.ffo
Analog Input function block: The output value OUT is not updated despite having a GOOD status.	Simulation is active → Deactivate simulation via the SIMULATE parameter group.
Error messages	
Error messages in the FF configuration program and on the local display → 📄 47	

▼

Other errors (without error message)	
Some other error has occurred.	Diagnosis and remedial measures → 📄 47

9.2 Diagnosis code messages

9.2.1 Category F diagnosis code messages

Code **Local display**	**FOUNDATION Fieldbus measured value status** **1 = Quality code (hex)** **2 = Quality status** **3 = Quality substatus** **4 = Limits** **5 = Advanced diagnosis message**	**Cause**	**Remedy:**
F 001 Device fault	1 = 0x0C 2 = BAD 3 = Device fault 4 = Constant 5 = Device failure	Serious device error	Replace the amplifier board
F 062 - 1 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection down CH1	Connection between "channel 1 down" sensor and transmitter interrupted.	■ Check cable connection between the sensor and transmitter ■ Sensor possibly defective
F 062 - 2 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection up CH1	Connection between "channel 1 up" sensor and transmitter interrupted.	
F 062 - 3 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection down CH2	Connection between "channel 2 down" sensor and transmitter interrupted.	
F 062 - 4 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection up CH2	Connection between "channel 2 up" sensor and transmitter interrupted.	
F 062 - 5 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection down CH3	Connection between "channel 3 down" sensor and transmitter interrupted.	
F 062 - 6 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection up CH3	Connection between "channel 3 up" sensor and transmitter interrupted.	
F 062 - 7 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection down CH4	Connection between "channel 4 down" sensor and transmitter interrupted.	
F 062 - 8 Sensor connection	1 = 0x0C 2 = BAD 3 = Sensor connection 4 = Constant 5 = Sensor connection up CH4	Connection between "channel 4 up" sensor and transmitter interrupted.	

Code **Local display**	**FOUNDATION Fieldbus measured value status** **1 = Quality code (hex)** **2 = Quality status** **3 = Quality substatus** **4 = Limits** **5 = Advanced diagnosis message**	**Cause**	**Remedy:**
F 242 Incompatible software	1 = 0x0C 2 = BAD 3 = Incompatible software 4 = Constant 5 = Software incompatible	The I/O board and the amplifier board are not compatible	Replace the amplifier board
F 262 Module connection	1 = 0x0C 2 = BAD 3 = Module connection 4 = Constant 5 = Module connection com I/O	Internal communication error on the amplifier board	Replace the amplifier board
F 282 - 1 Data storage	1 = 0x0C 2 = BAD 3 = Data storage 4 = Constant 5 = Data storage amplifier	Amplifier: Faulty EEPROM	Replace the amplifier board
F 282 - 2 Data storage	1 = 0x0C 2 = BAD 3 = Data storage 4 = Constant 5 = Data storage com	COM module: Faulty EEPROM	Replace COM module
F 282 - 3 Data storage	1 = 0x0C 2 = BAD 3 = Data storage 4 = Constant 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 Checksum error	1 = 0x0C 2 = BAD 3 = Checksum error 4 = Constant 5 = Memory content com	Amplifier: Error when accessing data of the EEPROM	■ See TROUBLESHOOTING function, → 📄 86 ■ Contact your Endress+Hauser representative.
F 283 - 2 Checksum error	1 = 0x0C 2 = BAD 3 = Checksum error 4 = Constant 5 = Memory content amplifier	COM module: Error when accessing data of the EEPROM	■ See TROUBLESHOOTING function, → 📄 86 ■ Contact your Endress+Hauser representative.
F 283 - 3 Checksum error	1 = 0x0C 2 = BAD 3 = Checksum error 4 = Constant 5 = Memory content T-DAT	Error accessing the values of the HistoROM/T-DAT ■ HistoROM/T-DAT is not plugged into the amplifier board or is defective ■ Amplifier board defective	■ Run the T-DAT LOAD function, select SAVE, see → 📄 72 ■ Plug HistoROM/T-DAT into the amplifier board or replace it. ■ Replace the amplifier board.
F 283 - 4 Checksum error	1 = 0x0C 2 = BAD 3 = Checksum error 4 = Constant 5 = Memory content powerfail	Totalizer checksum error	■ See TROUBLESHOOTING function, → 📄 86 ■ Restart measuring device ■ Replace the amplifier board if necessary

Code Local display	FOUNDATION Fieldbus measured value status 1 = Quality code (hex) 2 = Quality status 3 = Quality substatus 4 = Limits 5 = Advanced diagnosis message	Cause	Remedy:
F 881 - 1 Sensor signal	1 = 0x0C 2 = BAD 3 = Sensor signal 4 = Constant 5 = Sensor signal low CH1	Attenuation of acoustic measurement section is too high	■ It is possible that the fluid indicates too much attenuation ■ The measuring pipe is possibly only slightly full ■ Buildup ■ Fouling ■ Solids content too high ■ Air/gas content too high
F 881- 2 Sensor signal	1 = 0x0C 2 = BAD 3 = Sensor signal 4 = Constant 5 = Sensor signal low CH2		
F 881- 3 Sensor signal	1 = 0x0C 2 = BAD 3 = Sensor signal 4 = Constant 5 = Sensor signal low CH3		
F 881- 4 Sensor signal	1 = 0x0C 2 = BAD 3 = Sensor signal 4 = Constant 5 = Sensor signal low CH4		

9.2.2 Category C diagnosis code messages

Code **Local display**	**FOUNDATION Fieldbus measured value status** **1 = Quality code (hex)** **2 = Quality status** **3 = Quality substatus** **4 = Limits** **5 = Advanced diagnosis message**	**Cause**	**Remedy:**
C 281 Initialization	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Initialization 4 = High/low limits 5 = Initialization	Initialization of channel 1/2 in progress. All outputs are set to 0.	Wait until process is finished.
C 284 Software update	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Software update 4 = High/low limits 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. The device is restarted automatically.
C 411 Upload/download	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Upload/download 4 = High/low limits 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 Write backup	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Write backup 4 = High/low limits 5 = Write backup T-DAT	T-DAT save/load function (SAVE option) is executed. Data are saved from the EEPROM to the T-DAT.	-
C 413 Read backup	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Read backup 4 = High/low limits 5 = Read backup T-DAT	T-DAT save/load function (LOAD option) is executed. Data are loaded from the T-DAT to the EEPROM.	-
C 431 – 1 Adjust	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Adjustment 4 = High/low limits 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 Adjust	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Adjustment 4 = High/low limits 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 Adjust	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Adjustment 4 = High/low limits 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 Adjust	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Adjustment 4 = High/low limits 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 Adjust	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Adjustment 4 = High/low limits 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).

Code **Local display**	**FOUNDATION Fieldbus measured value status** **1 = Quality code (hex)** **2 = Quality status** **3 = Quality substatus** **4 = Limits** **5 = Advanced diagnosis message**	**Cause**	**Remedy:**
C 431 – 6 Adjust	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Adjustment 4 = High/low limits 5 = Zero point adjust running	Zero point adjustment is being carried out.	-
C 453 Value suppression	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Value suppression 4 = High/low limits 5 = Meas. Value Suppression	Positive zero return active.	Switch off positive zero return.
C 481 Diagnostic active	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Diagnostic active 4 = High/low limits 5 = Diagnostic active	The measuring device is being checked on site via the test and simulation device.	–
C 485 Simulation value	1 = 0x60 2 = UNCERTAIN - simulated value 3 = Simulation value 4 = High/low limits 5 = Simulation value	Simulation of a measured variable active (e.g. volume flow)	Switch off simulation

9.2.3 Category S diagnosis code messages

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

9.3 Process errors without messages

Symptoms	Remedial measures
✎ Note! 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. 2. "FLOW DAMPING" function → increase value (→ SYSTEM PARAMETER) 3. "DISPLAY DAMPING" function → increase value (→ USER INTERFACE)
Flow values are negative, even though the fluid is flowing forwards through the pipe.	1. Remote version: check wiring → 🖹 19. 2. 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) 2. "DISPLAY DAMPING" function → increase value (→ USER INTERFACE) 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. 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. 2. Check whether all the packaging material, including the meter body protective covers, was completely removed before mounting the device. 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. In these instances, please contact your Endress+Hauser representative.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service organization to have a service technician sent out, please be ready with the following information: – Brief description of the fault – Nameplate specifications: order code and serial number **Return devices to Endress+Hauser** The procedures on must be carried out before you return a measuring device requiring repair or calibration to Endress+Hauser. 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. **Replace transmitter electronics** Components in the electronics defective → order spare part

9.4 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 (screws, etc.)
- Installation instructions
- Packaging

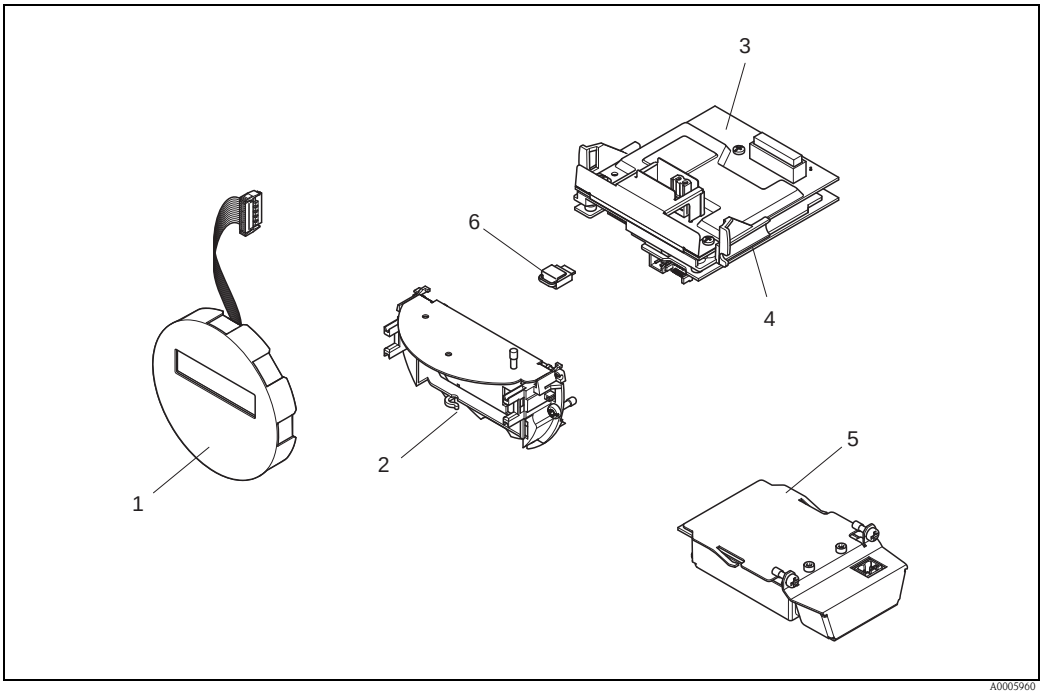


Fig. 24: Spare parts for Prosonic Flow 92F FOUNDATION Fieldbus transmitter

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

9.4.1 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 → *25:*

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.

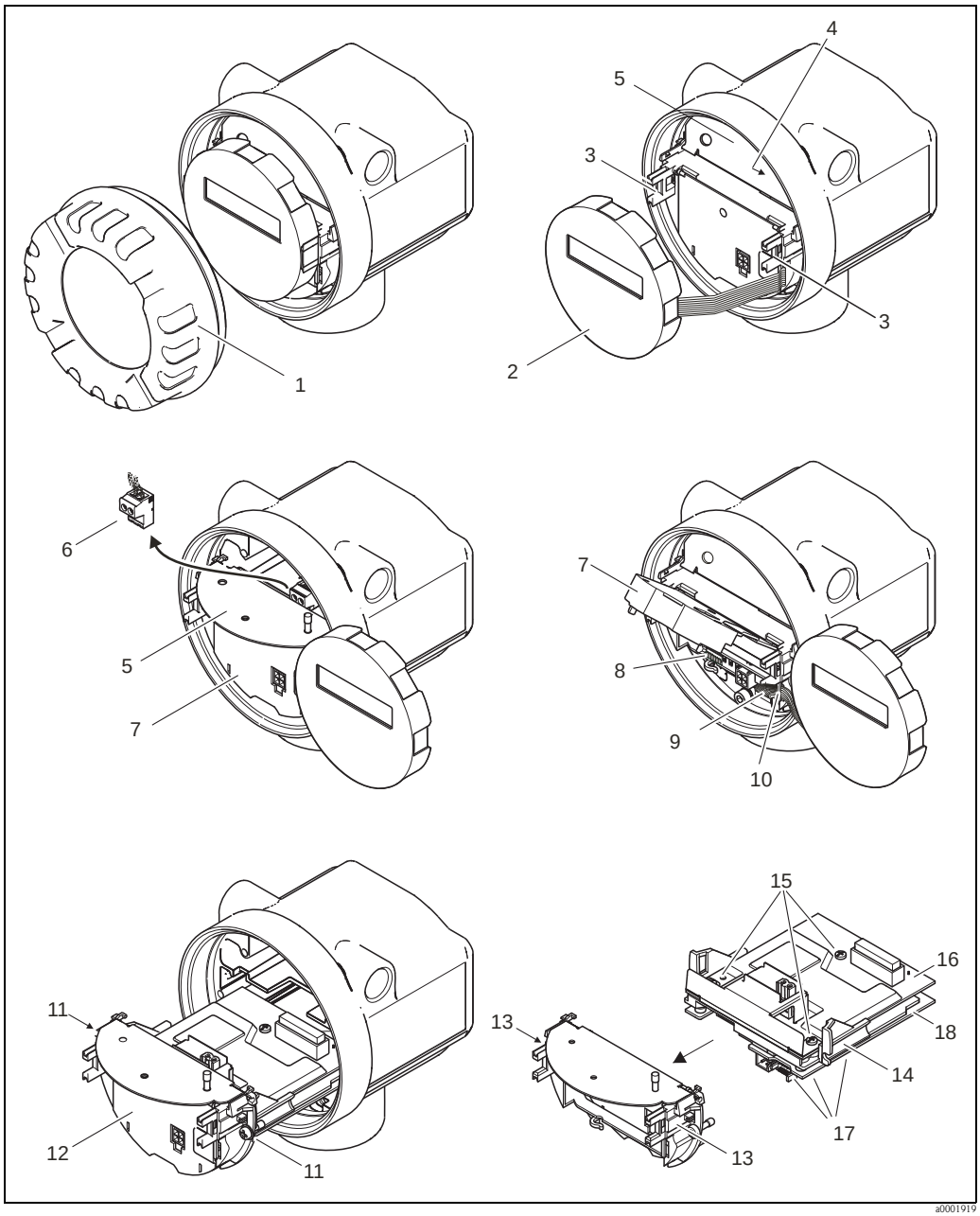


Fig. 25: Installing and removing electronics boards, non-Ex/Ex-i version

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 → *26:*

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.

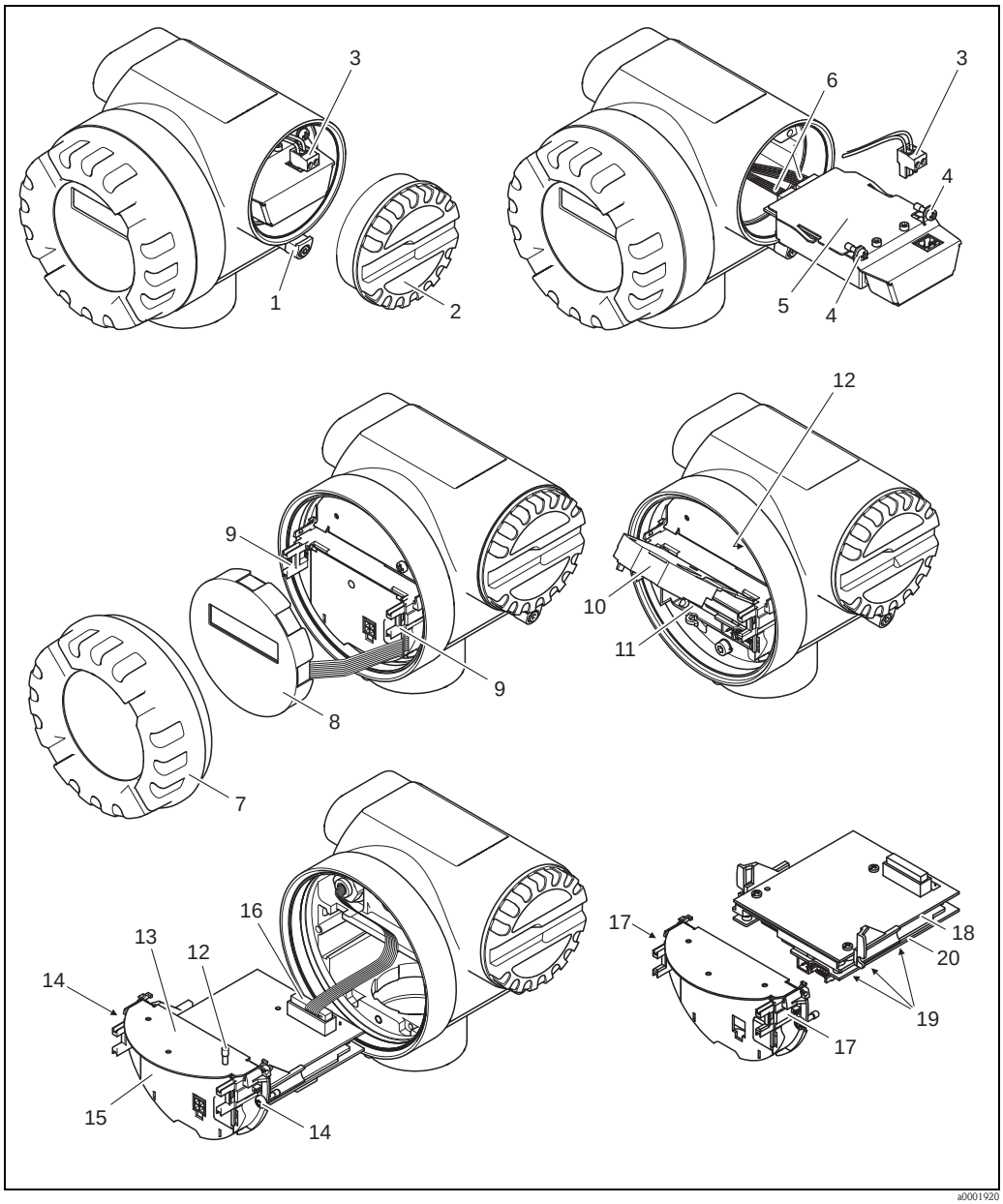


Fig. 26: Installing and removing electronics boards Ex d version

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

9.5 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.

9.6 Disposal

Observe the regulations applicable in your country!

9.7 Software history

Date	Software version	Changes to software	Operating Instructions
12.2010	FOUNDATION Fieldbus 1.01.XX	Software Expansion: – DN150–300	BA00128D/06/EN/12.10 71125107
02.2008	FOUNDATION Fieldbus 1.00.XX	Original software, can be operated via: – FieldCare – NATIONAL INSTRUMENTS NI-FBUS CONFIGURATOR	BA128D/06/en/02.08 71065950

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 = 0.01 to 10 m/s (0.03 to 32.1 ft/s) with the specified accuracy

Measuring ranges for liquids

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

10.1.4 Output

Output signal

Physical data transmission (Physical Layer Type):

- Fieldbus interface in accordance with IEC 61158-2
- Corresponds to device version type 512 of the FOUNDATION Fieldbus specification: type 512 standard data transfer (±9 mA, symmetrical), separate supply to field device (4-wire), intrinsically safe version of the FF interface, FISCO
- With integrated reverse polarity protection

Signal on alarm

Status message as per FOUNDATION Fieldbus specification

Link Master (LM) support

Yes

Link Master

Can be selected

Basic Device	Factory settings
Device basic current	16 mA
Device starting current	<16 mA
Device error current (FDE)	0 mA
Device (lift off) min. voltage	9 V (H1-segment)
Permissible fieldbus supply voltage	9 to 32 V
Integrated reverse polarity protection	Yes
ITK version	5.0
Number of VCRs (total)	44
Number of link objects in VFD	50
Device capacitance	In accordance with IEC 60079-27, FISCO/FNICO
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.
Data transmission rate	31.25 kBit/s, voltage mode
Signal coding	Manchester II
Bus times	Min. idle time between two telegrams: MIN_INTER_PDU_DELAY = 6 octet time (transfer time per octet)

Block information, execution times

Block	Base index	Execution time [ms]	Functionality
Resource Block	400	–	Enhanced
"Flow" Transducer Block	500	–	Vendor Specific
"Diagnosis" Transducer Block	800	–	Vendor Specific
"Display" Transducer Block	700	–	Vendor Specific
"Totalizer" Transducer Block	600	–	Vendor Specific
Analog Input function block 1	300	60	Standard
Analog Input function block 2	1000	60	Standard
Analog Input function block 3	1100	60	Standard

Block	Base index	Execution time [ms]	Functionality
Analog Input function block 4	1200	60	Standard
Discrete Output function block (DO)	1500	50	Standard
Analog Output function block (AO)	1300	120	Standard
Discrete Input function block (DI)	1400	50	Standard
PID function block (PID)	1600	110	Standard
Arithmetic function block (ARTH)	1700	105	Standard
Input Selector function block (ISEL)	1900	105	Standard
Signal Characterizer function block (CHAR)	1800	100	Standard
Integrator function block (INTG)	2000	105	Standard

Output data

Transducer Blocks / Analog Input function blocks

Block	Process variable	Channel parameter (AI Block)
"Flow" Transducer Block	Volume Flow	2
	Sound Velocity	21
	Flow Velocity	23
	Signal Strength	30
"Totalizer" Transducer Block	Totalizer 1	7
	Totalizer 2	8

Input data

Discrete Output function block (channel 16)

Status change	Action
Discrete state 0 → Discrete state 1	Reserved
Discrete state 0 → Discrete state 2	Positive zero return ON
Discrete state 0 → Discrete state 3	Positive zero return OFF
Discrete state 0 → Discrete state 4	Reserved
Discrete state 0 → Discrete state 5	Reserved
Discrete state 0 → Discrete state 6	Reserved
Discrete state 0 → Discrete state 7	Reset totalizer 1, 2
Discrete state 0 → Discrete state 8	Reset totalizer 1
Discrete state 0 → Discrete state 9	Reset totalizer 2

VCRs

VCRs (total)	Number
Permanent Entries	44
Client VCRs	0
Server VCRs	5
Source VCRs	8
Sink VCRs	0
Subscriber VCRs	12
Publisher VCRs	19

10.1.5 Power supply

Electrical connections	→ 📄 22
Supply voltage	9 to 32 V DC
Cable entry	■ Cable entry M20 × 1.5 (8 to 12 mm) (0.32" to 0.47") ■ 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: –40 °C… (permitted max. ambient temperature plus 10 °C) or –40 °F… (permitted max. ambient temperature plus 18 °F) ■ Remote version connecting cable → 📄 19
Power supply failure	■ Totalizer stops at the last value determined (can be configured). ■ EEPROM and T-DAT save measuring system data if power supply fails. ■ Error messages (incl. value of operated hours counter) are stored.

10.1.6 Performance characteristics

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

Compact version

- 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 +140 °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)
EEx-d / EEx-i version: –40 to +80°C (–40 to +176 °F)

Degree of protection

- Prosonic Flow 92 transmitter: IP 67 (NEMA 4X)
- Prosonic Flow F Inline sensor: IP 67 (NEMA 4X)
  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 → 68.

Limiting flow

Refer to "Measuring range" on → 60.

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 → 68.

Weight (SI-units)

Note!
The weight data refer to the compact version.
The weight of the remote version is approx. 0.9 kg greater.

Flange according to EN 1092-1

DN	Pressure rating	Weight [kg]
25	PN 40	10
40	PN 40	12
50	PN 40	14
80	PN 40	24
100	PN 16	32
	PN 40	35
150	PN 16	33.0
	PN 40	53.9
200	PN 16	44.2
	PN 40	92.0
250	PN 16	62.7
	PN 40	130.9
300	PN 16	82.1
	PN 40	174.3

Flange according to ASME B16.5

Size	Pressure rating		Weight [kg]
1"	Schedule 40	Cl. 150	9
		Cl. 300	10
	Schedule 80	Cl. 150	9
		Cl. 300	10
1½"	Schedule 40	Cl. 150	11
		Cl. 300	13
	Schedule 80	Cl. 150	11
		Cl. 300	13
2"	Schedule 40	Cl. 150	13
		Cl. 300	14
	Schedule 80	Cl. 150	13
		Cl. 300	15
3"	Schedule 40	Cl. 150	24
		Cl. 300	28
	Schedule 80	Cl. 150	25
		Cl. 300	28
4"	Schedule 40	Cl. 150	36
		Cl. 300	44
	Schedule 80	Cl. 150	36
		Cl. 300	44
6"	Schedule 40	Cl. 150	38.9
		Cl. 300	56.5
8"	Schedule 40	Cl. 150	57.6
		Cl. 300	82.6
10"	Schedule 40	Cl. 150	79.9
		Cl. 300	118.3
12"	Schedule 40	Cl. 150	113.5
		Cl. 300	164.5

Flange according to JIS B2220

DN	Pressure rating		Weight [kg]
25	Schedule 40	20K	10
	Schedule 80	20K	
40	Schedule 40	20K	12
	Schedule 80	20K	
50	Schedule 40	10K	13
		20K	
	Schedule 80	10K	
		20K	
80	Schedule 40	10K	24
		20K	28
	Schedule 80	10K	25
		20K	28
100	Schedule 40	10K	36
		20K	44
	Schedule 80	10K	36
		20K	44

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 1.4404+316L+316	1.4462 1.4404+316L+316	1.4462 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
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 → 📄 68.

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	■ FOUNDATION Fieldbus ■ FieldCare ■ 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.
FOUNDATION Fieldbus certification	The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications: ■ Certified to the FOUNDATION Fieldbus Specification. ■ The device meets all the specifications of the FOUNDATION Fieldbus H1. ■ Interoperability Test Kit (ITK), revision 5.0: The device can also be operated in conjunction with other-make certified devices. ■ Physical Layer Conformance Test of the Fieldbus Foundation
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 - Sulphide 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 → 🖹 41.

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

Groups / function groups		Functions			
MEASURED VALUES →	→ 70 →	VOLUME FLOW	SOUND VELOCITY	FLOW VELOCITY	SIGNAL STRENGTH
SYSTEM UNITS →	→ 71 →	UNIT VOLUME FLOW	UNIT LENGTH	UNIT VELOCITY	
QUICK SETUP →	→ 72 →	T-DAT SAVE/LOAD			
OPERATION →	→ 73 →	LANGUAGE	ACCESS CODE	DEFINE PRIVATE CODE	ACCESS CODE CUSTOMER
USER INTERFACE →	→ 74 →	ASSIGN LINE 1	ASSIGN LINE 2	100% VALUE LINE 1	100% VALUE LINE 2
		FORMAT	DISPLAY DAMPING	CONTRAST LCD	TEST DISPLAY
TOTALIZER 1 to 2 →	→ 76 →	SUM 1…2	SUM 1…2 - STATUS	CHANNEL	UNIT TOTALIZER
		SET TOTALIZER	PRESET TOTALIZER	TOTALIZER MODE	FAILSAFE MODE
COMMUNICATION →	CONFIGURATION → 79 →	WRITE PROTECTION	SIMULATION	DEVICE PD-TAG	
	FUNCTION BLOCKS → 80 →	BLOCK SELECTION	PID_OUT VALUE	PID_IN VALUE	CASCADE IN
		SETPOINT VALUE			
	INFORMATION → 81 →	MANUFACTURER ID	DEVICE TYPE	SERIAL NUMBER	DEVICE REVISION
		DD REVISION			
PROCESS PARAMETER →	→ 82 →	ASSIGN LOW FLOW CUTOFF	ON VALUE LOW FLOW CUTOFF	OFF VALUE LOW FLOW CUTOFF	ZERO POINT ADJUST
SYSTEM PARAMETER →	→ 84 →	INSTALLATION DIRECTION SENSOR	FLOW DAMPING	POSITIVE ZERO RETURN	MEASURING MODE
SENSOR DATA →	→ 85 →	K-FACTOR	ZEROPOINT	ZEROPOINT STATIC	CORRECTION FACTOR
		CABLE LENGTH	CABLE LENGTH VARIABLE		
SUPERVISION →	→ 86 →	ACTUAL SYSTEM CONDITION	PREVIOUS SYSTEM CONDITIONS	ALARM DELAY	TROUBLESHOOTING
		SYSTEM RESET	OPERATION HOURS		
SIMULAT. SYSTEM →	→ 88 →	SIMULATION MEASURAND	VALUE SIMULATION MEASURAND		
SENSOR VERSION →	→ 89 →	SERIAL NUMBER			
AMP. VERSION →	→ 89 →	DEVICE SOFTWARE	I/O TYPE		

11.2 Group MEASURING VALUES

Functional description, MEASURING VALUES group	
VOLUME FLOW	The flow currently measured appears on the display. **Display:** 5-digit floating-point number, including unit (e.g. 5.545 dm^3/m; 1.4359 kg/h; 731.63 gal/d etc.) ✎ Note! The appropriate unit is taken from the UNIT VOLUME FLOW function (see → 🖹 71).
SOUND VELOCITY	The sound velocity currently measured in the liquid appears on the display. **Display:** 5-digit fixed-point number, incl. unit (e.g. 1400.0 m/s, 5249.3 ft/s) ✎ Note! The appropriate unit is taken from the UNIT VELOCITY function (see → 🖹 71).
FLOW VELOCITY	The flow velocity currently measured appears on the display. **Display:** 5-digit floating-point number, including unit and sign (e.g. 8.0000 m/s, 26.247 ft/s) ✎ Note! The appropriate unit is taken from the UNIT VELOCITY function (see → 🖹 71).
SIGNAL STRENGTH	The signal strength appears on the display. **Display:** 4-digit fixed-point number, incl. unit (e.g. 80.0 dB) ✎ Note! To ensure reliable measurement takes place, Prosonic Flow requires a signal strength of >50 dB.

11.3 Group SYSTEM UNITS

Functional description, SYSTEM UNITS group	
UNIT VOLUME FLOW	For selecting the unit required and displayed for the volume flow. The unit you select here is also valid for the low flow cutoff. ✎ Note! The following time units can be selected: s = second, m = minute, h = hour, d = day **Options:** Metric: Cubic centimeter → cm^3/time unit Cubic decimeter → dm^3/time unit Cubic meter → m^3/time unit Milliliter → ml/time unit Liter → l/time unit Hectoliter → hl/time unit Megaliter → Ml/time unit MEGA US: Cubic centimeter → cc/time unit Acre foot → af/time unit Cubic foot → ft^3/time unit Fluid ounce → oz f/time unit Gallon → US gal/time unit Kilo gallon → US Kgal/time unit Mega gallon → US Mgal/time unit Barrel (normal fluids: 31.5 gal/bbl) → US bbl/time unit NORM. Barrel (beer: 31.0 gal/bbl) → US bbl/time unit BEER Barrel (petrochemicals: 42.0 gal/bbl) → US bbl/time unit PETR. Barrel (filling tanks: 55.0 gal/bbl) → US bbl/time unit TANK Imperial: Gallon → imp. gal/time unit Mega gallon → imp. Mgal/time unit Barrel (beer: 36.0 gal/bbl) → imp. bbl/time unit BEER Barrel (petrochemicals: 34.97 gal/bbl) → imp. bbl/time unit PETR. **Factory setting:** l/s
UNIT LENGTH	For selecting the unit for the length. **Options:** MILLIMETER INCH **Factory setting:** MILLIMETER
UNIT VELOCITY	For selecting the unit for the velocity. The unit you select here is also valid for: ■ Sound velocity ■ Flow velocity **Options:** m/s ft/s **Factory setting:** m/s

11.4 Group QUICK SETUP

Functional description, QUICK SETUP group	
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). Application examples: ■ After commissioning, the current measuring point parameters can be saved to the T-DAT as a backup. ■ When replacing the transmitter, it is possible to load the data from the T-DAT into the new transmitter (EEPROM). **Options:** CANCEL SAVE (from EEPROM to T-DAT) LOAD (from the T-DAT to the EEPROM) **Factory setting:** CANCEL

11.5 Group OPERATION

Functional description, OPERATION group	
LANGUAGE	For selecting the language in which all messages are shown on the local display. **Options:** ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS NORSK SVENSKA SUOMI PORTUGUES POLSKI CESKI **Factory setting:** Depends on country (metric system units, see Page 90, or US units, → 90)
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). Application examples: ■ After commissioning, the current measuring point parameters can be saved to the HistoROM/T-DAT as a backup. ■ If the transmitter is replaced for some reason, the data can be loaded from the HistoROM/T-DAT to the new transmitter (EEPROM). **User input:** Input limits: 0 to 9999 Note! ■ You can also disable programming in this function by entering any number (other than the private code). ■ 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. **User input:** Input limits: 0 to 9999 **Factory setting:** 92 Note! ■ Programming is always enabled if the code defined = 0. ■ Programming has to be enabled before this code can be changed. When programming is disabled this function cannot be edited, thus preventing others from accessing your personal code.
ACCESS CODE CUSTOMER	The access status for the function matrix appears on the display. **Display:** ACCESS CUSTOMER (parameters can be modified) LOCKED (parameters cannot be modified)

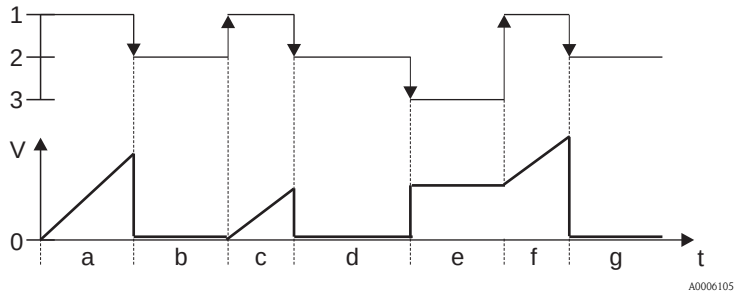
11.6 Group USER INTERFACE

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

Functional description, USER INTERFACE group	
FORMAT	For selecting the number of places displayed after the decimal point for the display value in the main line. **Options:** XXXXX. - XXXX.X - XXX.XX - XX.XXX -X.XXXX **Factory setting:** XX.XXX ✎ Note! ■ 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. ■ 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). **User input:** 0 to 100 seconds **Factory setting:** 0 seconds ✎ Note! The setting 0 seconds switches off damping.
CONTRAST LCD	For adjusting the display contrast to suit local operating conditions. **User input:** 10 to 100% **Factory setting:** 50%
TEST DISPLAY	Use this function to test the operability of the local display and its pixels. **Options:** OFF ON **Factory setting:** OFF Test sequence: 1. Start the test by selecting ON. 2. All pixels of the main line and additional line are darkened for minimum 0.75 seconds. 3. The main line and additional line show an “8” in each field for minimum 0.75 seconds. 4. The main line and additional line show a “0” in each field for minimum 0.75 seconds. 5. The main line and additional line show nothing (blank display) for minimum 0.75 seconds. 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)

Functional description, TOTALIZER (1 to 2) group	
The following functional descriptions apply to totalizers 1 to 2 which can be configured independently of one another.	
SUM 1…2	The current totalizer value incl. the unit appears on the display. **Display:** Max. 7-digit floating-point number, including sign and unit (e.g. 15467.04 m^3)
SUM 1…2 - STATUS	The status of the measured variable cyclically transmitted to the **zum** FOUNDATION Fieldbus master (Class 1) appears on the display (TOTALIZER module). ✎ Note! The measured variable to be transmitted is assigned to the totalizer function block in the CHANNEL function (see next function).
CHANNEL	For assigning a measured variable to the totalizer. **Options:** OFF VOLUME FLOW **Factory setting:** VOLUME FLOW
UNIT TOTALIZER	For selecting the unit for the measured variable assigned to the totalizer. **Options:** Metric: Cubic centimeter → cm^3 Cubic decimeter → dm^3 Cubic meter → m^3 Milliliter → ml Liter → l Hectoliter → hl Megaliter → Ml MEGA US: Cubic centimeter → cc Acre foot → af Cubic foot → ft^3 Fluid ounce → oz f Gallon → US gal Kilo gallon → US Kgal Mega gallon → US Mgal Barrel (normal fluids: 31.5 gal/bbl) → US bbl NORM.FL. Barrel (beer: 31.0 gal/bbl) → US bbl BEER Barrel (petrochemicals: 42.0 gal/bbl) → US bbl PETROCH. Barrel (filling tanks: 55.0 gal/bbl) → US bbl TANK Imperial: Gallon → imp. gal Mega gallon → imp. Mgal Barrel (beer: 36.0 gal/bbl) → imp. bbl BEER Barrel (petrochemicals: 34.97 gal/bbl) → imp. bbl PETROCH. **Factory setting:** m^3

Functional description, TOTALIZER (1 to 2) group	
SET TOTALIZER	Control of totalizer. **Options:** TOTALIZE Totalizing of the measured variable set in the CHANNEL function is started. RESET The totalizer is set to 0. The measured variable is no longer totalized. Totalizing does not start again until the TOTALIZE option is selected again (totalizing then starts from 0). PRESETTING The totalizer is set to the value defined in the PRESET TOTALIZER function. The measured variable is no longer totalized. Totalizing does not start again until the TOTALIZE option is selected again (totalizing then starts from the value defined in the PRESET TOTALIZER function). **Factory setting:** TOTALIZE  *Fig. 27: Example for setting the totalizer* *1 TOTALIZE option selected* *2 RESET option selected* *3 PRESET option selected* *a Start totalizing by selecting TOTALIZE (1)* *b Reset the totalizer to 0 by selecting RESET (2)* *c Restart totalizing by selecting TOTALIZE (1)* *d Reset the totalizer to 0 by selecting RESET (2)* *e Set the totalizer to the value defined in the PRESET TOTALIZER function by selecting PRESETTING (3)* *f Start totalizing, beginning with the value defined in the PRESET TOTALIZER function, by selecting TOTALIZE (1)* *g Reset the totalizer to 0 by selecting RESET (2)*
PRESET TOTALIZER	Use this function to specify a (start) value for the totalizer. ✎ Note! This value is not accepted by the totalizer unless the PRESET option is selected in the SET TOTALIZER function. **User input:** Input limits: -10^{13} to $+10^{13}$ **Factory setting:** 0

Functional description, TOTALIZER (1 to 2) group	
TOTALIZER MODE	For selecting how the flow components should be totalized. **Options:** BALANCE Positive and negative flow components are balanced. In other words, net flow in the flow direction is registered. POSITIVE (FORWARDS) Only positive flow components are recorded. NEGATIVE (BACKWARDS) Only negative flow components are recorded. LAST VALUE (HOLD) The totalizer stays at the last value. No more flow components are totalized. **Factory setting:** BALANCE ✎ 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 MEASURING MODE function (see Page 84).
FAILSAFE MODE	For selecting the behavior of the totalizer in an alarm condition. **Options:** STOP The totalizer does not continue to count the flow if a fault is present. The totalizer stops at the last value before the alarm condition occurred. ACTUAL VALUE The totalizer continues to count the flow on the basis of the current flow data. The fault is ignored. HOLD VALUE The totalizer continues to count the flow on the basis of the last valid flow data (before the fault occurred). **Factory setting:** STOP

11.8 Group COMMUNICATION

11.8.1 Function group CONFIGURATION

Functional description, COMMUNICATION group → CONFIGURATION function group	
WRITE PROTECTION	Indicates whether it is possible to write-access the measuring device via the fieldbus. Display: OFF Write access via FOUNDATION Fieldbus possible ON Write protection via FOUNDATION Fieldbus blocked Factory setting: OFF ✎ Note! Write protection is enabled or disabled by means of a jumper on the I/O board (see also the Operating Instructions for Proline Promass 83 FOUNDATION Fieldbus, BA 065D/06/en/).
SIMULATION	Indicates whether a simulation in the Analog Input function block is possible. Display: OFF Simulation not possible in the Analog Input and Discrete Output function block. ON Simulation possible in the Analog Input and Discrete Output function block. Factory setting: ON ✎ Note! ■ The simulation mode is enabled or disabled by means of a jumper on the I/O board (see Page 88). ■ The status of the simulation mode is also shown in the BLOCK_ERR parameter of the Resource Block.
DEVICE PD-TAG	Use this function to enter a tag name for the measuring device. User input: Max. 32-character text, permitted characters are: A-Z, 0-9, +,–, punctuation marks Factory setting: EH_PROSONIC_FLOW_92F_XXXXXX

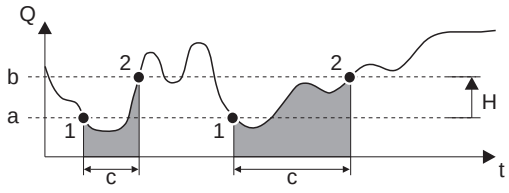
11.8.2 Function group FUNCTION BLOCKS

Functional description, COMMUNICATION group → FUNCTION BLOCKS function group	
BLOCK SELECTION	Use this function to select a function block whose value and status are displayed in the subsequent functions. Options: ANALOG INPUT 1 to 8 PID Factory setting: ANALOG INPUT 1
PID_OUT VALUE	The output value OUT incl. unit and status of the Analog Input or PID function block selected in the BLOCK SELECTION (6220) function appears on the display.
PID_IN VALUE	✎ Note! This function is not available unless the PID option was selected in the BLOCK SELECTION (6220) function. Display: The controlled variable IN incl. unit and status of the Analog Input or PID function block selected in the BLOCK SELECTION (6220) function appears on the display.
CASCADE IN	✎ Note! This function is not available unless the PID option was selected in the BLOCK SELECTION (6220) function. Display: The analog set point accepted from an external function block appears on the display, including the unit and status.
SETPOINT VALUE	✎ Note! ■ This function is not available unless the PID option was selected in the BLOCK SELECTION (6220) function. ■ If the service code is used to call this function, this value can be edited. Display: The internal set point for the PID function block appears on the display, incl. the unit and status.

11.8.3 Function group INFORMATION

Functional description, COMMUNICATION group → INFORMATION function group	
MANUFACTURER ID	The manufacturer ID appears on the display. Display: 452B48 (hex) for Endress+Hauser
DEVICE TYPE	The device type appears on the display. Display: 1061 (hex) for Prosonic Flow 92F FOUNDATION Fieldbus
SERIAL NUMBER	The serial number of the device appears on the display. Display: 11-digit number
DEVICE REVISION	The revision number of the device appears on the display. Display: 1 ✎ Note! With the aid of this display, it can be ensured that the correct system files (DD = Device Description) are used for integrating into the host system. The system files can be downloaded free from the Internet at (www.endress.com). Example: Display in the DEVICE REVISION function (6243) → 03 Display in the DD REVISION function (6244) → 01 Required device description files (DD) → 0301.sym / 0301.ffo
DD REVISION	The revision number of the device description appears on the display. Display: 1 ✎ Note! With the aid of this display, it can be ensured that the correct system files (DD = Device Description) are used for integrating into the host system. The system files can be downloaded free from the Internet at (www.endress.com). Example: Display in the DEVICE REVISION function (6243) → 03 Display in the DD REVISION function (6244) → 01 Required device description files (DD) → 0301.sym / 0301.ffo

11.9 Group PROCESS PARAMETER

Functional description, PROCESS PARAMETER group	
ASSIGN LOW FLOW CUTOFF	For selecting the measured variable on which low flow cutoff should act. **Options:** OFF VOLUME FLOW FLOW VELOCITY **Factory setting:** VOLUME FLOW
ON VALUE LOW FLOW CUTOFF	Note! This function is not available if OFF has been selected in the ASSIGN LOW FLOW CUTOFF function. Use this function to enter the on-value for low flow cutoff. 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. **User input:** Input limits: $0…10^{20}$ **Factory setting:** 0 Note! The unit is taken from the VOLUME FLOW function (→ 71).
OFF VALUE LOW FLOW CUTOFF	Use this function to enter the off-value for low flow cutoff. Enter the off-value as a positive hysteresis from the on-value. **User input:** Integer 0 to 100% **Factory setting:** 50%  a0001245 *Fig. 28: Example for the behavior of low flow cutoff* – *Q = Flow [volume/time]* – *t = Time* – *a = ON-VALUE LOW FLOW CUTOFF = 20 m³/h* – *b = OFF-VALUE LOW FLOW CUTOFF = 10%* – *c = Low flow cutoff active* – *1 = Low flow cutoff is switched on at 20 m³/h* – *2 = Low flow cutoff is switched off at 22 m³/h* – *H = Hysteresis*

Functional description, PROCESS PARAMETER group	
ZERO POINT ADJUST	Caution! Please refer to the instructions and the exact procedure on → 38. Start of zero point adjustment. **Options:** CANCEL START **Factory setting:** CANCEL Note! ■ Programming is disabled during zero point adjustment. The diagnosis message C 431 - 6 (see → 51) appears on the display. ■ 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 → 50) appears on the display.

11.10 Group SYSTEM PARAMETER

Functional description, SYSTEM PARAMETER group	
INSTALLATION DIRECTION SENSOR	Use this function to reverse the sign of the flow measured variable, if necessary. **Options:** NORMAL (flow as indicated by the arrow) INVERSE (flow opposite to direction indicated by the arrow) **Factory setting:** NORMAL ✎ Note! 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. **User input:** Input limits: 0 to 100 s **Factory setting:** 0 s
POSITIVE ZERO RETURN	Use this function to interrupt evaluation of measured variables. This is necessary when a pipe is being cleaned, for example. The setting acts on all functions and outputs of the measuring device. **Options:** OFF ON **Factory setting:** OFF
MEASURING MODE	For selecting how the flow components should be recorded by the measuring device. **Options:** UNIDIRECTIONAL (only the positive flow components) BIDIRECTIONAL = (the positive and negative flow components) **Factory setting:** BIDIRECTIONAL

11.11 Group SENSOR DATA

Functional description, SENSOR DATA group	
K-FACTOR	The calibration factor determined and set at the factory appears on the display. **Display:** 5-digit floating-point number 0.5000 to 2.0000 **Factory setting:** Depends on nominal diameter and calibration.
ZEROPOINT	The zero point correction value determined and set at the factory appears on the display. **Display:** Max. 4-digit number: –1000 to +1000 **Factory setting:** Depends on nominal diameter and calibration.
ZEROPOINT STATIC	The zero point correction value determined and set at the factory is adjusted. 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. **User input:** Max. 4-digit number: –1000 to +1000 **Factory setting:** 0
CORRECTION FACTOR	The calibration factor determined and set at the factory is adjusted. 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. **User input:** 5-digit floating-point number 0.5000 to 2.0000 **Factory setting:** 1.0000
CABLE LENGTH	For selecting the device version (compact version = COMPACT) or the length of the connecting cable for the remote version. **Options:** COMPACT LENGTH 5m/15ft LENGTH 10m/30ft LENGTH 15m/45ft LENGTH 30m/90ft LENGTH 50m/150ft OTHER **Factory setting:** COMPACT ✎ Note! 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. If a cable length or COMPACT is selected in the CABLE LENGTH function, the corresponding value is displayed here. **User input:** Input limits: 0.00 to 50000 mm or 0.00 to 1968.55 inch **Factory setting:** 0.00 (= compact version) ✎ Note! The appropriate unit is taken from the UNIT LENGTH function (see → 🖹 71).

11.12 Group SUPERVISION

Functional description, SUPERVISION group	
ACTUAL SYSTEM CONDITION	The current system status appears on the display. **Display:** SYSTEM OK or The diagnosis messages with the highest priority appear on the display ✎ Note! Further information is provided in the "Troubleshooting" section on → 🖹 43
PREVIOUS SYSTEM CONDITIONS	Use this function to view the 16 most recent diagnosis messages since measuring last started. **Display:** The last 16 diagnosis messages. ✎ Note! Further information is provided in the "Troubleshooting" section on → 🖹 43
ALARM DELAY	For entering a timeframe in which the criteria for an error have to be met continuously before a diagnosis message is generated. This suppression affects: ■ Display ■ FOUNDATION Fieldbus **User input:** Input limits: 0 to 100 s (in increments of one second) **Factory setting:** 0 s ☝ Caution! 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.
TROUBLESHOOTING	For acknowledging the diagnosis messages for data/checksum errors. If a data/checksum error occurs (diagnosis messages F283-1, F283-2 or F283-4, see Page 48), 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. **Display:** CANCEL The error block in which a data/checksum error was present appears on the display

Functional description, SUPERVISION group	
SYSTEM RESET	For restarting (resetting) the device. **Options:** NO The device is not restarted. MEASURING TUBE 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. RESTART Restart without disconnecting main power. In doing so, all the data (functions) are accepted unchanged. RESET DELIVERY Restart without disconnecting main power. In doing so, all the data (functions) apart from the sensor data are reset to the factory setting. **Factory setting:** NO
OPERATION HOURS	The hours of operation of the device appear on the display. **Display:** Depends on the number of hours of operation elapsed: Hours of operation <10 hours → Display format = 0:00:00 (hr:min:sec) Hours of operation 10 to 10 000 hours → Display format = 0000:00 (hr:min) Hours of operation <10 000 hours → display format = 000000 (hr)

11.13 Group SIMULATION SYSTEM

Functional description, SIMULATION SYSTEM group	
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. **Options:** OFF VOLUME FLOW FLOW VELOCITY SIGNAL STRENGTH SOUND VELOCITY **Factory setting:** OFF ✎ Note! ■ The measuring device can only be used for measuring to a certain extent while the simulation is in progress. ■ The setting is not saved if the power supply fails.
VALUE SIMULATION MEASURAND	✎ Note! This function is not available if OFF has been selected in the SIMULATION MEASURAND function. 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. **User input:** Input limits: -10^{20} to $+10^{20}$ **Factory setting:** 0 ✎ Note! ■ The measuring device can only be used for measuring to a certain extent while the simulation is in progress. ■ The unit is taken from the SYSTEM UNITS group (→ 🖹 71).

11.14 Group SENSOR VERSION

Functional description, SENSOR VERSION group	
SERIAL NUMBER	The serial number of the sensor appears on the display.

11.15 Group AMPLIFIER VERSION

Functional description, 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	Norway	Norsk
Czechia	Ceski	Poland	Polski
Denmark	English	Portugal	Portugues
England	English	Singapore	English
Finland	Suomi	South Africa	English
France	Francais	Spain	Espanol
Germany	Deutsch	Sweden	Svenska
Hong Kong	English	Switzerland	Deutsch
Hungary	English	Thailand	English
India	English	The Netherlands	Nederlands
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

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] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

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

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

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

Description of failure / *Fehlerbeschreibung* _____

_____

_____

Company data / *Angaben zum Absender*

Company / *Firma* _____

_____

Address / *Adresse*

_____

_____

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

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

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

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

_____ Signature / *Unterschrift*

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