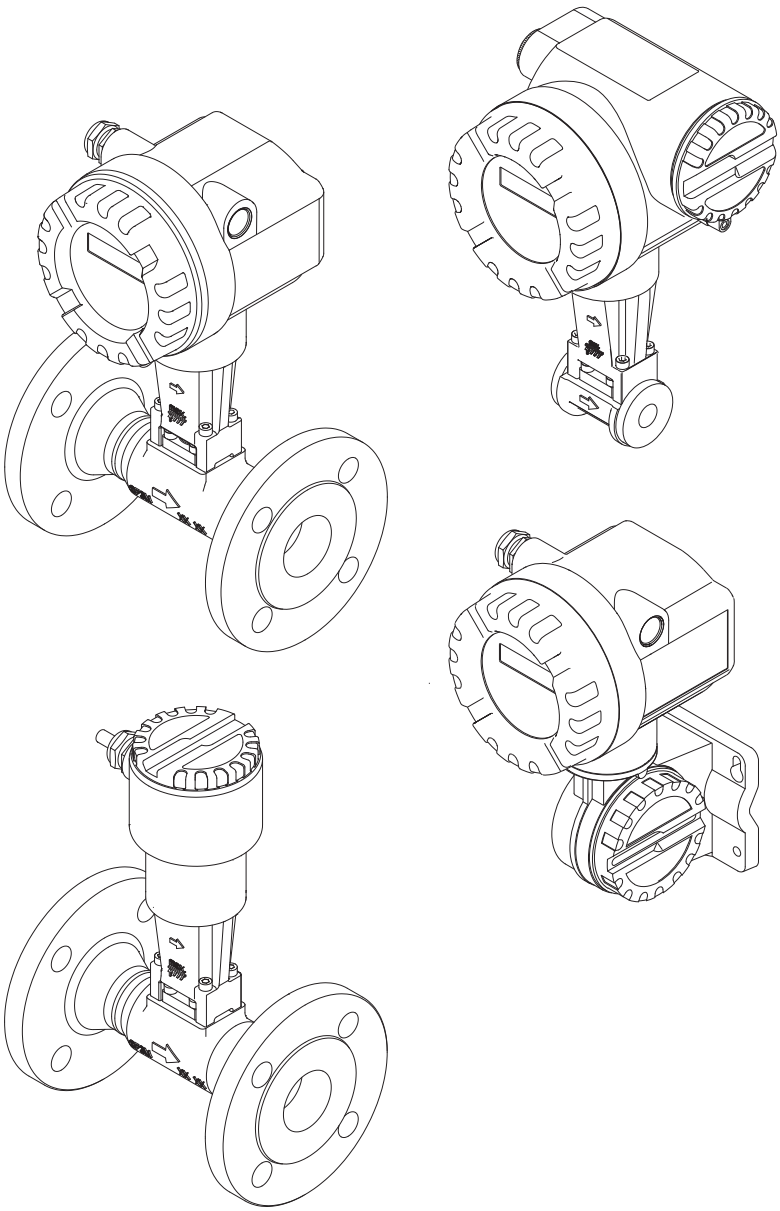
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Prowirl 73

Vortex Flow Measuring System

Fieldbus™ Foundation



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valid as of version
V 1.00.XX (Device software)

Endress+Hauser

People for Process Automation

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1 Safety instructions

1. 1 Designated use

The measuring system is used to measure the volume flow of saturated steam, superheated steam, gases and liquids. If the process pressure and process temperature are constant, the measuring device can also output the flow as the calculated mass flow or corrected volume flow.

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 resulting from this.

1. 2 Installation, commissioning and operation

Note the following points:
- Installation, electrical installation, 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.
- Endress+Hauser is willing to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning. However, small changes in temperature, concentration or the degree of contamination in the process can result in changes of the chemical resistance properties. Therefore, Endress+Hauser can not guarantee or accept liability for the chemical resistance properties of the fluid wetted materials in a specific application. The user is responsible for the choice of fluid wetted materials in regards to their in-process resistance to corrosion.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams.
- Invariably, local regulations governing the operation, maintenance and repair of electrical devices apply. Special instructions relating to the device can be found in the relevant sections of the documentation.

1. 3 Operational safety

Note the following points:
- Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an *integral part* of 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 the Ex documentation indicates the approval and the certification center (Ⓔx Europe, FM USA, Ⓒ Canada).
- The measuring system complies with the general safety requirements in accordance with EN 61010-1 and the EMC requirements of IEC/EN 61326 and NAMUR Recommendations NE 21, NE 43 and NE 53.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

1. 4 Return

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

- Always enclose a fully completed "Declaration of Contamination" form with the device. 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 European Directive 91/155/EEC.
- Remove all fluid residues. Pay special attention to the grooves for seals and crevices which could contain fluid residues.
  This is particularly important if the fluid is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

Note!
A *copy* of the "Declaration of Contamination" can be found at the end of these Operating Instructions.

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

1. 5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate.
The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". They 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 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 "Proline Prowirl 73 FOUNDATION Fieldbus" flowmeter system consists of the following components:

- Proline Prowirl 73 FOUNDATION Fieldbus transmitter
- Prowirl F or Prowirl W sensor

In the *compact version*, the transmitter and sensor form a mechanical unit; in the *remote version* they are mounted separate from one another.

2.1.1 Nameplate of the transmitter/sensor

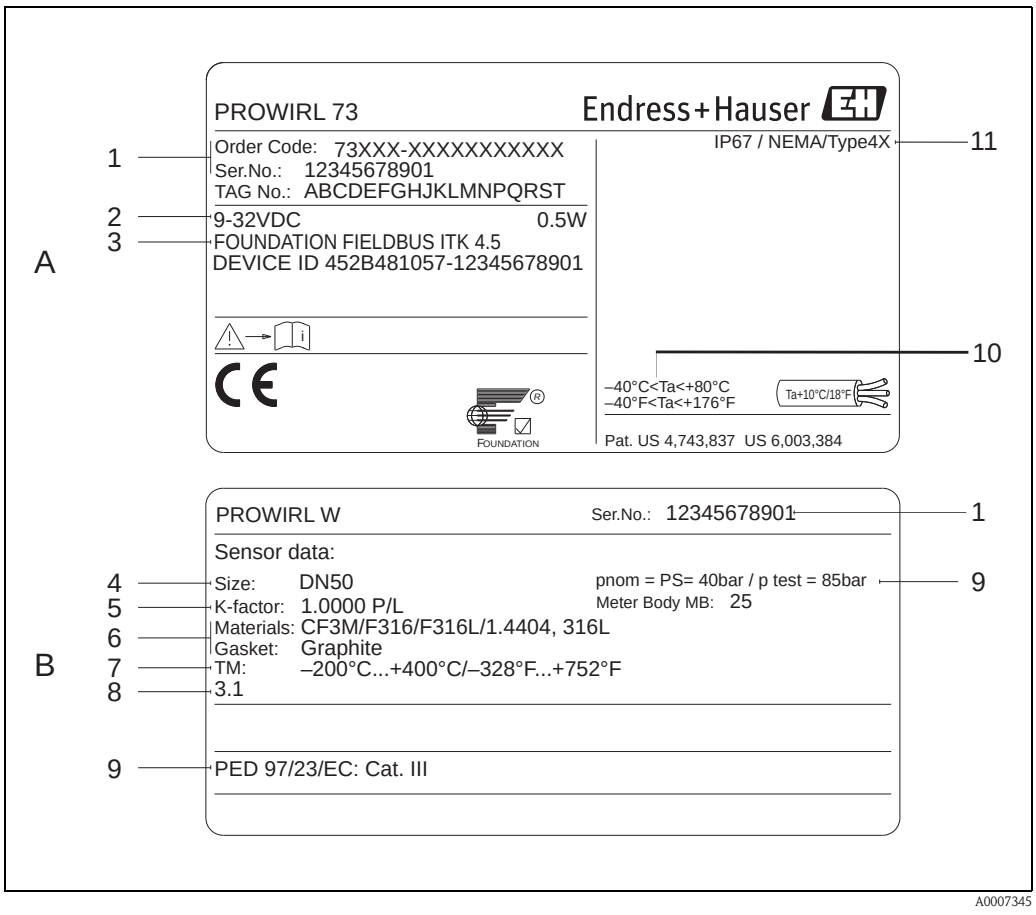

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Fig. 1: Nameplate specifications for transmitter and sensor (example)
A = Nameplate on transmitter, B = nameplate on sensor (only compact version)

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: 1.2 W
3 FOUNDATION Fieldbus: equipped with FOUNDATION Fieldbus H1 interface
ITK 4.5: certified by the Fieldbus Foundation; Interoperability Test Kit, revision status 4.5
DEVICE ID: FOUNDATION Fieldbus device identifier
4 Nominal diameter
5 Calibration factor
6 Material sensor and gasket
7 Fluid temperature range
8 Reserved for information on special products
9 Data regarding Pressure Equipment Directive (optional)
10 Permitted ambient temperature range
11 Degree of protection

2.1.2 Nameplate of the sensor, remote version

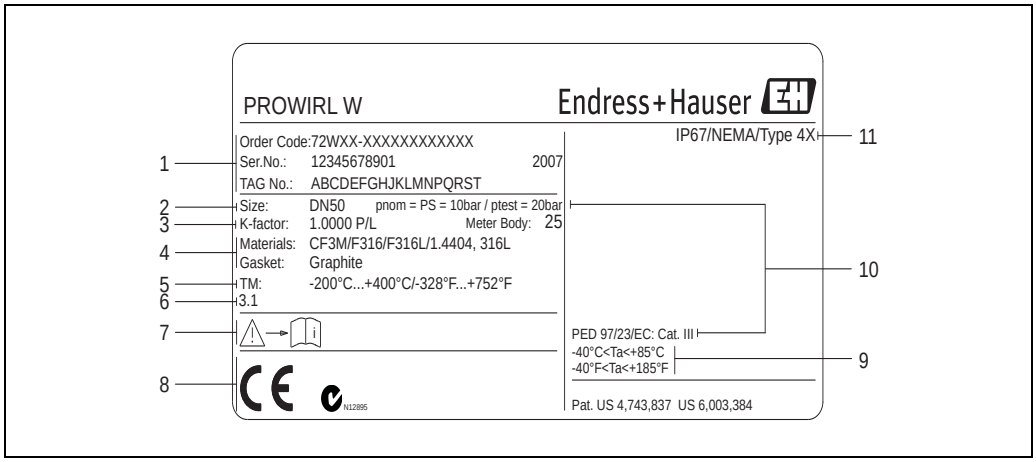

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Fig. 2: Nameplate specifications for transmitter, remote version (example)

1 *Order code / serial number: see the specifications on the order confirmation for the meanings of the individual letters and digits.*
2 *Nominal diameter*
3 *Calibration factor*
4 *Material sensor and gasket*
5 *Medium temperature range*
6 *Reserved for information on special products*
7 *Permitted ambient temperature range*
8 *Data regarding Pressure Equipment Directive (optional)*
9 *Degree of protection*

2.1.3 Service nameplate

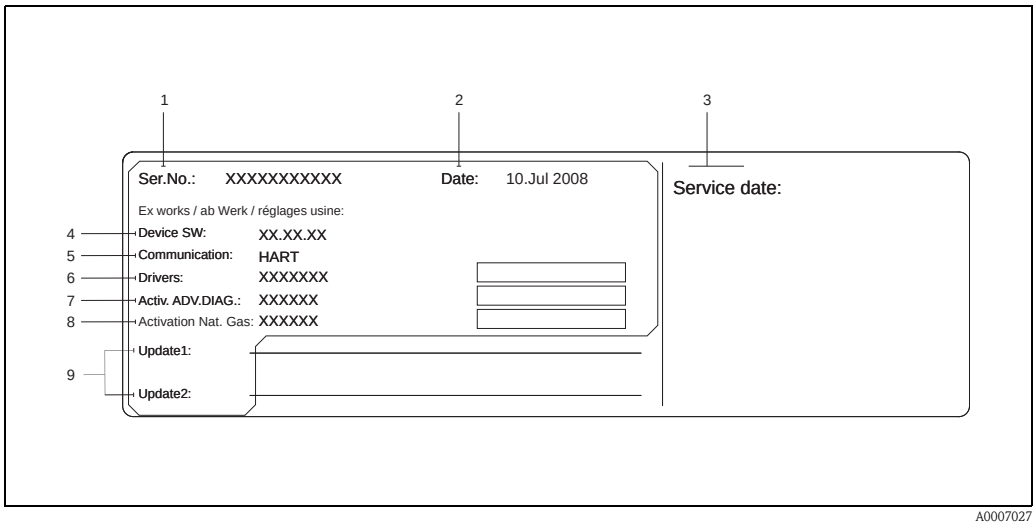

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Fig. 3: Service nameplate specifications for transmitter (example)

1 *Serial number*
2 *Date of manufacturing*
3 *Service date*
4 *Device software*
5 *Type of device communication (e.g. FOUNDATION Fieldbus)*
6 *Revision number*
7 *Activation Advanced Diagnostics (optional)*
8 *Activation "NX-19" (optional)*
9 *Space for update entries*

2. 2 Certificates and approvals

The devices are designed according to good engineering practice to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and the EMC requirements as per IEC/EN 61326.
The measuring system described in these Operating Instructions complies with the legal requirements of the EU Directives. Endress+Hauser confirms this by affixing the CE mark to it and by issuing the CE declaration of conformity.
The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

2. 3 Registered trademarks

GYLON®
Registered trademark of Garlock Sealing Technologies, Palmyar, NY, USA

FOUNDATION Fieldbus®
Registered trademark of the Fieldbus Foundation, Austin, USA

INCONEL®
Registered trademark of Inco Alloys International Inc., Huntington, USA

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

Fieldcheck®, Applicator®, FieldCare®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, Switzerland

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.
- Devices with nominal diameter DN 40 to 300 (1½ to 12") may not be lifted at the transmitter housing or at the connection housing of the remote version when transporting (see Fig. 4). 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 centre 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.

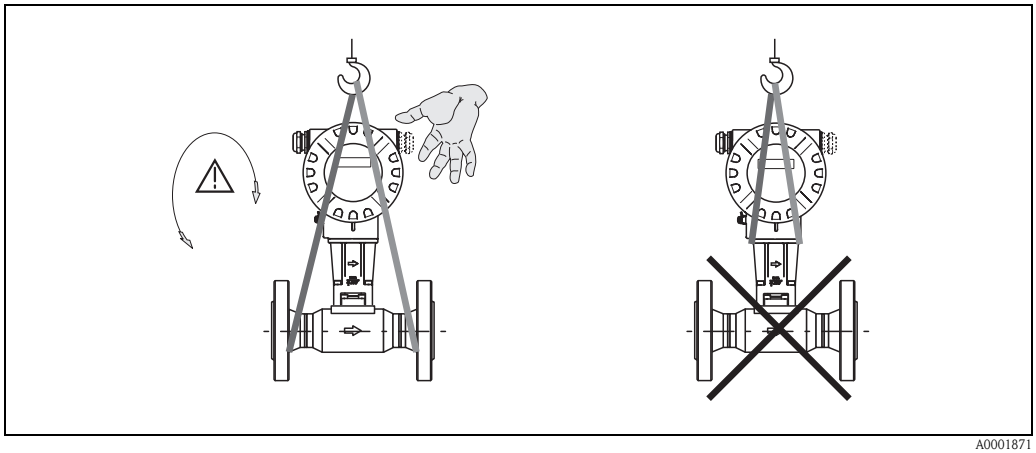

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Fig. 4: Instructions for transporting sensors with DN 40 to 300 (1½ to 12")

3.1.3 Storage

Note the following points:

- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The permissible storage temperature is:
  – Standard: –40 to +80 °C (–40 to +176 °F)
  – ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)
- When in storage, the device should not be exposed to direct sunlight in order to avoid impermissibly high surface temperatures.

3.2 Installation conditions

Note the following points:

- The measuring device requires a fully developed flow profile as a prerequisite for correct volume flow measurement. The inlet and outlet runs must be taken into account (see Page 14).
- The maximum permitted ambient temperatures (see Page 76) and fluid temperatures (see Page 76) must be observed.
- Pay particular attention to the notes on orientation and piping insulation (see Page 12 ff.).
- Verify that the correct nominal diameter and pipe standard (DIN/JIS/ANSI) were taken into account when ordering since the calibration of the device and the achievable accuracy depend on these factors. If the mating pipe and the device have different nominal diameters/pipe standards, an inlet correction can be made via the device software by entering the actual pipe diameter (see "Process Param. – Mating Pipe Diameter" parameter on Page 105).
- The correct operation of the measuring system is not influenced by plant vibrations up to 1 g, 10 to 500 Hz.
- For mechanical reasons, and in order to protect the piping, it is advisable to support heavy sensors.

3.2.1 Dimensions

The dimensions and lengths of the sensor and transmitter can be found in the Technical Information for Proline Prowirl TI070D/06/en.

3.2.2 Installation location

We recommend you observe the following dimensions to guarantee problem-free access to the device for service purposes:
- Minimum spacing (A) in all directions = 100 mm (3.94 inch)
- Necessary cable length (L): L + 150 mm (L + 5.91 inch).

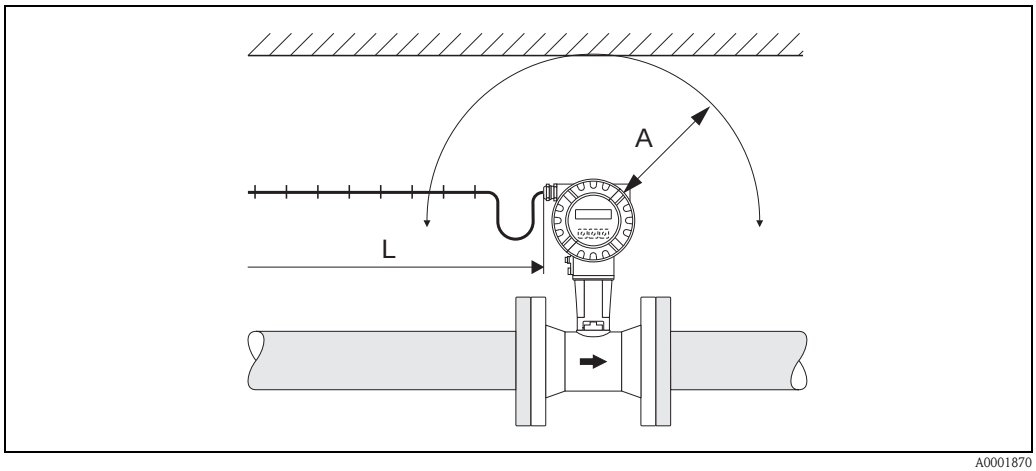

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Fig. 5: Minimum spacing

A = Minimum spacing in all directions
L = cable length

3.2.3 Orientation

The device can be installed basically in any orientation. Please consider the following, however (Fig. 6):

- In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (see orientation A).
- The arrow on the meter body has to point in flow direction.
- In order to make sure that the maximum ambient temperature (see Page 76) is not exceeded, we recommend the following orientations:
  – In the case of hot fluids (e.g. steam or fluid temperature ≥ 200 °C/≥392 °F), select orientation C or D.

Orientations B and D are recommended for very cold fluids (e.g. liquid nitrogen).

Caution!

- If fluid temperature is ≥ 200 °C (≥392 °F), orientation B is **not** permitted for the wafer version (Prowirl 73 W) with a nominal diameter of DN 100 (4") and DN 150 (6").
- In case of vertical orientation and downward flowing liquid, the piping has always to be completely filled.

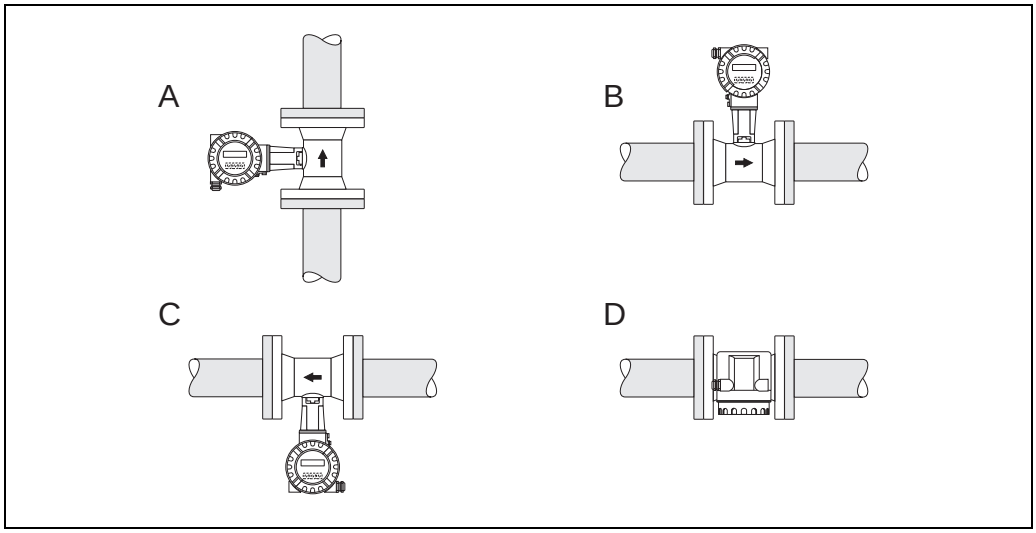

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Fig. 6: Possible orientations of the device

High fluid temperature:
– horizontal piping: orientation C or D
– vertical piping: orientation A

Low fluid temperature:
– horizontal piping: orientation B or D
– vertical piping: orientation A

3.2.4 Heat insulation

Some fluids require suitable measures to avoid heat transfer at the sensor to ensure optimum temperature measurement and mass calculation. A wide range of materials can be used to provide the required insulation.

When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part serves as a radiator and protects the electronics from overheating (or undercooling). The maximum insulation height permitted is illustrated in the diagrams. These apply equally to both the compact version and the sensor in the remote version.

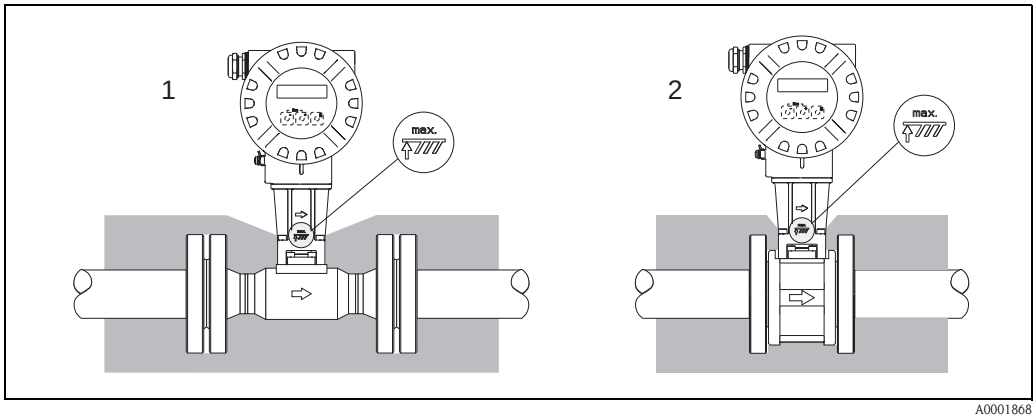

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Fig. 7: 1 = Flanged version, 2 = Wafer version

Caution!
Danger of electronics overheating!

- Therefore, make sure that the adapter between sensor and transmitter and the connection housing of the remote version are always exposed.
- Note that a certain orientation might be required, depending on the fluid temperature (see Page 12).
- Information on permissible temperature ranges (see Page 76).

3.2.5 Inlet and outlet run

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

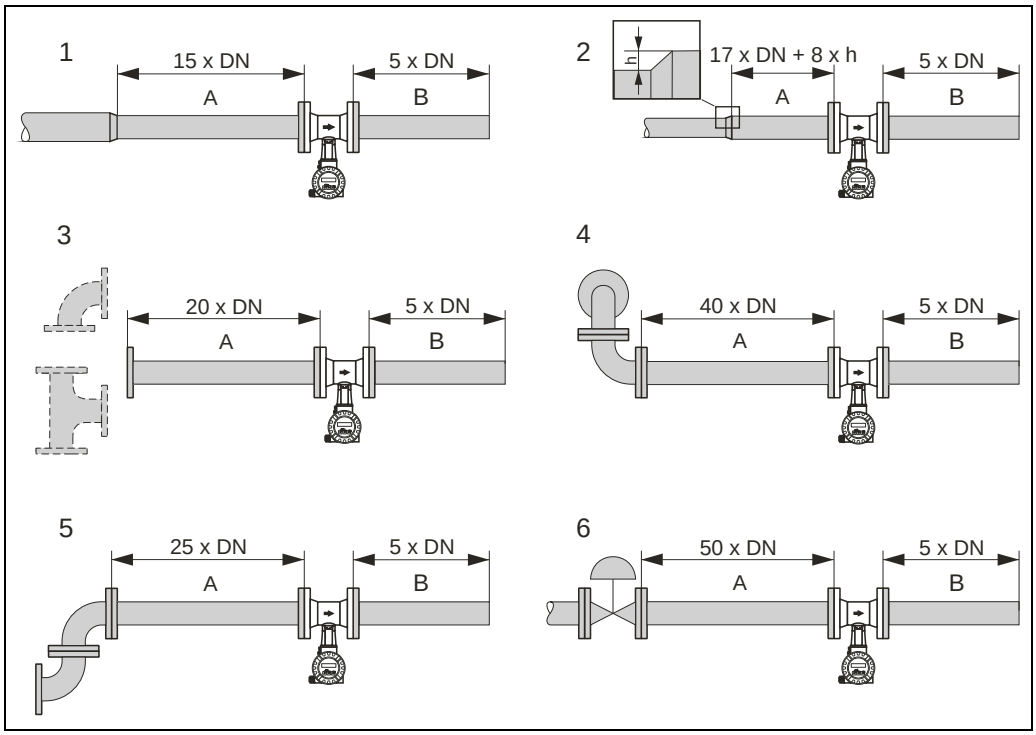

Fig. 8: Minimum inlet and outlet runs with various flow obstructions

A Inlet run
B Outlet run
1 Reduction
2 Extension
3 90° elbow or T-piece
4 2 x 90° elbow, 3-dimensional
5 2 x 90° elbow
6 Control valve

Note!
A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required (see Page 15).

Outlet runs with pressure measuring points
If pressure and temperature measuring points are installed after the device, please ensure there is a large enough distance between the device and the measuring point so there are no negative effects on vortex formation in the sensor.

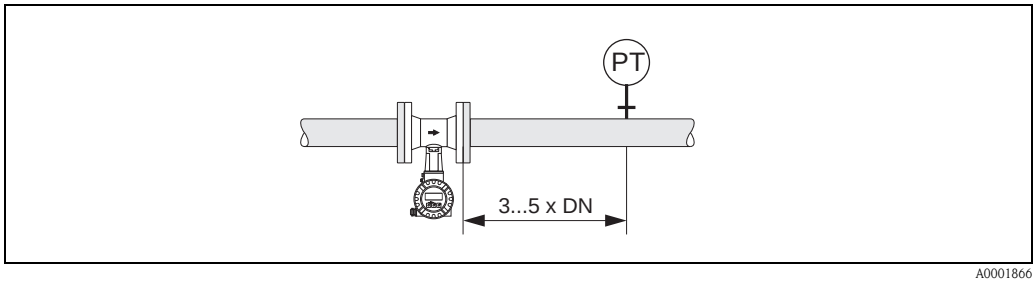

Fig. 9: Installing a pressure measuring point (PT)

Perforated plate flow conditioner
A specially designed perforated plate flow conditioner, available from Endress+Hauser, can be installed if it is not possible to observe the inlet runs required. The flow conditioner is fitted between two piping flanges and centered with mounting bolts. Generally, this reduces the inlet run required to 10 × DN with complete accuracy.

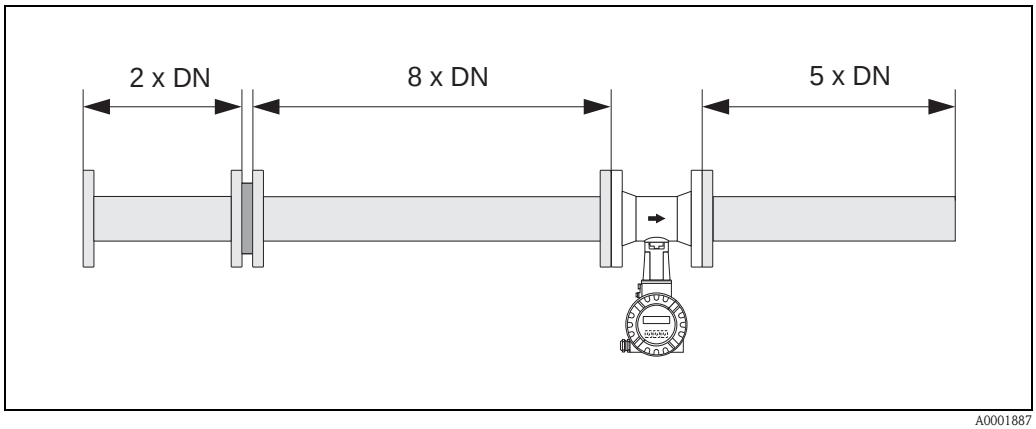

Fig. 10: Perforated plate flow conditioner

Calculation examples (SI units) for the pressure loss of flow conditioners:
The pressure loss for flow conditioners is calculated as follows:
Δp [mbar] = 0.0085 · ρ [kg/m³] · v² [m/s]

- Example with steam
  p = 10 bar abs
  t = 240 °C → ρ = 4.39 kg/m³
  v = 40 m/s
  $\Delta p = 0.0085 \cdot 4.39 \cdot 40^2 = 59.7$ mbar
- Example with H_2O condensate (80 °C)
  ρ = 965 kg/m³
  v = 2.5 m/s
  $\Delta p = 0.0085 \cdot 965 \cdot 2.5^2 = 51.3$ mbar

3.2.6 Vibrations

The correct operation of the measuring system is not influenced by plant vibrations up to 1 g, 10 to 500 Hz. Consequently, the sensors require no special measures for attachment.

3.2.7 Limiting flow

See the information on Page 70 ff.

3.3 Installation

3.3.1 Mounting sensor

Caution!
Please note the following prior to mounting:

- 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 pipe and piping. Seals projecting into the flow current have a negative effect on the vortex formation after the bluff body and cause inaccurate measurement. The gaskets provided by Endress+Hauser for the wafer version have therefore an inner diameter with a bigger inner diameter than the piping.
- Ensure that the arrow on the measuring pipe matches the direction of flow in the piping.
- Lengths:
  – Prowirl W (wafer version): 65 mm (2.56 inch)
  – Prowirl F (flanged version) → See Technical Information TI070D/06/en.

Mounting Prowirl W
The centering rings supplied are used to mount and center the wafer-style devices.
A mounting kit consisting of tie rods, seals, nuts and washers can be ordered separately.

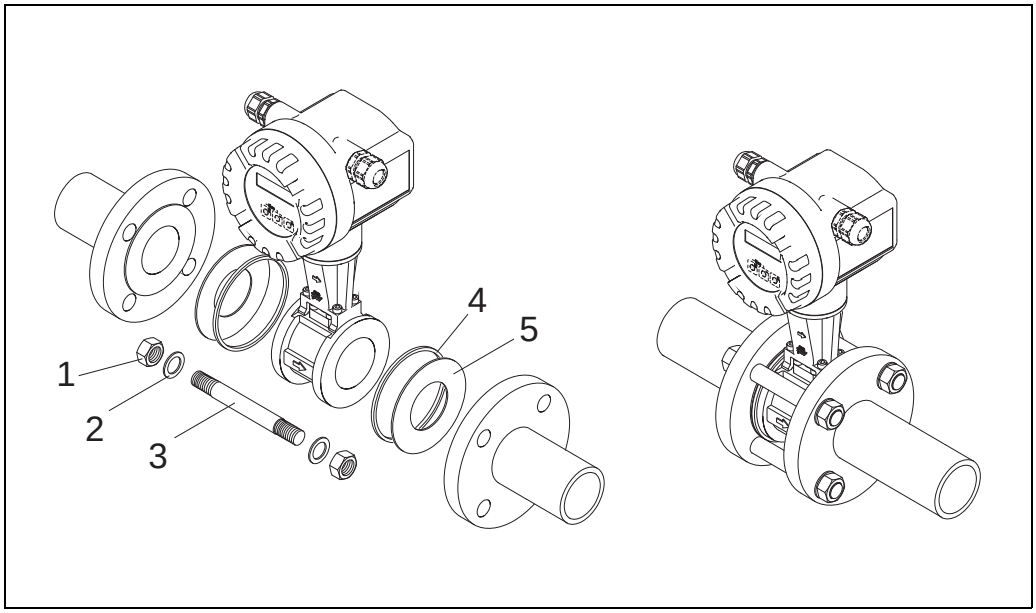

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Fig. 11: Mounting the wafer version

1 Nut
2 Washer
3 Tie rod
4 Centering ring (is supplied with the device)
5 Seal

3.3.2 Rotating the transmitter housing

The electronics housing can be rotated continuously 360° on the housing support.

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. Tighten the safety screw.

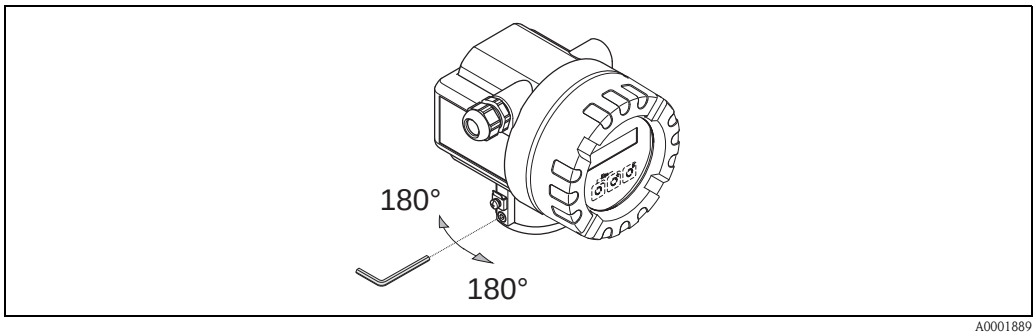

Fig. 12: Rotating the transmitter housing

3.3.3 Rotating 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.

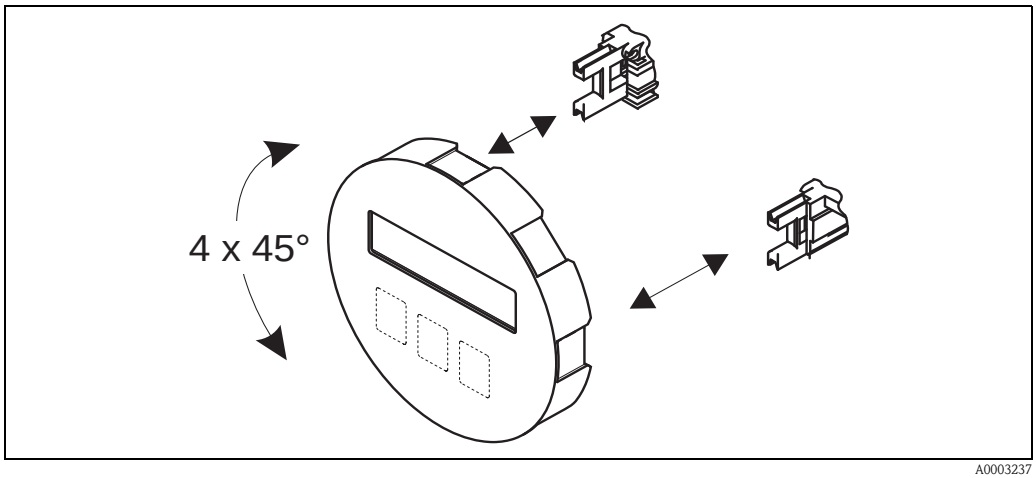

Fig. 13: Rotating the local display

3.3.4 Mounting transmitter (remote)

The transmitter can be mounted in the following ways:
- Wall mounting
- Pipe mounting (with separate mounting kit, accessories see Page 48)

The transmitter and the sensor must be mounted separate in the following circumstances:
- Poor accessibility,
- lack of space,
- extreme ambient temperatures.

Caution!
If the device is mounted to warm piping, make certain that the housing temperature does not exceed the max. permissible temperature value.
– Standard: –40 to +80 °C (–40 to +176 °F)
– EEx d/XP version: –40 to +60 °C (–40 to +140 °F)
– ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)

Mount the transmitter as illustrated in the diagram.

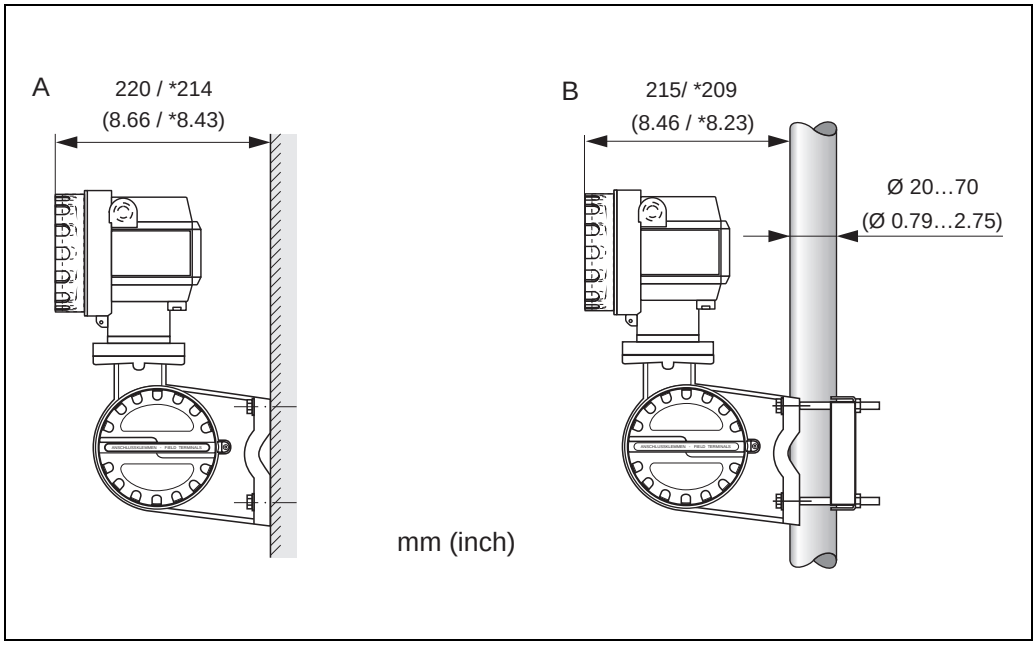

Fig. 14: Mounting the transmitter (remote version)

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 in the piping:

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?	see Page 70 ff.
Installation	Notes
Does the arrow on the sensor or pipe stand match the actual direction of flow through the pipe?	–
Are the measuring point number and labeling correct (visual inspection)?	–
Is the orientation chosen for the sensor correct, in other words suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?	see Page 11 ff.
Are the necessary inlet and outlet runs respected?	see Page 14 ff.
Process environment / process conditions	Notes
Is the measuring device protected against moisture and direct sunlight?	–

4 Wiring

Warning!
When connecting Ex-certified devices, please refer to 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.

4. 1 FOUNDATION Fieldbus cable specifications

4.1.1 Cable type

Twin-core cables are required 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 lack of shielding 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 size	0.8 mm^2 (AWG 18)	0.32 mm^2 (AWG 22)
Loop-resistance (direct current)	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 (inc. spurs >1 m)	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 (see Page 20).
- 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 is restricted under certain conditions (explosion protection, bus feed, field device current consumption).
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 lines 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!
If there are large potential differences between the individual grounding points, only one point of the shielding is directly connected to the reference ground. In plants without potential matching, therefore, cable shielding of fieldbus systems should only be grounded on one side, for example for the fieldbus supply unit or safety barriers.

Caution!
If the shielding of the cable is grounded at more than one point in systems without potential matching, power supply frequency equalizing currents can occur that damage the bus cable or shielding or have a serious effect on signal transmission.

Bus termination
The start and end of each fieldbus segment must always be terminated with a bus terminator. With various junction boxes (non-Ex), the bus termination can be activated via a switch. If this is not the case, a separate bus terminator must be installed. Note the following points:
- In the case of a branched bus segment, the device furthest from the segment coupler represents the end of the bus.
- If the fieldbus is extended with a repeater, then the extension must also be terminated at both ends.

Further information
General information and further pointers on wiring can be found on www.fieldbus.org, the website of the Fieldbus Foundation.

4. 2 Connecting the remote version

4.2.1 Connecting the sensor

Note!
- The remote version must be grounded. In doing so, the sensor and transmitter must be connected to the same potential matching.
- When using the remote version, always make sure that you connect the sensor only to the transmitter with the same serial number. If this is not observed when connecting the devices, compatibility issues (e.g. the wrong K-factor is used) can arise.

1. Remove the cover of the connection compartment of the transmitter (a).
2. Remove the cover of the connection compartment of the sensor (b).
3. Feed the connecting cable (c) through the appropriate cable entries.
4. Wire the connecting cable between the sensor and transmitter in accordance with the electrical wiring diagram:
   see Fig. 15 or the wiring diagram in the connection compartment covers (a/b).
5. Tighten the glands of the cable entries on the sensor housing and transmitter housing.
6. Screw the cover of the connection compartment (a/b) back onto the sensor housing or transmitter housing.

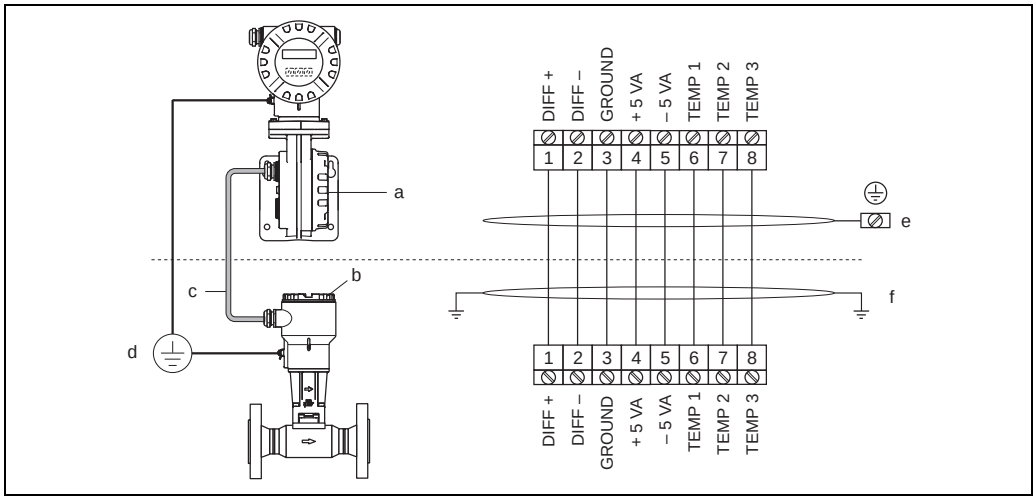

Fig. 15: Connecting the remote version

a Connection compartment cover (transmitter)
b Connection compartment cover (sensor)
c Connecting cable (signal cable)
d Identical potential matching for sensor and transmitter
e Connect shielding to ground terminal in transmitter housing and keep as short as possible
f Connect shielding to cable strain relief clamp in connection housing

Wire color (colour code according to DIN 47100):
Terminal number: 1 = white; 2 = brown; 3 = green; 4 = yellow, 5 = gray; 6 = pink; 7 = blue; 8 = red

4.2.2 Cable specifications, standard connecting cable

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:
- 4 × 2 × 0.5 mm² (AWG 20) PVC cable with common shield (4 pairs, pair-stranded)

✎ Note!
If the cross-section of a cable deviates from the specification, the value for the cable length has to be calculated. → See "Calculating and entering the cable length".

- Conductor resistance to DIN VDE 0295 Class 5 or IEC 60228 Class 5: 39 Ω/km

✎ Note!
The conductor resistance specified by the standard is compensated for.

- Capacity core/screen: < 400 pF/m (122 pF/ft)
- Cable length: max. 30 m (98 ft)
- Operating temperature: –40 to +105 °C (–40 to +221 °F)

4.2.3 Cable specifications, armored connecting cable

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:
- 4 × 2 × 0.5 mm² (AWG 20) PVC cable with common shield (4 pairs, pair-stranded)

✎ Note!
If the cross-section of a cable deviates from the specification, the value for the cable length has to be calculated. → See "Calculating and entering the cable length".

- Conductor resistance to DIN VDE 0295 Class 5 or IEC 60228 Class 5: 39 Ω/km

✎ Note!
The conductor resistance specified by the standard is compensated for.

- Extensively resistant against acids, bases and specific oils
- A galvanized braided steel wire forms the total shield
- Outer sheath version: smooth, uniform, round
- Cable length: max. 30 m (98 ft)
- Operating temperature: –30 to +70 °C (–22 to +158 °F)

✎ Note!
The cable resistance, as per specification is 39 Ω/km , is compensated. If a cable is used with a cable cross-section deviating from the specification, the value for the cable length must be calculated as follows and entered in the "Sensor Data - Cable Length" parameter (see Page 112):

$$\frac{\text{Cable resistance of used cable } [\Omega/\text{km}]}{\text{Cable resistance as per specification } [\Omega/\text{km}]} \bullet \text{Actual cable length } [\text{m}] = \text{cable length to be entered } [\text{m}]$$

Example:
- Cable resistance of used cable = 26 Ω/km
- Cable resistance as per specification = 39 Ω/km
- Actual cable length = 15 m

$$\frac{26\ [\Omega/\text{km}]}{39\ [\Omega/\text{km}]} \bullet 15\ [\text{m}] = 10\ \text{m}$$

In the "Sensor Data - Cable Length" parameter (see Page 112), the value 10 m (32.81 ft) must be entered.

4. 3 Connecting the measuring unit

Field instruments can be connected to the FOUNDATION Fieldbus in two ways:

- Connection via conventional cable gland see Section 4.2.1
- Connection via prefabricated fieldbus connector (option) see Section 4.3.2

4.3.1 Connecting the transmitter

Caution!

- Risk of damaging the fieldbus cable!
  If the shielding of the cable is grounded at more than one point in systems without additional potential matching, power supply frequency equalizing 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 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.
- Please pay particular attention to company-internal grounding concepts and national installation regulations and guidelines.

Note!

- When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.
- The remote version must be grounded. In doing so, the sensor and transmitter must be connected to the same potential matching.
- The national regulations governing the installation of electrical equipment must be observed.
- When connecting the transmitter, use a connecting cable with a continuous service temperature of at least –40 °C (–40 °F) to 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 lines are confused.
- Cable cross-section: max 2.5 mm²
- Observe the grounding concept of the plant.

Procedure for connecting the transmitter, Non-Ex, Ex i/IS and Ex n version (see Fig. 16)

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 the fixing screw (d) of the cover of the connection compartment and fold down the cover.
4. Push the power supply/fieldbus cable through the cable gland (e).
5. Tighten the cable glands (e) (see also Page 28).
6. Pull the terminal connector (f) out of the transmitter housing and connect the power supply/fieldbus cable (see Fig. 18).

   ✎ Note!
   The terminal connector (f) is pluggable, i.e. it can be plugged out of the transmitter housing to connect the cable.

7. Plug the terminal connector (f) into the transmitter housing.
8. Secure the ground cable to the ground terminal (g).

   ✎ Note!
   Between the stripped fieldbus cable and the ground terminal, the cable shielding should not exceed a length of 5 mm (0.20 in).

9. Only remote version:
   Secure ground cable to the ground terminal (see Fig. 18, B).
10. Fold up the cover of the connection compartment and tighten the fixing screw (d).
11. Remove the display module (b) and fit on the retaining rails (c).
12. Screw the cover of the electronics compartment (a) onto the transmitter housing.

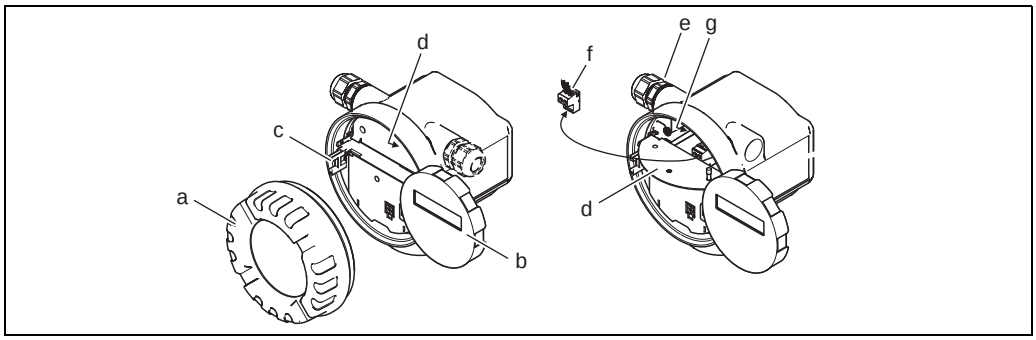

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Fig. 16: Procedure when connecting the transmitter, Non-Ex, Ex i/IS and Ex n version

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

Connecting the transmitter, Ex d/XP version (see Fig. 17)

1. Release the securing clamp (a) of the connection compartment cover.
2. Screw the connection compartment cover (b) off the transmitter housing.
3. Push the power supply/fieldbus cable through the cable gland (c).
4. Tighten the cable glands (c) (see also Page 28).
5. Pull the terminal connector (d) out of the transmitter housing and connect the power supply/fieldbus cable (see Fig. 18).

   ✎ Note!
   The terminal connector (d) is pluggable, i.e. it can be plugged out of the transmitter housing to connect the cable.

6. Plug the terminal connector (d) into the transmitter housing.
7. Secure the ground cable to the ground terminal (e).

   ✎ Note!
   Between the stripped fieldbus cable and the ground terminal, the cable shielding should not exceed a length of 5 mm (0.20 in).

8. Only remote version:
   Secure ground cable to the ground terminal (see Fig. 18, B).
9. Screw the connection compartment cover (b) onto the transmitter housing.
10. Tighten the securing clamp (a) of the connection compartment cover.

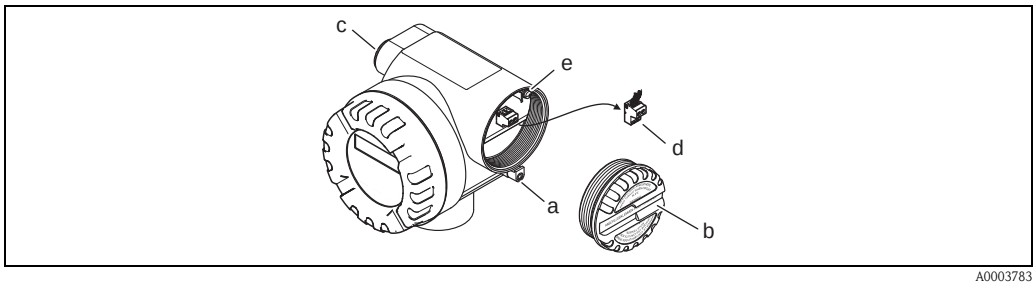

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Fig. 17: Procedure when connecting the transmitter, Ex d/XP version

a Securing clamp for connection compartment cover
b Connection compartment cover
c Cable gland
d Terminal connector
e Ground terminal

Wiring diagram

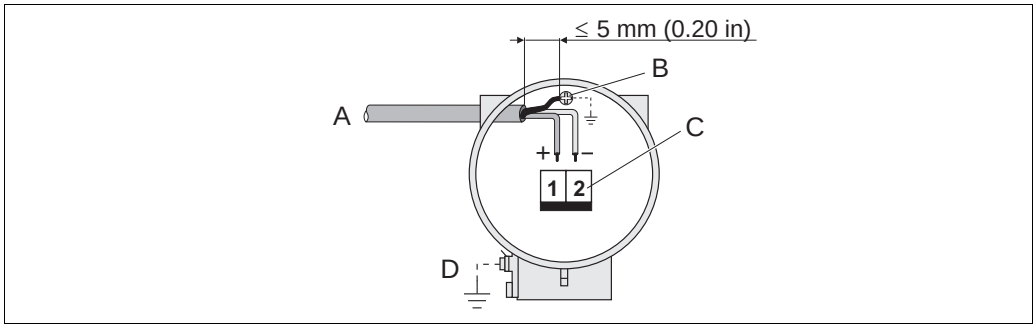

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Fig. 18: Connecting the transmitter

A Fieldbus cable (FOUNDATION Fieldbus)
B Ground terminal (between the stripped fieldbus cable and the ground terminal, the cable shielding should not exceed a length of 5 mm (0.20 in).
C Terminal connector (1 = FF+; 2 = FF–)
D Ground terminal (external, only relevant for remote version)

4.3.2 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 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 (see Page 64).

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

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

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

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

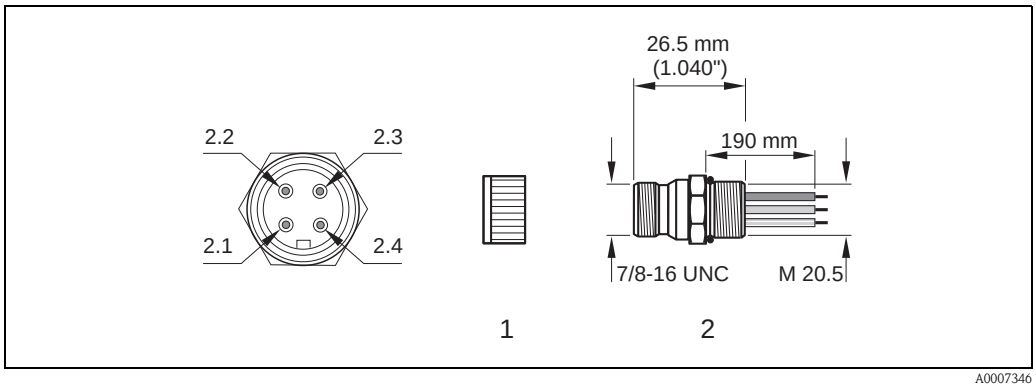


Fig. 19: Connectors for connecting to the FOUNDATION Fieldbus

1 Protection cap for connector
2 Fieldbus connector (pin assignment/color codes)
2.1 Brown wire: FF+ (terminal 1)
2.2 Blue wire: FF– (terminal 2)
2.3 Not assigned
2.4 Green/yellow: earth (notes on connection, see Page 21, 24)

Connector technical data:
– Degree of protection IP 67
– Ambient temperature: –40 to +150 °C (–40 to +302 °F)

4.3.3 Terminal assignment

Order version	Terminal no. (inputs/outputs)	
	1	2
73***-**********K	FF +	FF –

4. 4 Degree of protection

The measuring device meets all the requirements for IP 67 (NEMA 4X).
Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP 67 (NEMA 4X) 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 (see Page 74), cable entries.
- The cable entries must be firmly tightened (point **a**, see Fig. 20).
- The cable must loop down before it enters the cable entry ("water trap") (point **b**, see Fig. 20). This arrangement prevents moisture penetrating the entry.

✎ Note!
The cable entries should not point upwards.

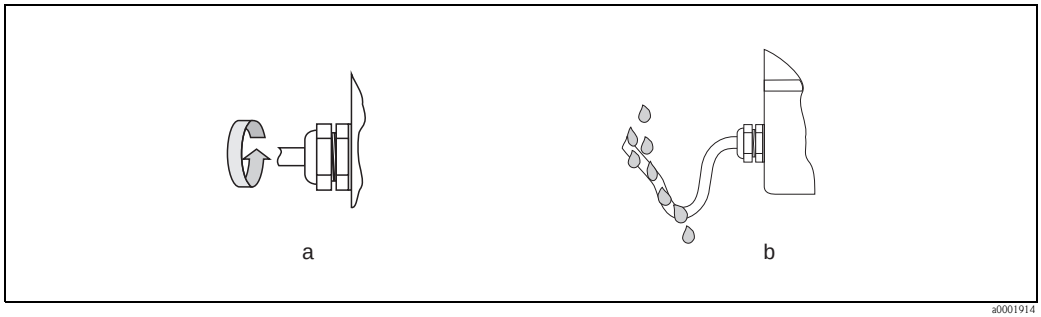


Fig. 20: Installation instructions for cable entries

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

4. 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?	9 to 32 V DC
Do the cables used comply with the specifications?	■ Fieldbus cable see Page 20 ■ Signal cable see Page 23
Do the cables have adequate strain relief?	–
Are the power supply and fieldbus cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all terminals firmly tightened?	–
Are all the cable entries installed, tightened and sealed? Cable run with "water trap"?	see Page 28
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?	see Page 21
Has the max. length of the spurs been observed in accordance with the FOUNDATION Fieldbus specifications?	see Page 21
Is the fieldbus cable fully shielded and correctly grounded?	see Page 21

5 Operation

5. 1 Quick operation guide

You have a number of options for configuring and commissioning the device:

1. Operating programs see Page 33
The configuration of FOUNDATION Fieldbus functions and device-specific parameters is primarily done via the fieldbus interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.

2. Miniature switches (DIP switches) for diverse hardware settings see Page 35
You can make the following hardware settings for the FOUNDATION Fieldbus interface using miniature switches (DIP switches) on the I/O board or the amplifier board:
- Enabling/disabling the simulation mode in the AI, AO and DO function block
- Switching the hardware write protection on/off

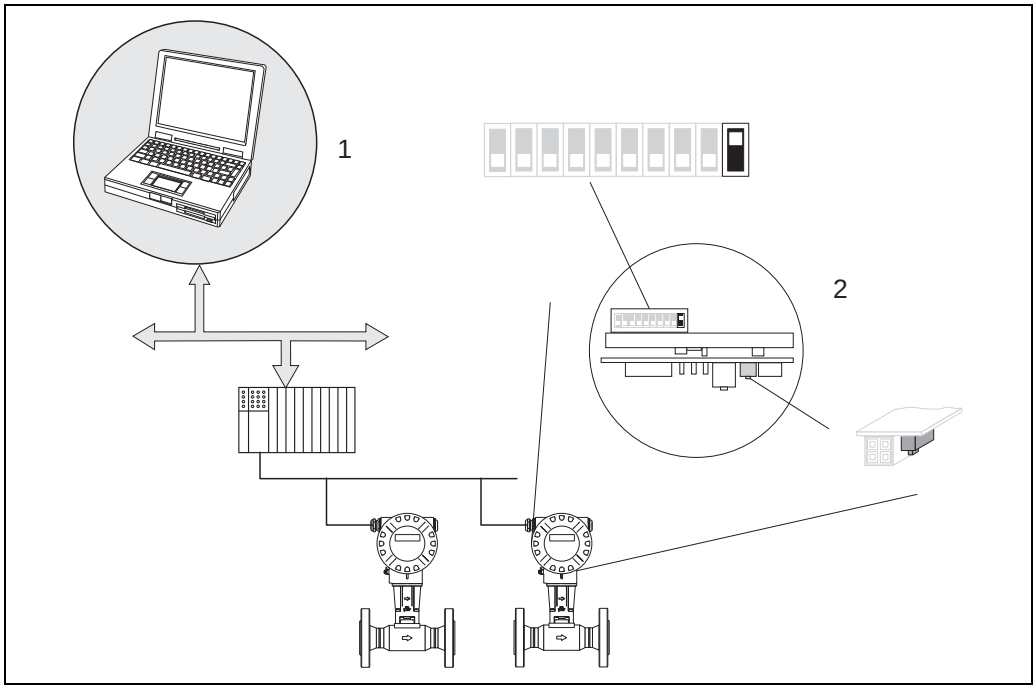


Fig. 21: Device operating options via the FOUNDATION Fieldbus interface

1 Configuration/operating programs for operation via FOUNDATION Fieldbus (FOUNDATION Fieldbus functions, device parameter)
2 Miniature switches for hardware settings (write protection, simulation mode)

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 (see Page 142 ff.).

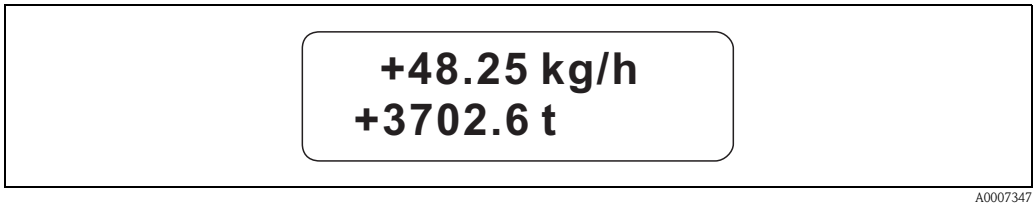


Fig. 22: Liquid crystal display

The two-line liquid-crystal display shows measured values, fault messages and notice messages.
– Top line: shows main measured values, e.g. calculated mass flow in [kg/h] or in [%].
– Bottom line: shows additional measured variables and status variables, e.g. totalizer reading in [t], bar graph, tag name.

5.2.2 Display symbols

Display symbol	Meaning
S	System error
P	Process error
ϟ	Fault message
!	Notice message
◒	FF communication active

5.2.3 Error message display

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

The measuring system distinguishes between two types of error:
- *System error:* this group includes all device errors, for example communication errors, hardware errors, etc.
- *Process error:* this group includes all application errors, for example "empty pipe" etc.

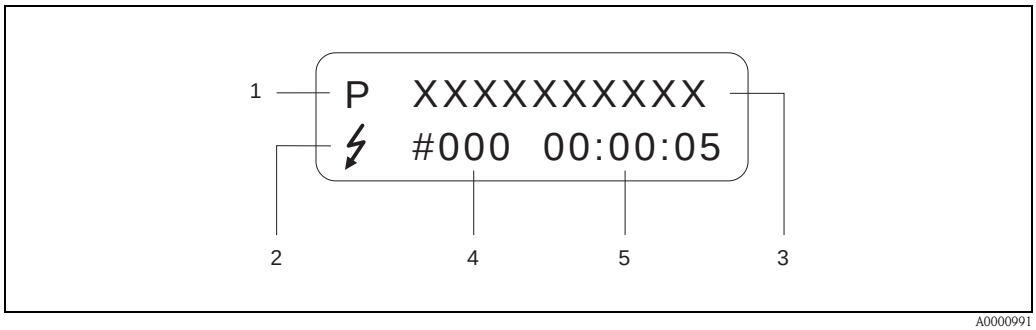


Fig. 23: Error messages on the display (example)

1 Type of error: P = process error, S = system error
2 Error message type: ϟ = fault message, ! = notice message
3 Error designation: e.g. DSC SENS LIMIT = device being operated near application limits
4 Error number: e.g. #395
5 Duration of most recent error occurrence (in hours, minutes and seconds)

Types of error message
The measuring device always assigns system and process errors which occur to two types of error messages (fault or notice messages), resulting in different weightings (see Page 53 ff.).
Serious system errors, e.g. electronic module defects, are always identified and displayed as "Fault messages" by the measuring device.

Notice message (!)
- The error in question does not have any effect on the current measuring operation.
- Displayed as → Exclamation mark (!), type of error (S: system error, P: process error)
- FOUNDATION Fieldbus → Notice messages are relayed to downstream function blocks or higher-level process control systems with the status "UNCERTAIN" of the output value OUT (AI Block).

Fault message (ϟ)
- The error in question interrupts or stops the measuring operation running.
- Displayed as → Lightning flash (ϟ), type of error (S: system error, P: process error)

FOUNDATION Fieldbus → Fault messages are relayed to downstream function blocks or higher-level process control systems with the status "BAD" of the output value OUT (AI Block).

5. 3 FOUNDATION Fieldbus technology

For configuration information, please refer to Operating Instructions "FOUNDATION Fieldbus Overview" (BA013S). Available at: → www.endress.com → Download.

5. 4 Operating programs

5.4.1 Operating program "FieldCare"

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

Contents of the "FieldCare":
- Commissioning, maintenance analysis
- Measuring device configuration
- Service functions
- Visualization of process data
- Trouble-shooting
- Reading out the verification data and updating the software of the "Fieldcheck" flow simulator

5.4.2 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 of 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 36 ff. together with information on configuring device-specific parameters. For general information on the FOUNDATION Fieldbus, please refer to Operating Instructions "FOUNDATION Fieldbus Overview" (BA013S). Available at: → www.endress.com → Download.

System files
You require the following files for commissioning and configuring the network:
- Commissioning → D (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 by quoting the order number (No. 50097199)
- From the Fieldbus Foundation Organization → www.fieldbus.org

Note!
Make sure you are using the correct system files for integrating field devices into the host system. Relevant version information can be queried with Prowirl 73 by means of the following parameters in the Resource Block:

FOUNDATION Fieldbus interface:

- Resource Block → DEV_REV parameter
- Resource Block → DD_REV parameter

Example:
Display in DEV_REV parameter → 01
Display in DD_REV parameter → 01
Device description file (DD) required → 0101.sym / 0101.ffo

5.4.3 Current device description files

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

Access via FOUNDATION Fieldbus:

Valid for I/O software	1.00.XX
Device data FOUNDATION Fieldbus Manufacturer ID: Device ID:	 11_{hex} (ENDRESS+HAUSER) 1057_{hex}
Version data FOUNDATION Fieldbus	Device Revision 1/ DD Revision 1
Software release	06.2004
Operating program	**How to acquire:**
Device Description (DD) and Capability File (CFF)	■ www.endress.com (→ Download → Software → Driver) ■ www.fieldbus.org ■ CD-ROM
Device drivers for FF host systems:	**How to acquire:**
ABB (FieldController 800)	See FOUNDATION Fieldbus standard device drivers
Allen Bradley (Control Logix)	See FOUNDATION Fieldbus standard device drivers
Emerson (Delta V)	www.easydeltav.com
Endress+Hauser (ControlCare)	See FOUNDATION Fieldbus standard device drivers

Access via the service protocol:

Valid for I/O software	1.00.XX
Software release	06.2004
Operating program	**Sources for obtaining device descriptions**
Tester/simulator	**Sources for obtaining device descriptions**
Fieldcheck	■ Update by means of the "FieldCare" operating program via the "Fieldflash" module

5. 5 Hardware settings

5.5.1 Switching the write protection and simulation mode on and off

Hardware write protection and simulation mode (for AI, AO and DO function block) can be switched on and off by means of DIP switches on the I/O board or the amplifier board. When write protection is active, parameters cannot be modified. The current write protection status is displayed in the WRITE_LOCK parameter (Resource Block see Page 87).

1. Unscrew the cover of the electronics compartment from the transmitter housing.
2. Remove the local display module (a) from the retaining rails (b) and refit onto right retaining rail with the left side (this secures the local display module).
3. Fold up the plastic cover (c).
4. Configure the hardware write protection and simulation mode accordingly with the aid of the DIP switches (see Fig. 24).
5. Installation is the reverse of the removal procedure.

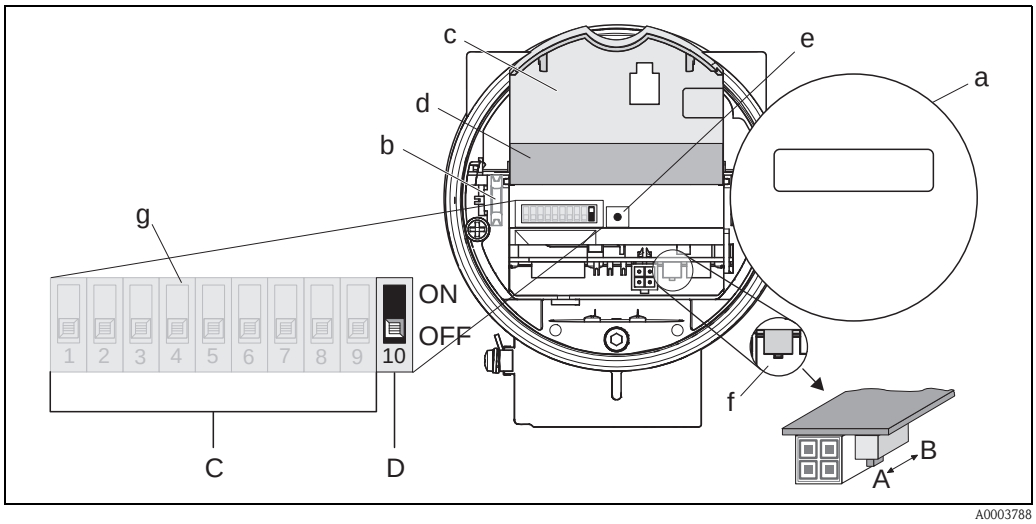


Fig. 24: Hardware settings (I/O board or amplifier board)

a Local display module (optional)
b Retaining rails of local display module
c Plastic cover
d I/O board cover (COM module)
e LED (light emitting diode):
- *Lit continuously = ready for operation*
- *Not lit = not ready for operation*
- *Flashing = system or process error present (see Page 53 ff.)*

f DIP switch for hardware write protection
- *A = write protection switched off (DIP switch to the front = factory setting) → Access to device parameters via FOUNDATION Fieldbus interface possible*
- *B = write protection switched on (DIP switch to the rear) → Access to device parameters via FOUNDATION Fieldbus interface not possible*

g DIP switch for simulation mode:
- *C= DIP switches 1 to 9 = not assigned*
- *D= DIP switch 10 = simulation mode*
  OFF (factory setting) = simulation mode possible in the Analog Input Function Block, Analog Output Function Block or in the Discrete Output Function Block
  ON = simulation mode not possible in the Analog Input Function Block, Analog Output Function Block or in the Discrete Output Function Block

6 Commissioning

6. 1 Function check

Make sure that all final checks have been completed before you commission your measuring point:
- "Post-installation check" checklist see Page 19
- "Post-connection check" checklist see Page 29

Note!
- The FOUNDATION Fieldbus interface's technical data must be maintained in accordance with IEC 61158-2 (MBP).
- A normal multimeter can be used to check the bus voltage of 9 to 32 V and the current consumption of 16 mA at the device.
- Using the LED on the I/O board (see Page 35), it is possible to carry out a simple function check on the fieldbus communication in the non-hazardous area.

6.1.1 Switching on the measuring device

Once the final checks have been successfully completed, it is time to switch on the supply voltage. The device is ready for operation after approx. 5 seconds!

The measuring device performs a number of internal test functions after power-up. As this procedure progresses, the following sequence of messages appears on the local display:

PROWIRL 73 **XX.XX.XX**	Start-up message displaying the current amplifier software
▼	
FOUND. FIELDBUS **XX.XX.XX**	Displays the current software of the FOUNDATION Fieldbus I/O board
▼	
PD-TAG display	Displays the tag name

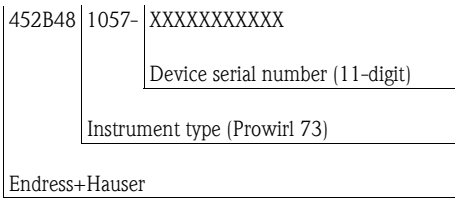
Normal measuring mode commences as soon as startup completes.
Various measured value and/or status variables appear on the display.

Note!
If startup fails, an appropriate error message is displayed, depending on the cause.

6. 2 Commissioning via FOUNDATION Fieldbus

Note the following points:
- The files required for commissioning and network configuration can be obtained as described on Page 33.
- 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, device type and device serial number. It is unique and can never be assigned twice.

The DEVICE_ID of Prowirl 73 is formed as follows:



6.2.1 Initial 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 (see Page 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. Please note the example on Page 33. The first time you establish a connection, the Prowirl 73 reacts as follows:

   – E+H_PROWIRL_73_ xxxxxxxxxxx (tag name PD-TAG)
   – 452B481057- xxxxxxxxxxx (DEVICE_ID)
   – Block structure:

Display text (xxx... = serial number)	Base index	Description
RESOURCE_ xxxxxxxxxxx	400	Resource Block
TRANSDUCER_FLOW_xxxxxxxxxxx	500	Transducer Block "Flow"
TRANSDUCER_TOT_1_xxxxxxxxxxx	600	Transducer Block "Totalizer 1"
TRANSDUCER_TOT_2_xxxxxxxxxxx	700	Transducer Block "Totalizer 2"
TRANSDUCER_FLOW_COMP_xxxxxxxxxxx	800	Transducer Block "Flow Computer"
TRANSDUCER_ADV_DIAG_xxxxxxxxxxx	900	Transducer Block "Advanced Diagnostic"
TRANSDUCER_DISP_xxxxxxxxxxx	1000	Transducer Block "Display"
TRANSDUCER_DIAG_xxxxxxxxxxx	1100	Transducer Block "Diagnosis"
TRANSDUCER _SERV_xxxxxxxxxxx	1200	Transducer Block "Service"
ANALOG_INPUT_1_ xxxxxxxxxxx	1300	Analog Input Function Block 1

Display text (xxx... = serial number)	Base index	Description
ANALOG_INPUT_2_ xxxxxxxxxxx	1400	Analog Input Function Block 2
ANALOG_INPUT_3_ xxxxxxxxxxx	1500	Analog Input Function Block 3
ANALOG_INPUT_4_ xxxxxxxxxxx	1600	Analog Input Function Block 4
ANALOG_INPUT_5_ xxxxxxxxxxx	1700	Analog Input Function Block 5
ANALOG_INPUT_6_ xxxxxxxxxxx	1800	Analog Input Function Block 6
ANALOG_INPUT_7_ xxxxxxxxxxx	1900	Analog Input Function Block 7
ANALOG_OUTPUT xxxxxxxxxxx	2000	Analog Output Function Block
DISCRETE_OUTPUT_ xxxxxxxxxxx	2100	Discrete Output Function Block

✎ Note!
Prowirl 73 is delivered from the factory with the bus address "250" and is thus in the address range between 248 and 251 reserved for readdressing the field devices. This means that the LM (Link Master) allocates a non-assigned bus address to the device in the initialization stage.

5. Using the DEVICE_ID noted, identify the field device and assign the desired tag name (PD_TAG) to the fieldbus device in question.
Factory setting: E+H_PROWIRL_73_xxxxxxxxxxx

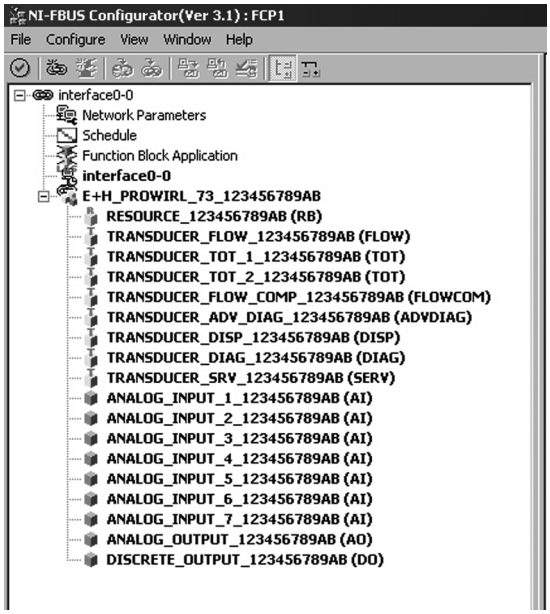


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Fig. 25: Screen display in the configuration program "NI-FBUS Configurator" (National Instruments) after the connection has been established

Configuring the "Resource Block" (base index 400)

6. Open the Resource Block.

7. When the device is delivered, the hardware write protection is disabled so the write parameters can be accessed via the 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 see Page 35.

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.

Configuring the "Transducer Blocks"

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

Flow measurement	→	Transducer Block "Flow" (base index: 500)
Totalizer 1	→	Transducer Block "Totalizer 1" (base index: 600)
Totalizer 2	→	Transducer Block "Totalizer 2" (base index: 700)
Flow computer	→	Transducer Block "Flow Computer" (base index: 800)
Advanced diagnosis*	→	Transducer Block "Adv. Diagnostic" (base index: 900)
Local display functions	→	Transducer Block "Display" (base index: 1000)
Diagnostic functions	→	Transducer Block "Diagnosis" (base index: 1100)
Service functions	→	Transducer Block "Service" (base index: 1200)

*Functions and parameters for "Advanced diagnosis" are only available once the corresponding software option has been enabled. For enabling see the "Activ. Adv. Diag" parameter in the Transducer Block "Adv. Diagnostic" (see Page 134)

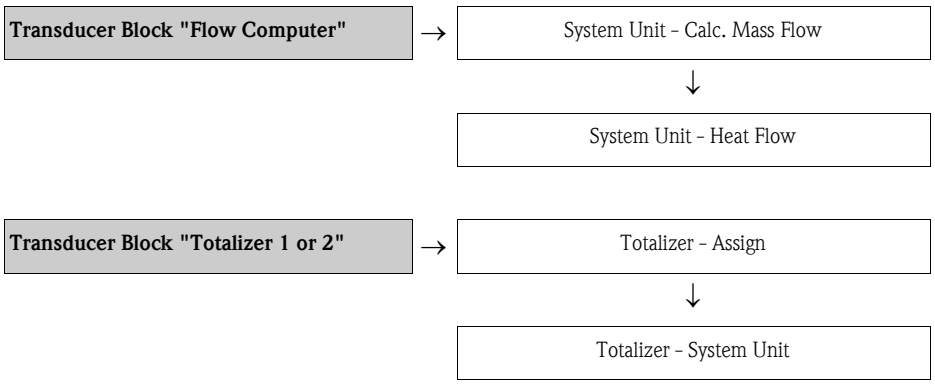
The following section describes an example for the Transducer Block "Flow Computer" (base index 800).

10. Enter the desired name for the block (optional).
    Factory setting: TRANSDUCER_FLOW_ COMP_xxxxxxxxxxx

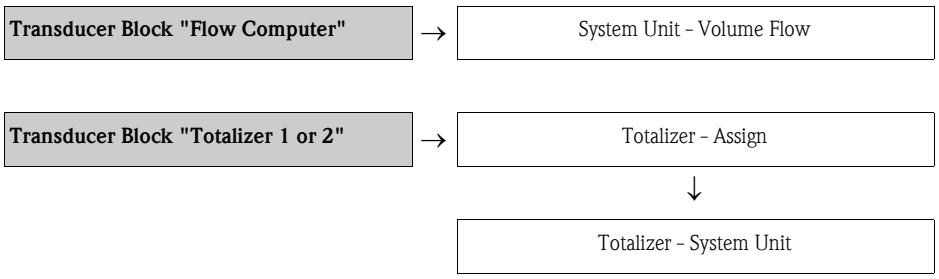
11. Open the Transducer Block "Flow Computer".

12. Now configure the device-specific parameters relevant for your application.
    – Enabling code in "Un-/Locking - Access Code" parameter see Page 96 (factory setting = 73)
    – Select the fluid from → "Select Fluid" and configure the corresponding parameters for your application → See following configurations

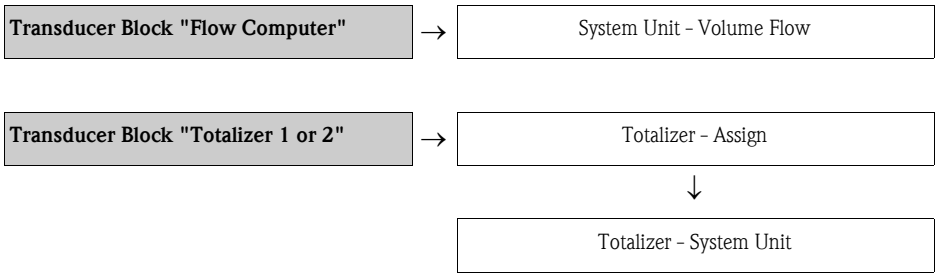
Configuration for fluid selection → Saturated Steam



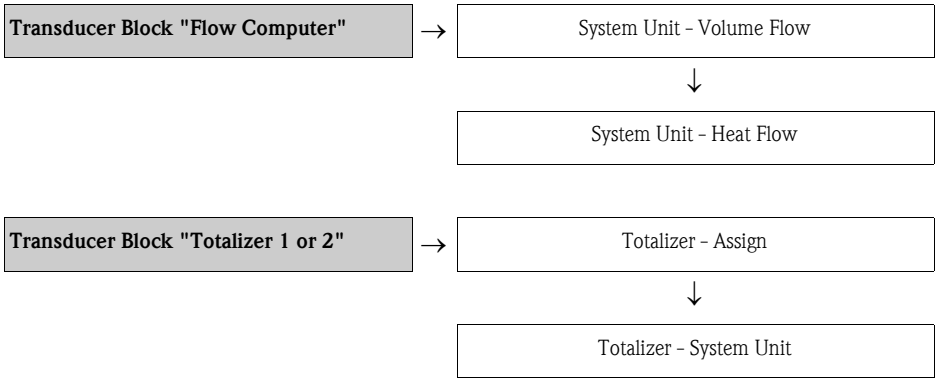
Configuration for fluid selection → Gas Volume



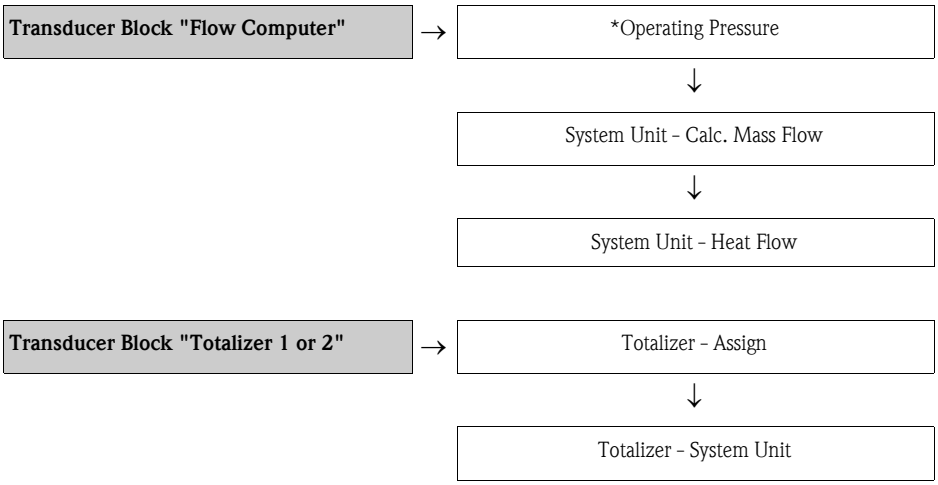
Configuration for fluid selection → Liquid Volume



Configuration for fluid selection → Water

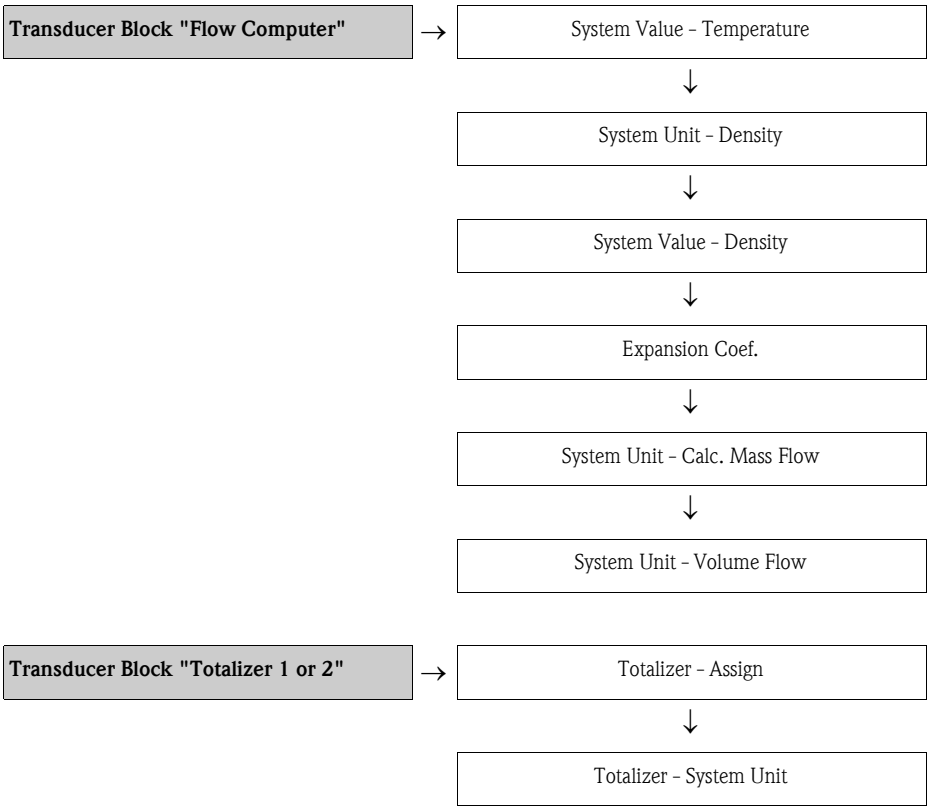


Configuration for fluid selection → Sup. Steam

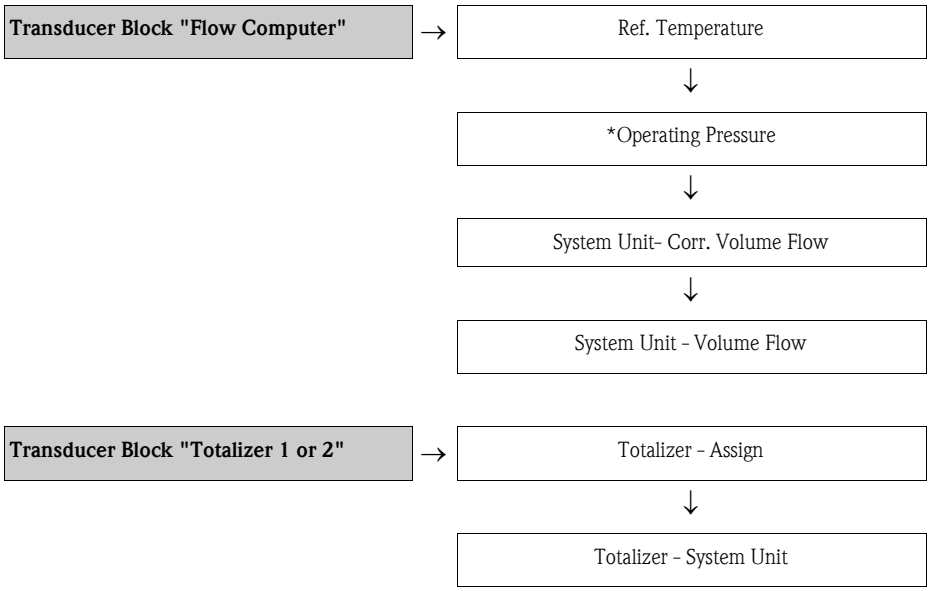


* The operating pressure can also be read in from a pressure measuring instrument via FOUNDATION Fieldbus interface (see Page 156 ff.).

Configuration for fluid selection → User Def. Liquid

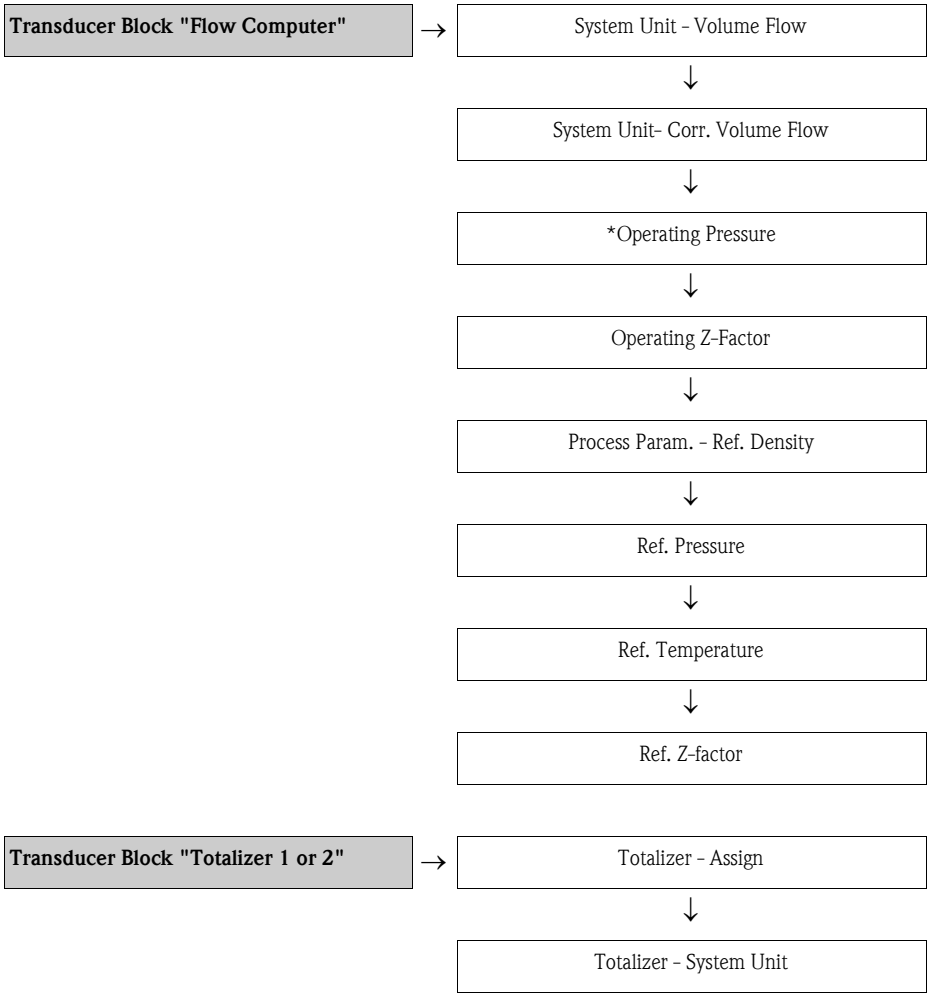


Configuration for fluid selection → Compressed Air



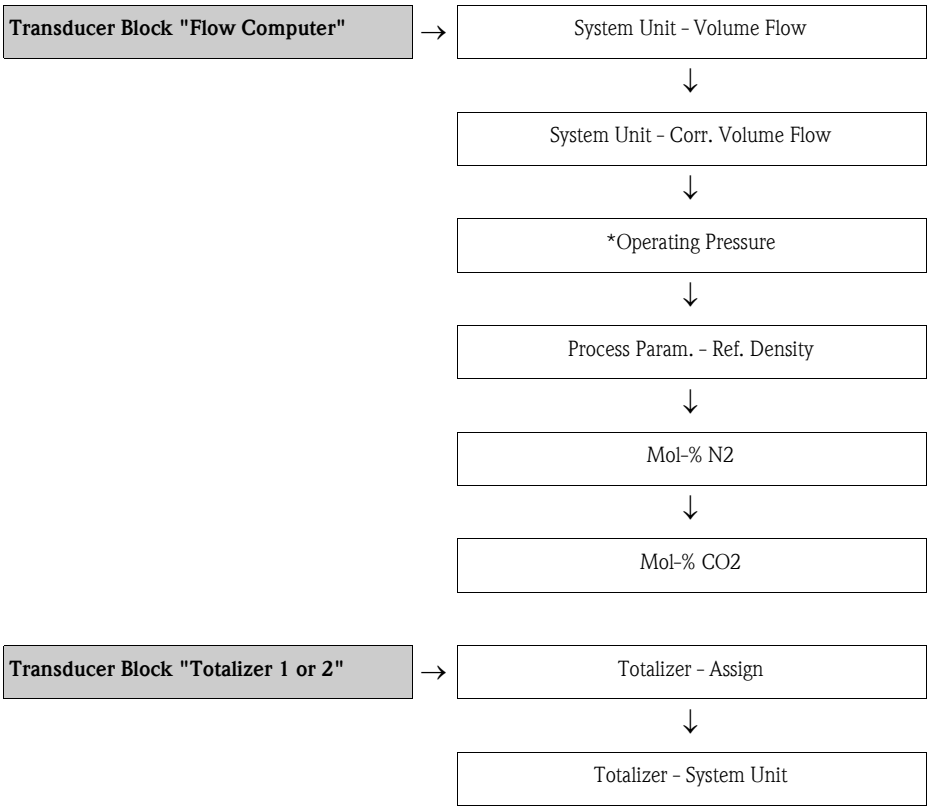
* The operating pressure can also be read in from a pressure measuring instrument via FOUNDATION Fieldbus interface (see Page 156 ff.).

Configuration for fluid selection → Real Gas



* The operating pressure can also be read in from a pressure measuring instrument via FOUNDATION Fieldbus interface (see Page 156 ff.).

Configuration for fluid selection → Nat. Gas NX-19



* The operating pressure can also be read in from a pressure measuring instrument via FOUNDATION Fieldbus interface (see Page 156 ff.).

✎ Note!
– Please note that device parameter modifications are only possible once a valid enabling code has been entered in the "Un-/Locking - Access Code" parameter.
– The system units selected in the Transducer Blocks do not have any effect on the desired units which should be transmitted by means of the FOUNDATION Fieldbus interface. This setting is made separately by means of the corresponding AI Block in the XD_SCALE parameter group (see following section → Configuration of the "Analog Input Function Blocks"). The unit selected in the Transducer Blocks is only used for the local display, low flow cut off and for simulation.

Configuring the "Analog Input Function Blocks"
Prowirl 73 has seven Analog Input Function Blocks which can be assigned to the different process variables as desired. The following section describes an example for the Analog Input Function Block (base index 1300).

13. Enter the required name for the Analog Input Function Block (optional). Factory setting: ANALOG_INPUT_1_ xxxxxxxxxxx

14. Open Analog Input Function Block 1.

15. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to OOS, i.e. the block is out of service.

16. Use the CHANNEL parameter to select the process variable which should be used as the input value for the function block algorithm (scaling and limit value monitoring functions). The following settings are possible:
    – CHANNEL = 1 → Calc. Mass Flow
    – CHANNEL = 2 → Volume Flow
    – CHANNEL = 3 → Corr. Volume Flow
    – CHANNEL = 6 → Temperature
    – CHANNEL = 7 → Totalizer 1
    – CHANNEL = 8 → Totalizer 2
    – CHANNEL = 23 → Flow Velocity
    – CHANNEL = 53 → Heat Flow
    – CHANNEL = 54 → Spec. Enthalpy
    – CHANNEL = 55 → Calc. Sat Pressure (calculated saturated steam pressure)
    – CHANNEL = 56 → Z-Factor (only available with the software option "Natural gas NX-19")
    – *CHANNEL = 57 → Reynolds Number
    – CHANNEL = 58 → Frequency (Vortex Frequency)
    – *CHANNEL = 59 → Elec. Temperature (Electronics Temperature)

    *Only available with the software option "Advanced diagnosis". If the software option is not enabled and if one of the two assignments have been made, the value NaN (not-a-number) is transmitted as the value for the process variable. For enabling see the "Activ. Adv. Diag" parameter in the Transducer Block "Adv. Diagnostic" (see Page 134).

    ✎ Note!
    The availability of the process variables depends on the fluid selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). For process variables that are not available for a certain option, the value NaN (not-a-number) is transmitted or displayed.

17. In the XD_SCALE parameter group, select the desired engineering unit, which should be transmitted by means of the FOUNDATION Fieldbus interface, as well as the block input range (measuring range of the flow application) for the process variable in question (see next example).

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

18. In the L_TYPE parameter, select the type of linearization for the input variable (direct, indirect, indirect sq. root) (see Page 86 ff.).

    ☝ Caution!
    Please note that if the "Direct" linearization type is selected, the settings in the OUT_SCALE parameter group are not taken into account. The engineering units selected in the XD_SCALE parameter group are decisive. XD_SCALE_UNIT is then displayed as the unit on the local display, in accordance with the process variable selected.

Example:
– The measurement range of the sensor is 0 to 30 m^3/h.
– The output range to the automation system should also be 0 to 30 m^3/h.

The following settings must be made:

– Analog Input Function Block / CHANNEL parameter (select input value), option 2 → Volume flow
– L_TYPE parameter → Direct
– XD_SCALE parameter group

XD_SCALE 0 % = 0

XD_SCALE 100 % = 30

XD_SCALE UNIT = m^3/h

19. 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 early warning alarm
– LO_LIM → Limit value for the lower early warning alarm
– 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.

20. In addition to the actual limit values, the behavior in the event of limit value overshoot must be specified by "alarm priorities" (HI_HI_PRI, HI_PRI, LO_PR, LO_LO_PRI parameters) (see Page 86 ff.). Reporting to the fieldbus host system only occurs if the alarm priority is greater than 2.

Configuring the "Discrete Output Function Block" (optional)

21. The Discrete Output Function Block allows various device functionalities (e.g. totalizer reset, positive zero return switch-on, switch-off) to be optionally triggered in the Transducer Blocks by means of the FOUNDATION Fieldbus interface.
Configuration see Page 154 ff.

Configuring the "Analog Output Function Block" (optional)

22. By means of the Analog Output Function Block, a value for the operating pressure can be read in continuously (cyclically) from a pressure measuring instrument (e.g. Cerabar S) via the FOUNDATION Fieldbus interface. The value for the operating pressure is used for continuous density calculation (see "Operating Pressure" parameter in the Transducer Block "Flow Computer" see Page 128).
Configuration see Page 156 ff.

System configuration / connecting function blocks (see Fig. 26):

23. A final "overall system configuration" is necessary so that the operating mode of the Analog Input Function Block can be set to AUTO and the field device is integrated in the system application.
    For this purpose, configuration software, e.g. 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.

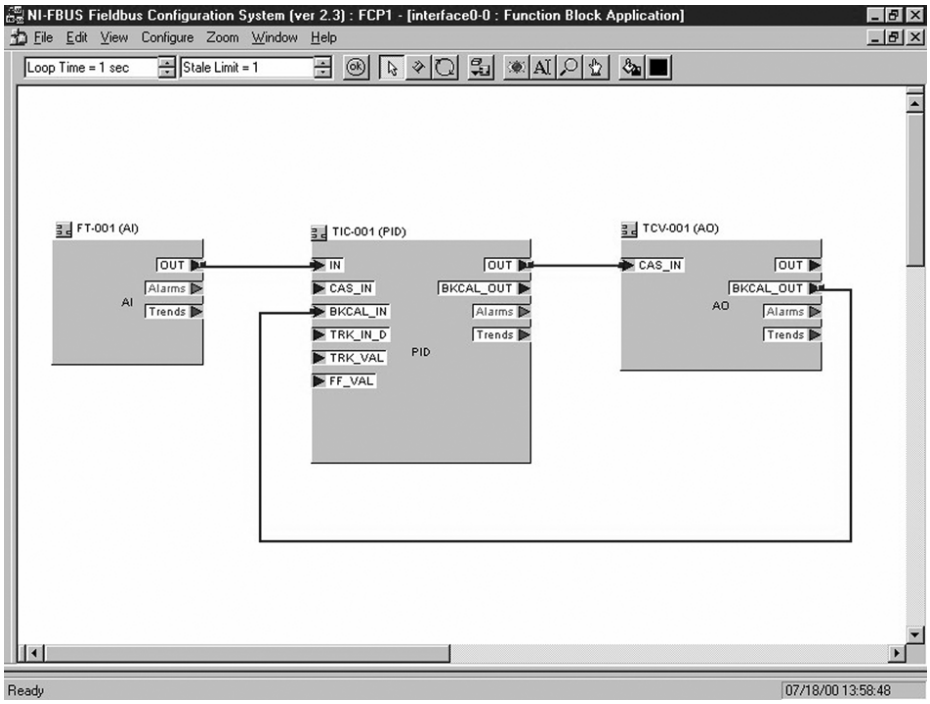


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Fig. 26: Connecting function blocks with the aid of the "NI-FBUS Configurator"

24. Once you have specified the active LAS, download all the data and parameters to the field device.

25. 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 to one another.
    – The Resource Block is in the AUTO operating mode.

7 Maintenance

The flow measuring system requires no special maintenance.

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.

Cleaning with pigs
Cleaning with pigs is **not** possible!

Replacing sensor seals
Under normal circumstances, wetted seals must not be replaced. Replacement is necessary only in special circumstances, for example if aggressive or corrosive fluids are incompatible with the seal material.

✎ Note!
- The time span between the individual replacements depends on the fluid properties.
- Replacement seals (accessory) see Page 48.
  Only sensor seals from Endress+Hauser can be used.

Replacing housing seals
The housing seals must be clean and undamaged when inserted into their grooves.
The seals must be dried, cleaned or replaced if necessary.

✎ Note!
If the measuring device is used in a dust atmosphere, only the associated housing seals from Endress+Hauser should be used.

8 Accessories

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

Accessory	Description	Order code
Transmitter Prowirl 73	Transmitter for replacement or for stock. Use the order code to define the following specifications: – Approvals – Degree of protection / version – Cable entry – Display / operation – Software – Outputs / inputs	73XXX – XXXXX ***** K
Mounting kit for Prowirl 73 W	Mounting kit for wafer version consisting of: – Threaded studs – Nuts incl. washers – Flange seals	DKW – **_****
Mounting kit for sensor	Mounting kit for remote version, suitable for pipe and wall mounting.	DK5WM – B
Conversion kits	Conversion kits: – Prowirl 72 to Prowirl 73 – Compact version to remote version (10 meters, 30 meters)	DK7UP – **
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.	RSG40 - **********
Flow conditioner	To reduce the inlet run after interference in the flow.	DK7ST – ***
Applicator	Software for selecting and planning flowmeters. The 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.	DXC10 – **
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser Web site: www.endress.com
Pressure transmitter Cerabar S	Cerabar S is used for measuring the absolute and gauge pressure of gases, steams and liquids. ✎ Note! To read in the pressure via FOUNDATION Fieldbus, only Cerabar S sensors for absolute pressure are suitable.	PMC71 – ********* PMP71 – *********

Accessory	Description	Order code
TMT 165 temperature transmitter	Universal two-channel field transmitter for resistance thermometers, thermocouples, resistance transmitters, voltage transmitters and differential measurement, can be configured via FOUNDATION Fieldbus protocol, PID controller, galvanic isolation.	TMT165 – ****AA

9 Troubleshooting

9. 1 Troubleshooting instructions

Always start troubleshooting with the checklists below if faults occur after startup or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

Caution!
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. In such cases, the procedures on Page 6 must be carried out before you return the measuring device to Endress+Hauser.
Always enclose a fully completed "Declaration of Contamination" form with the device. A copy of the form can be found at the end of these Operating Instructions.

Check display (local display)	
No display visible - No connection to the FF host system.	1. Check supply voltage → Terminal 1, 2 2. Electronics defective → Order spare part → Page 64
No display visible - However, connection has been established to the FF host system.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → Page 65 2. Display module defective → Order spare part → Page 64 3. Electronics defective → Order spare part → Page 64

▼

Error messages on display
Errors which occur during commissioning or measuring operation are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows (example): – *Type of error:* **S** = *system error,* **P** = *process error* – *Error message type:* ϟ = *fault message,* **!** = *notice message* – **DSC SENS LIMIT** = *error designation (device being operated near application limits)* – **03:00:05** = *duration of error occurrence (in hours / minutes /seconds)* – **#395** = error number Caution! Please refer also to the information on Page 32 ff.!
System error (device error) has occurred → Page 54
Process error (application error) has occurred → Page 61

▼

Faulty connection to the fieldbus host system	
No connection can be made between the fieldbus host system and the device. Check the following points:	
Fieldbus connection	Check data lines
Fieldbus connector (optional)	– *Check pin assignment / wiring → Page 24 ff.* – *Check connection between connector / fieldbus port.* Is the coupling ring tightened correctly?

Continued on next page

Faulty connection to fieldbus host system (contd.)	
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 → Page 21
Basic current	Is there a basic current of min. 16 mA?
Fieldbus address	Check bus address: make sure there are no double assignments!
Terminating resistors	Has the FOUNDATION Fieldbus network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in communication.
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 unit.

▼

System or process error messages
Error messages in the FOUNDATION Fieldbus configuration program → Page 53 ff. Error messages on the local display → Page 53 ff. Error messages are configured in the Transducer Block "Diagnosis".

▼

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 set to AUTO → MODE_BLK parameter group / TARGET parameter.
Analog Input Function Block: The operating mode cannot be set to AUTO.	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 set to AUTO. MODE_BLK parameter group / TARGET parameter. If not and the mode cannot be changed to AUTO, first check the following points. 2. Make sure that the CHANNEL parameter (select process variable) has already been configured in the Analog Input Function Block (see Page 43). The option CHANNEL = 0 (uninitialized) is not valid. 3. Make sure that the XD_SCALE parameter group (input range, unit) has already been configured in the Analog Input Function Block (see Page 43 ff.) (incl. configuration example) Caution! Make sure that the unit selected suits the process variable chosen in the CHANNEL parameter. Otherwise the BLOCK_ERROR parameter displays the "Block Configuration Error" error message. In this state, the operating mode cannot be set to AUTO. 4. Make sure that the L_TYPE parameter (linearization type) has already been configured in the Analog Input Function Block (see Page 43 ff.). 5. Check whether the operating mode of the Resource Block is set to AUTO. MODE_BLK parameter group / TARGET parameter 6. Make sure that the function blocks are correctly connected together and that this system configuration has been sent to the fieldbus users (see Page 46)
Analog Input Function Block: Although the operating mode is set to AUTO, the status of the AI output value OUT is "BAD" or "UNCERTAIN".	Check whether an error is pending in the Transducer Block "Diagnosis" → Transducer Block "Diagnosis" → "Diagnosis - Actual System Condition" parameter. Error messages → Page 53

– *Parameters cannot be changed or* – *No write access to parameters*	1. Parameters that only show values or settings cannot be changed! 2. The hardware write protection is enabled. Disable the write protection → Page 35 ✎ Note! You can check whether the hardware write protection is enabled or disabled via the WRITE_LOCK parameter in the Resource Block: LOCKED = write protection enabled UNLOCKED = 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) mode or the MAN (manual) mode → Set the operating mode of the block to the desired 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 "Un-/Locking - Access Code" parameter or by means of the Service Code in the Service parameters.
Transducer Block: The manufacturer-specific parameters are not visible.	The device description file (Device Description, DD) has not yet been loaded to the host system or the configuration program? Download the file to the configuration system. For information on where to obtain the DD see Page 34 ✎ Note! Make sure you are using the correct system files for integrating field devices into the host system. Relevant version information can be queried with Prowirl 73 by means of the following functions/parameters: FOUNDATION Fieldbus interface: – *Resource Block → DEV_REV parameter* – Resource Block → DD_REV parameter Example: Display in DEV_REV parameter → 01 Display in the DD_REV parameter → 01 Device description file (DD) required → 0101.sym / 0101.ffo
Analog Input Function Block: The output value OUT is not updated despite a valid "GOOD" status.	The simulation is active → Deactivate the simulation by means of the SIMULATE parameter group.

9. 2 System and process error messages

General notes
The measuring device always assigns system and process errors which occur to two types of error messages, resulting in different weightings.

"Fault message" error message type:
- If this message occurs, operation is immediately interrupted or stopped.
- Display on the FOUNDATION Fieldbus → Fault messages are relayed to downstream function blocks or higher-level process control systems with the status "BAD" of the AI output parameter OUT.
- Local display → A lightning symbol (ϟ) flashes on the display

"Notice message" error message type:
- Normal operation continues despite this message.
- Display on the FOUNDATION Fieldbus → Notice messages are relayed to downstream function blocks or higher-level process control systems with the status "UNCERTAIN" of the AI output parameter OUT.
- Local display → An exclamation mark (!) flashes on the display.

Serious system errors, e.g. electronic module defects, are always categorized and displayed as "Fault messages" by the measuring device. On the other hand, the measuring system interprets simulations of the measured value in the Transducer Block "Flow" and positive zero return as "Notice messages".

Error messages in FOUNDATION Fieldbus configuration program → See Table
In Prowirl 73, system/process errors are recognized and reported in the Transducer Block "Diagnosis". Such errors are displayed by means of the following parameters specified in the FOUNDATION Fieldbus Specification:
- BLOCK_ERR
- Transducer Error

In the Transducer Block "Diagnosis", detailed causes of error or device status messages are displayed via the "Diagnosis - Actual System Condition" parameter (manufacturer-specific) → Table.

Error messages on the local display → See Table
For detailed information on how the error messages are displayed, see → Page 54 ff..

9.2.1 List of system error messages

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
* With FOUNDATION Fieldbus, error messages are displayed in the "Diagnosis" Transducer Block (base index: 1100) by means of the "Diag. – Act.Sys.Condition" parameter (manufacturer-specific). S = System error ϟ = Fault message (with an effect on operation) ! = Notice message (without any effect on operation)					
001	*Device status message (FF):* Critical Failure – Err. No. 001 *Local display:* S: CRITICAL FAIL. ϟ: # 001	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* ROM/RAM error. Error when accessing the program memory (ROM) or random access memory (RAM) of the processor. *Remedy:* Replace the amplifier board.	All
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure		
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)		
11	*Device status message (FF):* Amplifier EEPROM failure - Err. No. 011 *Local display:* S AMP HW-EEPROM ϟ # 011	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* Faulty EEPROM *Remedy:* Replace the amplifier board. Spare parts → Page 64	All
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure		
12	*Device status message (FF):* Amplifier EEPROM data inconsistent – Err. No. 012 *Local display:* S AMP SW-EEPROM ϟ # 012	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* Error when accessing data of the amplifier EEPROM *Remedy:* Perform a warm start (= start the measuring system without disconnecting main power). ■ FF: Transducer Block "Diagnosis" (base index 1100) → "System - Reset" parameter → RESTART SYSTEM	All
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure		
21	*Device status message (FF):* COM module EEPROM failure – Err. No. 021 *Local display:* S COM HW-EEPROM ϟ # 021	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* COM module: faulty EEPROM *Remedy:* Replace COM module. Spare parts → Page 66	All
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure		
22	*Device status message (FF):* COM module EEPROM data inconsistent – Err. No. 022 *Local display:* S COM SW-EEPROM ϟ # 022	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* COM module: error when accessing data of the EEPROM *Remedy:* Contact your Endress+Hauser service organization.	All
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure		
111	*Device status message (FF):* Totalizer could not be restored at startup – Err. No. 111 *Local display:* S CHECKSUM TOT. ϟ # 111	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* Totalizer checksum error *Remedy:* Contact your Endress+Hauser service organization.	CHANNEL=7 (totaliz.1) CHANNEL=8 (totaliz.2)
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure		

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
261	*Device status message (FF):* Communication failure amplifier – Err. No. 261 *Local display:* S COMMUNIC. I/O ϟ # 261	BLOCK_ERR = Device needs maintenance now Transducer_Error = I/O Error (communication problems)	OUT. QUALITY = BAD OUT. SUBSTATUS = Device Failure	*Cause of error:* Communication error. No data reception between amplifier and I/O board or faulty internal data transfer. *Remedy:* Check whether the electronics boards are correctly inserted in their holders → Page 66, 68	All
310	*Device status message (FF):* DSC Temperature sensor defect – Err. No. 310 *Local display:* S PT DSC BROKEN ϟ # 310	Transducer_Error = Unspecific error	OUT. QUALITY = BAD OUT. SUBSTATUS = Non specific	*Cause of error:* The temperature sensor is defect. Temperature measurement is inaccurate and total temperature sensor failure (#316) should be expected. *Remedy:* Contact your Endress+Hauser service organization. ✎ Note! Where applicable, this error message indicates that the max. permitted flow velocity has been greatly exceeded.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
311	*Device status message (FF):* DSC Temperature sensor defect – Err. No. 311 *Local display:* S SHORT C. PT DSC ϟ # 311	Transducer_Error = Unspecific error	OUT. QUALITY = BAD OUT. SUBSTATUS = Non specific	*Cause of error:* The temperature sensor is defect. Temperature measurement is inaccurate and total temperature sensor failure (#316) should be expected. *Remedy:* Contact your Endress+Hauser service organization.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
312	*Device status message (FF):* DSC Temperature sensor defect – Err. No. 312 *Local display:* S PT DSC BROKEN ϟ # 312	Transducer_Error = Unspecific error	OUT. QUALITY = BAD OUT. SUBSTATUS = Non specific	*Cause of error:* The temperature sensor is defect. Temperature measurement is inaccurate and total temperature sensor failure (#316) should be expected. *Remedy:* Contact your Endress+Hauser service organization. ✎ Note! Where applicable, this error message indicates that the max. permitted flow velocity has been greatly exceeded.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
313	*Device status message (FF):* DSC Temperature sensor defect – Err. No. 313 *Local display:* S SHORT C. PT DSC ϟ # 313	Transducer_Error = Unspecific error	OUT. QUALITY = BAD OUT. SUBSTATUS = Non specific	*Cause of error:* The temperature sensor is defect. Temperature measurement is inaccurate and total temperature sensor failure (#316) should be expected. *Remedy:* Contact your Endress+Hauser service organization.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
314	*Device status message (FF):* Temperature Electronics defect – Err. No. 314 *Local display:* S PT EL. BROKEN ϟ # 314		OUT. QUALITY = UNCERTAIN	*Cause of error:* The temperature sensor is defect and temperature measurement is no longer possible. The measuring device uses the value specified in the "Error -> Temperature" parameter (Page 124). *Remedy:* Replace amplifier board: Spare parts → Page 64.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.)
315	*Device status message (FF):* Temperature Electronics defect – Err. No. 315 *Local display:* S SHORT C. PT EL ϟ # 315	Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
316	*Device status message (FF):* Sensor conversion not accurate – Err. No. 316 *Local display:* S NO T SENSOR ϟ # 316		OUT. QUALITY = BAD	*Cause of error:* The temperature sensor has failed or no temperature sensor is available. The measuring device uses the value specified in the "Error -> Temperature" parameter (Page 124). *Remedy:* Contact your Endress+Hauser service organization. ✎ Note! Where applicable, this error message indicates that the max. permitted flow velocity has been greatly exceeded.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Sensor Failure		

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
317	*Device status message (FF):* DSC Temperature sensor defect – Err. No. 317 *Local display:* S CHECK T-SENSOR ϟ # 317		OUT. QUALITY = BAD	*Cause of error:* The temperature sensor is defect. Temperature measurement is inaccurate and total temperature sensor failure (#316) should be expected. *Remedy:* Contact your Endress+Hauser service organization.	All except CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
318	*Device status message (FF):* sensor failure – Err. No. 318 *Local display:* S CHECK SENSOR ϟ # 318	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* The automatic monitoring of the device has discovered an error in the DSC sensor which can have an impact on the flow and temperature measurement. ✎ Note! The mass flow is calculated with the value entered in the "Error -> Temperature" parameter (Page 124) for the temperature. *Remedy:* Contact your Endress+Hauser service organization.	All except CHANNEL=6 (temperature) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
379	*Device status message (FF):* Device operated in resonance frequency – Err. No. 379 *Local display:* S RESONANCE DSC ϟ # 379		OUT. QUALITY = BAD	*Cause of error:* The device is being operated in the resonance frequency. ✎ Note! If the device is operated in the resonance frequency, this can result in damage which can lead to complete device failure. *Remedy* Reduce the flow.	All except CHANNEL=6 (temperature) CHANNEL=59 (electr. temp.)
		Transducer_Error = Mechanical component error	OUT. SUBSTATUS = Non specific		
381	*Device status message (FF):* Out of service – Err. No. 381 *Local display:* S FLUIDTEMP. MIN ϟ # 381		OUT. QUALITY = BAD	*Cause of error:* The limit value for the minimum fluid temperature allowed is undershot *Remedy:* Increase the fluid temperature	Not: CHANNEL=2 (volume flow) CHANNEL=23 (veloc.) CHANNEL=58 (vortex frequ.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
382	*Device status message (FF):* Out of service – Err. No. 382 *Local display:* S FLUIDTEMP. MAX ϟ # 382			*Cause of error:* The limit value for the maximum fluid temperature allowed is overshot *Remedy:* Reduce the fluid temperature.	

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
394	*Device status message (FF):* DSC sensor defect – Err. No. 394 *Local display:* S DSC SENS DEFCT ϟ # 394	BLOCK_ERR = Device needs maintenance now Transducer_Error = Mechanical component error	OUT. QUALITY = BAD OUT. SUBSTATUS = Sensor Failure	*Cause of error:* The DSC sensor is defective, measurement no longer takes place. *Remedy* Contact your Endress+Hauser service organization.	All except CHANNEL=6 (temperature) CHANNEL=59 (electr. temp.)
395	*Device status message (FF):* DSC sensor operated near applications limits – Err. No. 395 *Local display:* S DSC SENS LIMIT ϟ # 395	BLOCK_ERR = Other Transducer_Error = Unspecific error	OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Sensor Failure	*Cause of error:* The DSC sensor is being operated near application limits, device failure is probable soon. *Remedy* If this message persists, please contact your local Endress+Hauser service organization.	All except CHANNEL=6 (temperature) CHANNEL=59 (electr. temp.)
396	Device status message (FF): Signal outside the set filter range – Err. No. 396 *Local display:* S SIGNAL>LOW PASS ϟ # 396	BLOCK_ERR = Other Transducer_Error = Unspecific error	OUT. QUALITY = BAD OUT. SUBSTATUS = Non specific	*Cause of error:* The device finds the signal outside the set filter range. Possible causes: ■ The flow is outside the measuring range. ■ The signal is caused by a strong vibration which is intentionally not measured and is outside the measuring range. *Remedy:* ■ Check whether the device was installed in the flow direction. ■ Verify that the correct option was selected in the "Select Fluid" parameter in the Transducer Block "Flow Computer" (Page 119). ■ Check whether the operating conditions are within the specifications of the measuring device (e.g. flow is above measuring range which means that the flow may have to be reduced) If the checks do not solve the problem, please contact your E+H service organization.	All except CHANNEL=6 (temperature) CHANNEL=59 (electr. temp.)

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
397	*Device status message (FF):* sensor failure – Err. No. 397 *Local display:* S T ELECTR. MIN. ϟ # 397		OUT. QUALITY = BAD	*Cause of error:* The limit value for the minimum ambient temperature allowed is undershot. *Remedy* ■ Check whether the device was correctly insulated (see Page 13). ■ Check whether the transmitter is pointing upwards or to the side (see Page 13). ■ Increase the ambient temp.	CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Sensor Failure		
398	*Device status message (FF):* sensor failure – Err. No. 398 *Local display:* S T ELECTR. MAX. ϟ # 398		OUT. QUALITY = BAD	*Cause of error:* The limit value for the maximum ambient temperature allowed is overshot *Remedy* ■ Check whether the device was correctly insulated (see Page 13). ■ Check whether the transmitter is pointing downwards or to the side (see Page 12). ■ Reduce the ambient temperature.	CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Sensor Failure		
399	Device status message (FF): Pre-amplifier disconnected – Err. No. 399 *Local display:* S PREAMP. DISCONN. ϟ # 399	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause of error:* Pre-amplifier disconnected. *Remedy:* Check the connection between the preamplifier and amplifier board and establish connection if necessary.	CHANNEL=59 (electr. temp.)
		Transducer_Error = Electronics component error	OUT. SUBSTATUS = Device Failure		
501	Device status message (FF): Download device software active – Err. No. 501 *Local display:* S SW UPDATE ACT.. ! # 501		OUT. QUALITY = UNCERTAIN	*Cause of error:* New amplifier software version or data being loaded into device. No other commands can be executed. *Remedy:* Wait until the procedure is complete. The device is automatically restarted.	All
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
502	*Device status message (FF):* Up-/ Download active – Err. No. 502 *Local display:* S UP./DOWNLOAD ACT. ! # 502		OUT. QUALITY = UNCERTAIN	*Cause of error:* Device data are being uploaded. No other commands can be executed. *Remedy:* Wait until the procedure is complete.	All
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
516	*Device status message (FF):* No Data Totalizer 1 – Err. No. 516 *Local display:* S NO DATA - ϟ ->TOT.1 ϟ # 516		OUT. QUALITY = UNCERTAIN	*Cause of error:* Totalizer 1 does not receive any valid data. *Remedy* Check the option selected in the "Totalizer- Assign" parameter in the Transducer Block "Totalizer 1"	CHANNEL=7 (totaliz.1)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
517	*Device status message (FF):* No Data Totalizer 2 – Err. No. 517 *Local display:* S NO DATA - ϟ ->TOT.2 ϟ # 517		OUT. QUALITY = UNCERTAIN	*Cause of error:* Totalizer 2 does not receive any valid data. *Remedy* Check the option selected in the "Totalizer- Assign" parameter in the Transducer Block "Totalizer 2"	CHANNEL=2 (totaliz.2)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
601	*Device status message (FF):* Positive zero return active – Err. No. 601 *Local display:* S POS. ZERO-RET. ! # 601		OUT. QUALITY = UNCERTAIN	*Cause:* Positive zero return is active. ✎ Note! This message has the highest display priority. *Remedy:* Switch off positive zero return: ■ FF: Transducer Block "Flow" (base index 500) → "System - Positive Zero Return" parameter → OFF	All except CHANNEL=6 (temperature) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
691	*Device status message (FF):* Simulation Failsafe active – Err. No. 691 *Local display:* S SIM. FAILSAFE ! # 691	BLOCK_ERR = Simulation active	OUT. QUALITY = BAD	*Cause:* Simulation of failsafe mode (totalizer) active. *Remedy:* Switch off simulation: ■ FF: Transducer Block "Diagnosis" (base index 1100) → "System - Simulation Failsafe Mode" parameter → OFF	All
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
692	*Device status message (FF):* Simulation measurand active – Err. No. 692 *Local display:* S SIM. MEASURAND ! # 692	BLOCK_ERR = Simulation active	OUT. QUALITY = UNCERTAIN	*Cause:* Simulation is active *Remedy:* Switch off simulation: ■ FF: Transducer Block "Flow" (base index 500) → "Simulation -Measurand" parameter → OFF	All
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
698	*Device status message (FF):* Device test active – Err. No. 698 *Local display:* S DEV. TEST ACT. ! # 698		OUT. QUALITY = UNCERTAIN	*Cause:* The device is tested on site by the "Fieldcheck" tester and simulator. *Remedy:* Remove "Fieldcheck" device.	All
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		

9.2.2 List of process error messages

No.	Error messages: – *FOUNDATION Fieldbus (FF) ** – *Local display*	Error messages in the Transducer Block "Diagnosis"	Analog Input funct. block error messages	Cause of error / remedy	Output variables affected
* With FOUNDATION Fieldbus, error messages are displayed in the "Diagnosis" Transducer Block (base index: 1600) by means of the "Diag. – Act.Sys.Condition" parameter (manufacturer-specific). P = Process error ϟ = Fault message (with an effect on operation) ! = Notice message (without any effect on operation)					
412	*Device status message (FF):* Out of service – Err. No. 412 *Local display:* P P, T -> NO DATA - ϟ ϟ # 412		OUT. QUALITY = UNCERTAIN	*Cause of error:* No data are stored in the device for the combination of current values for the medium pressure and fluid temperature. *Remedy* Check: ■ Whether the correct fluid was selected in the "Select Fluid" parameter (see P. 119). ■ Whether the correct pressure was entered in the "Operating Pressure" parameter (P. 128).	All except CHANNEL=2 (volume flow) CHANNEL=6 (temperature) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
421	*Device status message (FF):* Sensor failure – Err. No. 421 *Local display:* P FLOW RANGE ϟ # 421		OUT. QUALITY = UNCERTAIN	*Cause of error:* The current flow velocity overshoots the value permitted for the device. Flow monitoring is active in the "Reynolds - Warning" parameter (P. 140). *Remedy* Reduce the flow.	All except CHANNEL=6 (temperature) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		
494	*Device status message (FF):* Sensor failure – Err. No. 494 *Local display:* P REYNOLDS<20000 ϟ # 494		OUT. QUALITY = UNCERTAIN	*Cause of error:* The Reynolds number of 20000 is undershot. The accuracy is reduced if the Reynolds number <20000. *Remedy* Increase the flow.	All except CHANNEL=6 (temperature) CHANNEL=58 (vortex frequ.) CHANNEL=59 (electr. temp.)
		Transducer_Error = Unspecific error	OUT. SUBSTATUS = Non specific		

9. 3 Process errors without messages

Symptoms	Remedial measures
Remark: You may have to change or correct settings in certain functions of the function matrix in order to rectify faults. The functions listed below are described in detail in the "Operation via FOUNDATION Fieldbus" section on Page 91 ff.	
No flow signal	■ For liquids: Check whether the piping is completely filled. The piping must always be completely filled for accurate and reliable flow measurement. ■ Check whether all the packaging material, including the meter body protective covers, was completely removed before mounting the device. ■ Check whether the desired electrical output signal was connected correctly.
Flow signal even though there is no flow	Check whether the device is exposed to particularly strong vibrations. If so, a flow can be displayed even if the fluid is at a standstill, depending on the frequency and direction of the vibration. Remedial measures at the device: ■ Turn the sensor 90° (please observe the installation conditions when doing so, see Page 11 ff.). The measuring system is most sensitive to vibrations which follow in the direction of the sensor. Vibrations have less of an effect on the device in the other axes. ■ In the Transducer Block "Flow" → "Sensor Data - Amplification" parameter, change the amplification → Page 111. Remedy through constructive measures during installation: ■ If the source of the vibration (e.g. pump or a valve) has been identified, the vibrations can be reduced by decoupling or supporting the source. ■ Support the piping near the device. If these measures do not solve the problem, your Endress+Hauser service organization can adjust the filters of the device to suit your special application.
Faulty or highly-fluctuating flow signal	■ The fluid is not sufficiently single-phase or homogeneous. The piping must always be completely filled and the fluid must be single-phase and homogeneous for accurate and reliable flow measurement. ■ In many instances, the following measures can be taken to improve the measurement result even under non-ideal conditions: – For liquids with a low gas content in horizontal pipework, it helps to install the device with the head pointing downwards or to the side. This improves the measuring signal since the sensor is not in the area where gas accumulates when this type of installation is used. – For liquids with a low solids content, avoid installing the device with the electronics housing pointing downwards. – For steam or gases with a low liquid content, avoid installing the device with the electronics housing pointing downwards. ■ The inlet and outlet runs must be present as per the installation instructions (see Page 14). ■ Suitable seals with an internal diameter not smaller than the pipe internal diameter must be installed and correctly centered. ■ The static pressure must be large enough to rule out cavitation in the area of the sensor. ■ Check whether the right fluid has been selected in the "Select Fluid" parameter in the "Flow Computer" Transducer Block → Page 119. The setting in this function determines the filter settings and can thus affect the measuring range. ■ Check whether the data for the K-factor on the nameplate match the data in the Transducer Block "Flow" → "Sensor Data - K-Factor" parameter (see Page 109). Continued on next page

Symptoms	Remedial measures
Faulty or highly fluctuating flow signal (contd.)	■ Check whether the right fluid has been selected in the "Select Fluid" parameter in the "Flow Computer" Transducer Block → Page 119. The setting in this function determines the filter settings and can thus affect the measuring range. ■ Check whether the data for the K-factor on the nameplate match the data in the Transducer Block "Flow" → "Sensor Data - K-Factor" parameter (see Page 109). ■ Check whether the device is correctly installed in the flow direction. ■ Verify that the nominal diameter of the mating pipe and the device match (Transducer Block "Flow" → "Process Param. - Mating Pipe Diameter" parameter → Page 105). ■ The flow must be in the measuring range of the device (see Page 70 "measuring range"). The start of measuring range depends on the density and the viscosity of the fluid. Density and viscosity depend on temperature. Density also depends on the process pressure in the case of gases. ■ Check whether the operating pressure is affected by pressure pulsations (e.g. from piston pumps). The pulsations can affect vortex shedding if they have a frequency similar to the vortex frequency. ■ Check whether the correct engineering unit was selected for the flow or totalizer.
The fault cannot be rectified or some other fault not described above has occurred. In these instances, please contact your Endress+Hauser service organization.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service organization to have a service technician sent out, please be ready with the following information: – *A brief description of the error with information on the application.* – Nameplate specifications (Page 7 ff.): order code and serial number **Return devices to Endress+Hauser** The procedures on Page 6 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 form can be found at the end of these Operating Instructions. **Replace transmitter electronics** Components in the electronics defective → Order spare part → Page 64

9. 4 Spare parts

Section 9. 1 contains detailed troubleshooting instructions (see Page 50).
The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.
Trouble-shooting can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your Endress+Hauser service organization by quoting the serial number printed on the transmitter nameplate (see Page 7).

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

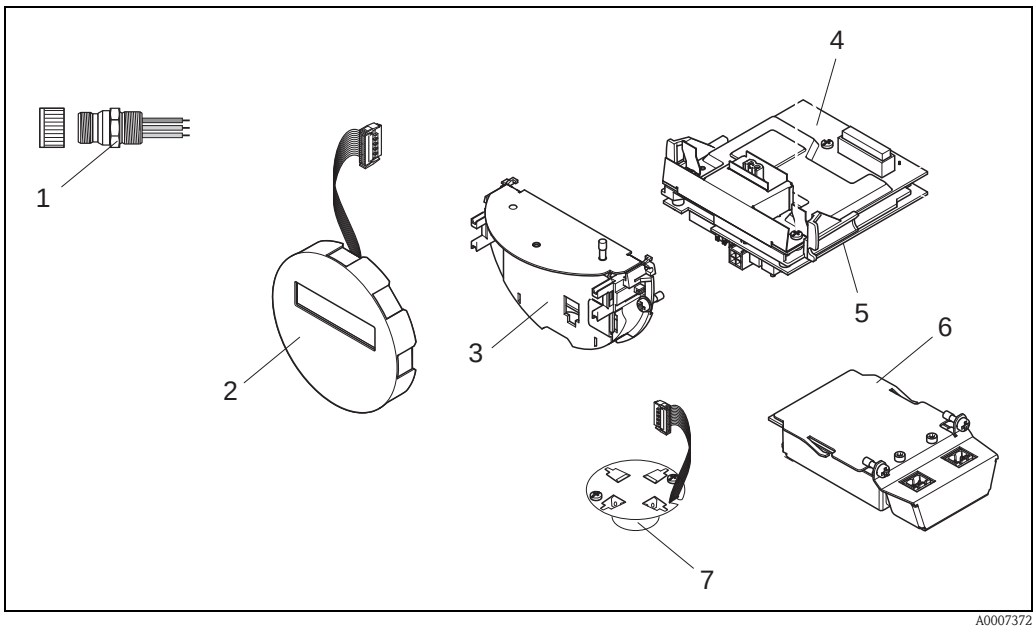

Fig. 27: Spare parts for Proline Prowirl 73 FOUNDATION Fieldbus transmitter (field and wall-mount housing)

1 Fieldbus connector
2 Local display module
3 Board holder
4 I/O board (COM module); Non-Ex, Ex i/IS and Ex n version
5 Amplifier board
6 I/O board (COM module); Ex d/XP version
7 Pre-amplifier

9. 5 Installing and removing electronics boards

9.5.1 Non-Ex, Ex i/IS and Ex n version

Note!
- When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

- 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!

Caution!
Use only genuine Endress+Hauser parts.

Procedure when installing/removing electronics boards (see Fig. 28)

1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.
2. Remove the display module (b) from the retaining rails (c).
3. Fit the display module (b) with the left side onto the right retaining rail (c) (this secures the local display module).
4. Loosen the fixing screw (d) of the cover of the connection compartment (e) and fold down the cover.
5. Pull terminal connector (f) out of the I/O board (COM module) (q).
6. Fold up the plastic cover (g).
7. Remove the signal cable connector (h) from the amplifier board (s) and release from the cable holder (i).
8. Remove the ribbon cable connector (j) from the amplifier board (s) and release from the cable holder (k).
9. Remove the local display module (b) from the right retaining rail (c).
10. Fold down the plastic cover (g) again.
11. Release both fixing screws (l) of the board holder (m).
12. Pull the board holder (m) out completely.
13. Press the side latches (n) of the board holder and separate the board holder (m) from the board body (o).

14. Replace the I/O board (COM module) (q):
    – Loosen the three fixing screws (p) of the I/O board (COM module).
    – Remove the I/O board (COM module) (q) from the board body (o).
    – Set a new I/O board (COM module) on the board body.
15. Replace the amplifier board (s):
    – Loosen fixing screws (r) of the amplifier board.
    – Remove the amplifier board (s) from the board body (o).
    – Set a new amplifier board on the board body.
16. Installation is the reverse of the removal procedure.

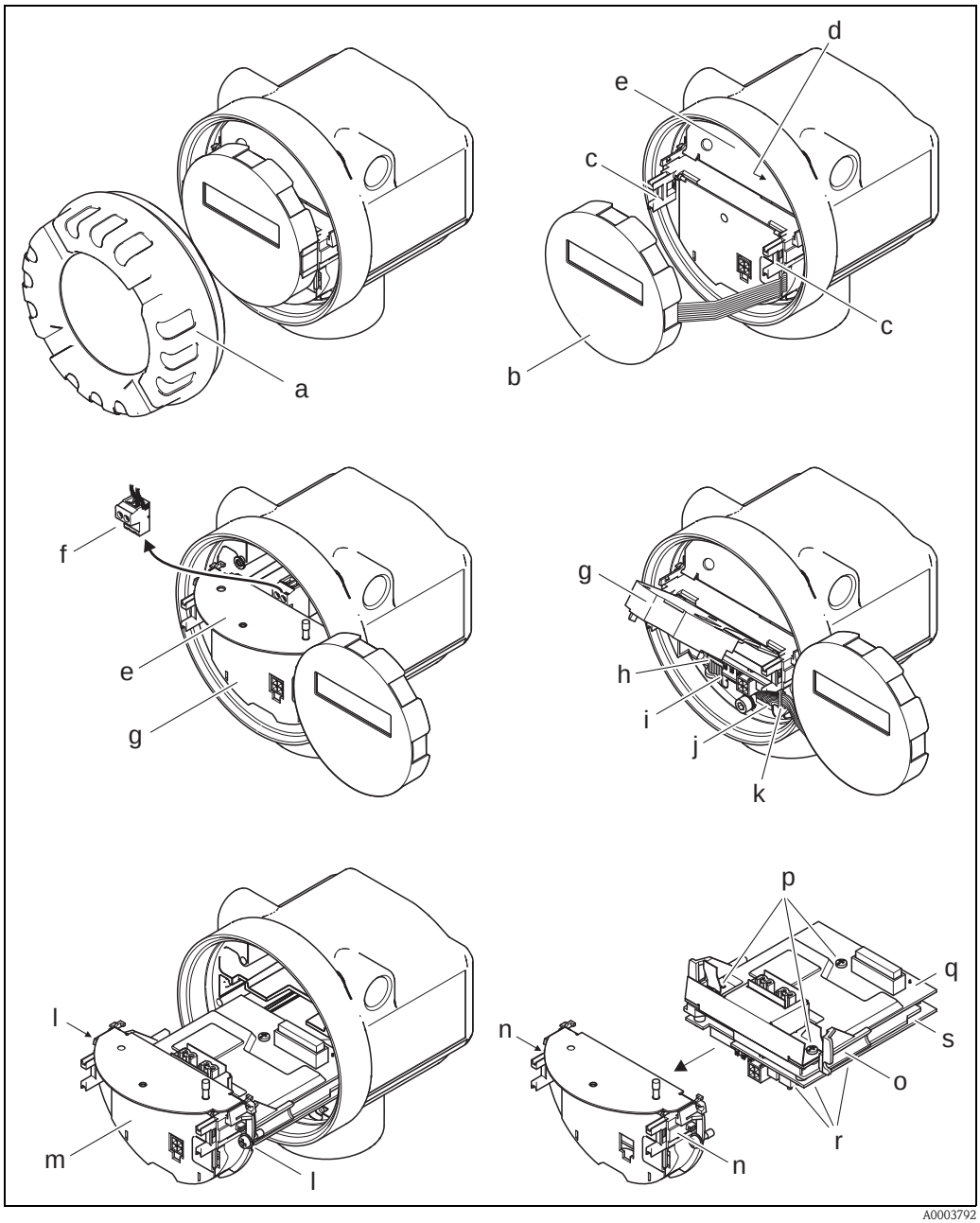

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Fig. 28: Installing and removing electronics boards, Non-Ex, Ex i/IS and Ex n version

a Cover of electronics compartment
b Display module
c Display module retaining rails
d Fixing screw for cover of connection compartment
e Connection compartment cover
f Terminal connector
g Plastic cover
h Signal cable connector
i Retainer for signal cable connector
j Display module ribbon-cable connector
k Retainer for ribbon-cable connector
l Fixing screws for board holder
m Board holder
n Board holder latches
o Board body
p Fixing screws for I/O board (COM module)
q I/O board (COM module)
r Fixing screws for amplifier board
s Amplifier board

9.5.2 Ex d/XP version

Note!
- When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

- 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!

Caution!
Use only genuine Endress+Hauser parts.

Procedure when installing/removing electronics boards (see Fig. 29)

Installing/removing I/O board (COM module)

1. Release the securing clamp (a) of the connection compartment cover (b).
2. Remove connection compartment cover (b) from the transmitter housing.
3. Pull the terminal connector (c) out of the I/O board (COM module) (e).
4. Release fixing screws (d) of the I/O board (COM module) (e) and pull the board out slightly.
5. Remove connecting cable plug (f) from the I/O board (COM module) (e) and remove the board completely.
6. Installation is the reverse of the removal procedure.

Installing and removing the amplifier board

1. Unscrew the cover (g) of the electronics compartment from the transmitter housing.
2. Remove the display module (h) from the retaining rails (i).
3. Fold up the plastic cover (j).
4. Remove the ribbon-cable connector of the local display module (h) from the amplifier board (t) and release from the cable holder.
5. Remove the signal cable connector (k) from the amplifier board (t) and release from the cable holder.
6. Release the fixing screw (l) and fold down the cover (m).
7. Release both fixing screws (n) of the board holder (o).
8. Pull the board holder (o) out slightly and disconnect the connecting cable plug (p) from the board body.
9. Pull the board holder (o) out completely.
10. Press the side latches (q) of the board holder and separate the board holder (o) from the board body (r).
11. Replace the amplifier board (t):
    – Loosen fixing screws (s) of the amplifier board.
    – Remove the amplifier board (t) from the board body (r).
    – Set a new amplifier board on the board body.
12. Installation is the reverse of the removal procedure.

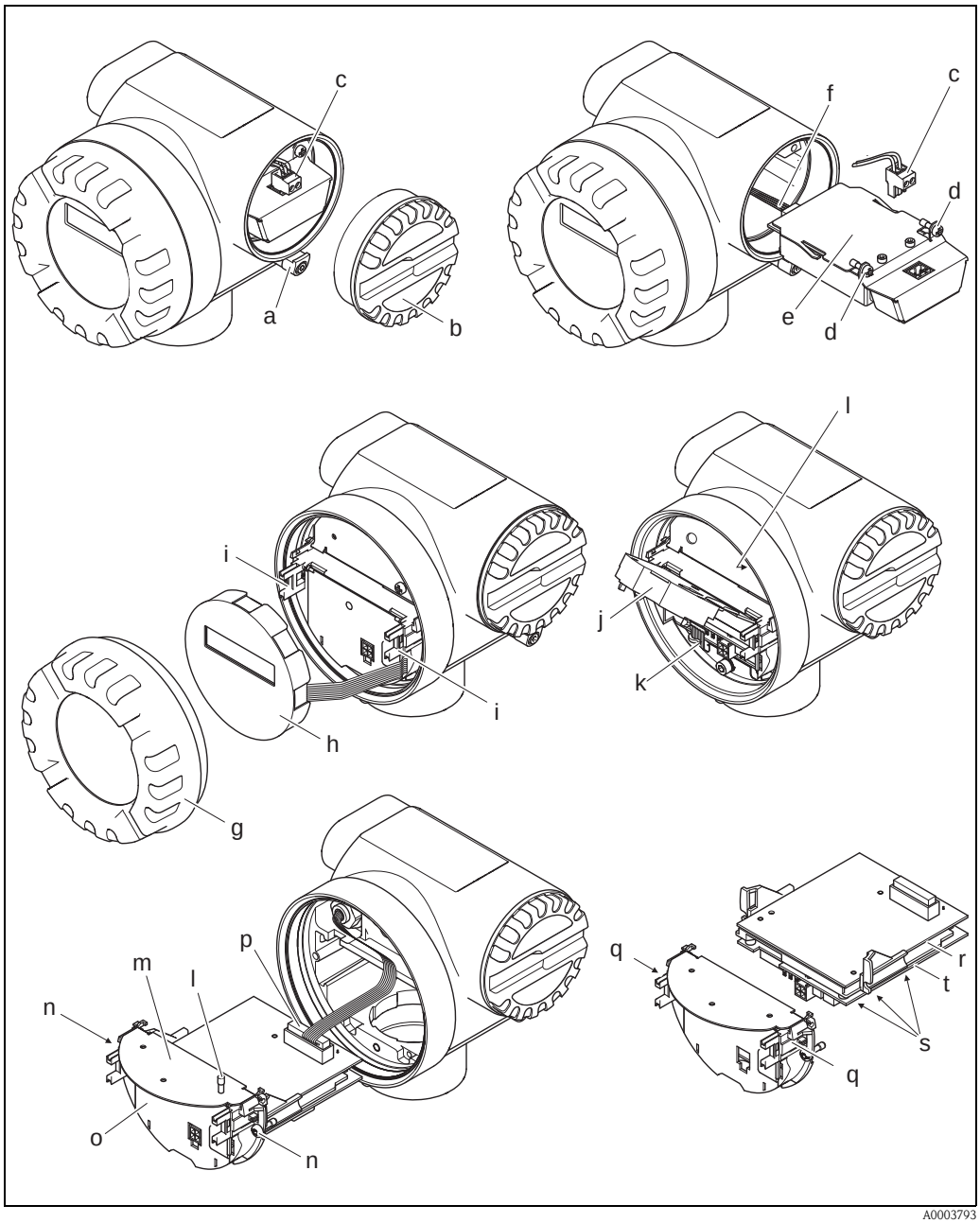

Fig. 29: Installing and removing electronics boards, Ex-d version

a Securing clamp for connection compartment cover
b Connection compartment cover
c Terminal connector
d Fixing screws I/O board (COM module)
e I/O board (COM module)
f I/O module connecting cable plug
g Cover of electronics compartment
h Local display module
i Retaining rails of local display module
j Plastic cover
k Signal cable connector
l Fixing screw for cover of connection compartment
m Connection compartment cover
n Fixing screws for board holder
o Board holder
p Connecting cable plug
q Board holder latches
r Board body
s Fixing screws for amplifier board
t Amplifier board

9. 6 Software history

Date	Software version	Software modifications	Documentation
06.2004	Communication module: V 1.00.00	Original software	71041643/01.07 50107509/06.04
03.2004	Amplifier: V 1.01.03	Supplement: ■ Support of the Prowirl 72, 73 FOUNDATION Fieldbus communication module. Compatible with: ■ ToF Tool – Fieldtool Package (the latest SW version can be downloaded under: www.tof-fieldtool.endress.com)	

10 Technical data

10. 1 Technical data at a glance

10.1.1 Application

The measuring system is used to measure the volume flow of saturated steam, superheated steam, gases and liquids. If the process pressure and process temperature are constant, the measuring device can also output the flow as the calculated mass flow and corrected volume flow.

10.1.2 Function and system design

Measuring principle

Vortex flow measurement on the principle of the Karman vortex street.

Measuring system

The measuring system consists of a transmitter and a sensor:
- Prowirl 73 FOUNDATION Fieldbus transmitter
- Prowirl F or W sensor

Two versions are available:
- Compact version: Transmitter and sensor form a single mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

10.1.3 Input

Measured variable

Volumetric flow (volume flow) is proportional to the frequency of vortex shedding after the bluff body.

Volume flow can be output as the output variable, as can the calculated mass flow or corrected volume flow if process conditions are constant.

Measuring range

The measuring range depends on the fluid and the pipe diameter.

Start of measuring range
Depends on the density and the Reynolds number ($Re_{min} = 4000$, $Re_{linear} = 20\,000$). The Reynolds number is dimensionless and indicates the ratio of a fluid's inertial forces to its viscous forces. It is used to characterize the flow. The Reynolds number is calculated as follows:

$$Re = \frac{4 \cdot Q\ [m^3/s] \cdot \rho\ [kg/m^3]}{\pi \cdot di\ [m] \cdot \mu\ [Pa \cdot s]} \qquad Re = \frac{4 \cdot Q\ [ft^3/s] \cdot \rho\ [lb/ft^3]}{\pi \cdot di\ [ft] \cdot \mu\ [0.001\ cP]}$$

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Re = Reynolds number
Q = Flow
di = Internal diameter
μ = Dynamic viscosity
ρ = Density

$$\text{DN } 15\ldots25 \rightarrow v_{min.}{}^* = \frac{6}{\sqrt{\rho\ [kg/m^3]}}\ [m/s] \qquad \text{DN } 40\ldots300 \rightarrow v_{min.}{}^* = \frac{7}{\sqrt{\rho\ [kg/m^3]}}\ [m/s]$$

$$½\ldots1" \rightarrow v_{min.}{}^* = \frac{4.92}{\sqrt{\rho\ [lb/ft^3]}}\ [ft/s] \qquad 1½\ldots12" \rightarrow v_{min.}{}^* = \frac{5.74}{\sqrt{\rho\ [lb/ft^3]}}\ [ft/s]$$

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Full scale value
Liquids: v_{max} = 9 m/s (30 ft/s)
Gas/steam: see Table

Nominal diameter	v_{max}
Standard instrument: DN 15 (½") R-type: DN 25 (1") > DN 15 (½") S-type: DN 40 (1½") >> DN 15 (½")	46 m/s (151 ft/s) or Mach 0.3 (depending on which is smaller)
Standard instrument: DN 25 (1"), DN 40 (1½") R-type: – DN 40 (1½") > DN 25 (1") – DN 50 (2") > DN 40 (1½") S-type: – DN 80 (3") >> DN 40 (1½")	75 m/s (246 ft/s) or Mach 0.3 (depending on which is smaller)
Standard instrument: DN 50 (2") to 300 (12") R-type: – DN 80 (3") > DN 50 (2") – Nominal diameters larger than DN 80 (3") S-type: – DN 100 (4") >> DN 50 (2") – Nominal diameters larger than DN 100 (4")	120 m/s (394 ft/s) or Mach 0.3 (depending on which is smaller) Calibrated range: up to 75 m/s (246 ft/s)

Note!
By using the selection and planning program "Applicator", you can determine the exact values for the fluid you use. You can obtain the Applicator from your Endress+Hauser sales center or on the Internet under www.endress.com.

K-factor range
The table is used for orientation purposes. The range in which the K-factor can be is indicated for individual nominal diameters and designs.

Nominal diameter		K-factor range [pulse/dm³]	
DIN	ANSI	73 F	73 W
DN 15	½"	390 to 450	245 to 280
DN 25	1"	70 to 85	48 to 55
DN 40	1½"	18 to 22	14 to 17
DN 50	2"	8 to 11	6 to 8
DN 80	3"	2.5 to 3.2	1.9 to 2.4
DN 100	4"	1.1 to 1.4	0.9 to 1.1
DN 150	6"	0.3 to 0.4	0.27 to 0.32
DN 200	8"	0.1266 to 0.1400	–
DN 250	10"	0.0677 to 0.0748	–
DN 300	12"	0.0364 to 0.0402	–

10.1.4 FOUNDATION Fieldbus output

Output signal	Physical data transfer (Physical Layer Type): ■ Fieldbus interface in accordance with IEC 61158-2 (MBP) ■ With integrated reverse polarity protection
Signal on alarm	Status message in accordance with Specification of the FOUNDATION Fieldbus
Starting current	Smaller than the basic current
Basic current	16 mA

Error current	0 mA
Permissible fieldbus feed voltage	9 to 32 V
Data transmission rate	31.25 kBit/s, voltage mode
Signal coding	Manchester II
Bus times	Min. rest between two telegrams: MIN_INTER_PDU_DELAY = 6 octet time (transmission time per octet)

Block information, execution times

Block	Base index	Execution time [ms]
Resource Block	400	–
Transducer Block "Flow"	500	–
Transducer Block "Totalizer 1"	600	–
Transducer Block "Totalizer 2"	700	–
Transducer Block "Flow Computer"	800	–
Transducer Block "Adv. Diagnostic"	900	–
Transducer Block "Display"	1000	–
Transducer Block "Diagnosis"	1100	–
Transducer Block "Service"	1200	–
Analog Input Function Block 1 to 7	1300, 1400, to 1900	50
Analog Output Function Block	2000	50
Discrete Output Function Block	2100	50

Output data

Transducer Blocks / Analog Input Function Blocks

Block	Process variable	Channel parameter (AI Block)
Transducer Block " Flow"	Mass Flow	1
	Volume Flow	2
	Corr. Volume Flow	3
	Temperature	6
Transducer Block "Totalizer 1"	Totalizer 1	7
Transducer Block "Totalizer 2"	Totalizer 2	8
Transducer Block "Flow Computer"	Flow Velocity	23
	Heat Flow	53
	Spec. Enthalpy	54
	Calc. Sat. Pressure (calculated steam pressure, saturated steam)	55
	Z Factor	56
	Frequency (Vortex Frequency)	58
Transducer Block "Advanced Diagnostic"	Reynolds Number	57
	Elec. Temperature (Electronics Temperature)	59

Input data

Discrete Output Function Block

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 totalizers 1 + 2
Discrete state 0	→	Discrete state 8	Reset totalizer 1
Discrete state 0	→	Discrete state 9	Reset totalizer 2
Discrete state 0	→	Discrete state 25	System/process error messages* are not displayed and evaluated (application e.g. for rinsing the pipework)
Discrete state 0	→	Discrete state 26	System/process error messages* are displayed and evaluated

* Affects the following system/process error messages (Page 53 ff.):
- System error message: # 381, 382, 396, 515, 516, 517, 601
- Process error message: # 412, 421, 494

Analog Output Function Block
Default value for operating pressure for continuous density calculation see Page 156 ff.

LM function

LM function is supported.

10.1.5 Power supply

Electrical connection

see Page 20 ff.

Supply voltage

9 to 32 V DC

Cable entry

Power supply cable/field cable (outputs):
- Cable entry: M20 x 1.5 (6 to 12 mm / 0.24 to 0.47 inch)
- Thread for cable entry: ½" NPT, G ½", G ½" Shimada

Cable specifications, remote version

- Permitted temperature range:
  between –40 °C (–40 °F) and the max. permissible ambient temperature plus 10 °C (plus 18 °F)
- Remote version see Page 23

Power supply failure

- The totalizer stays at the value last determined.
- All settings are kept in the EEPROM.
- Error messages (incl. value of operated hours counter) are stored.

10.1.6 Performance characteristics

Reference operating conditions

Error limits following ISO/DIN 11631:
- 20 to 30 °C
- 2 to 4 bar
- Calibration rig traced to national standards.
- Calibration with the process connection corresponding to the particular standard.

Maximum measured error

- Liquid (volume flow):
  <0.75% o.r. for Re > 20 000
  <0.75% o.f.s for Re between 4000 and 20 000
- Gas/steam (volume flow):
  <1% o.r. for Re > 20 000 and v < 75 m/s (246 ft/s)
  <1% o.f.s for Re between 4000 and 20 000
- Temperature:
  <1 °C (T > 100 °C, saturated steam);
  Rise time 50% (agitated under water, following IEC 60751): 8 s
- Mass flow (saturated steam):
  – For flow velocity v = 20 to 50 m/s (66 to 164 ft/s), T>150 °C/302° F (423 K)
    <1.7% o.r. (2% o.r. for remote version) for Re > 20 000
    <1.7% o.f.s (2% o.f.s for remote version) for Re between 4000 and 20 000
  – For flow velocity v = 10 to 70 m/s (33 to 230 ft/s), T>140 °C/284° F (413 K)
    <2% o.r. (2.3% o.r. for remote version) for Re > 20 000
    <2% o.f.s (2.3% o.f.s for remote version) for Re between 4000 and 20 000
- Mass flow (other fluids)
  Depends on the pressure value specified in the "Operating Pressure" parameter (Page 128).
  Individual error observation must be carried out.

o.r. = of measured value, o.f.s = of full scale value, Re = Reynolds number

Diameter jump correction

Prowirl 73 can correct shifts in the calibration factor which are caused by a jump in the diameter between the device flange and the mating pipe. The diameter jump should only be corrected within the following limit values (for which test measurements have also been performed).

Flange connection:
DN 15 (½"): ±20% of the internal diameter
DN 25 (1"): ±15% of the internal diameter
DN 40 (1½"): ±12% of the internal diameter
DN ≥ 50 (2"): ±10% of the internal diameter

Wafer:
DN 15 (½"): ±15% of the internal diameter
DN 25 (1"): ±12% of the internal diameter
DN 40 (1½"): ±9% of the internal diameter
DN ≥ 50 (2"): ±8% of the internal diameter

Repeatability

±0.25% o.r. (of measured value)

Reaction time/step response time

If all the configurable functions are set to 0, you must reckon with a reaction time/step response time of 200 ms for vortex frequencies of 10 Hz and higher.
For other settings where vortex frequencies are 10 Hz and higher, a reaction time/step response time of 100 ms has to be added to the overall filter reaction time.

- System Param. - Flow Damping see Page 109
- Display - Damping see Page 145
- Sensor Data - Amplification see Page 111
- PV_FTIME see Page 149

10.1.7 Operating conditions: Installation

Installation instructions

see Page 11 ff.

Inlet and outlet run

see Page 14 ff.

10.1.8 Operating conditions: Environment

Ambient temperature range

Compact version
- Standard: –40 to +70 °C (–40 to +158 °F)
- EEx d/XP version: –40 to +60 °C (–40 to +140 °F)
- ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)
- Display can be read between –20 and +70 °C (–4 to +158 °F)

Sensor remote version
- Standard: –40 to +85 °C (–40 to +185 °F)
- ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)

Transmitter remote version
- Standard: –40 to +80 °C (–40 to +176 °F)
- EEx d/XP version: –40 to +60 °C (–40 to +140 °F)
- ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)
- Display can be read between –20 °C and +70 °C (–4 to +158 °F)
- Version to –50 °C (–58 °F) on request

When mounting outside, we recommend you protect from direct sunlight with a protective cover (order number 543199-0001), especially in warmer climates with high ambient temperatures.

Storage temperature

Standard: –40 to +80 °C (–40 to +176 °F)
ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)
Version to –50 °C (–58 °F) on request

Degree of protection

IP 67 (NEMA 4X) in accordance with EN 60529

Vibration resistance

Acceleration up to 1 g, 10 to 500 Hz (with factory setting for amplification), following IEC 60068-2-6

Electromagnetic compatibility (EMC)

To IEC/EN 61326 and NAMUR Recommendation NE 21.

10.1.9 Operating conditions: Process

Medium temperature

DSC sensor (differential switched capacitor, capacitive sensor)

DSC standard sensor	–200 to +400 °C (–328 to +752 °F)
DSC sensor Inconel (PN 63 to 160, Class 600, JIS 40K under development)	–200 to +400 °C (–328 to +752 °F)

Seals

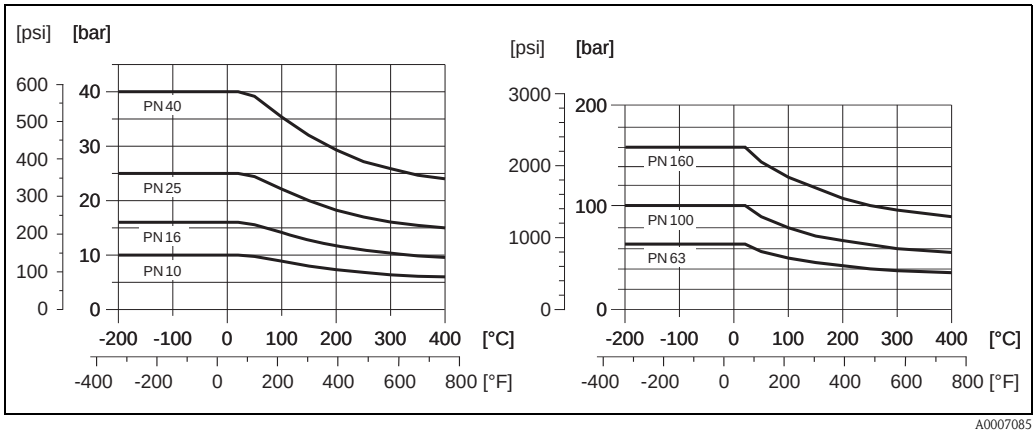
Graphite	–200 to +400 °C (–328 to +752 °F)
Viton	–15 to +175 °C (+5 to +347 °F)
Kalrez	–20 to +275 °C (–4 to +527 °F)
Gylon (PTFE)	–200 to +260 °C (–328 to +500 °F)

Sensor

Stainless steel	–200 to +400 °C (–328 to +752 °F)
Special version for very high fluid temperatures (on request)	–200 to +450 °C (–328 to +842 °F) –200 to +440 °C (–328 to +824 °F), Ex version

Medium pressure

Pressure-temperature curve to EN (DIN), (stainless steel)
PN 10 to 40 → Prowirl 73W and 73F
PN 63 to 160 → Prowirl 73F (under development)



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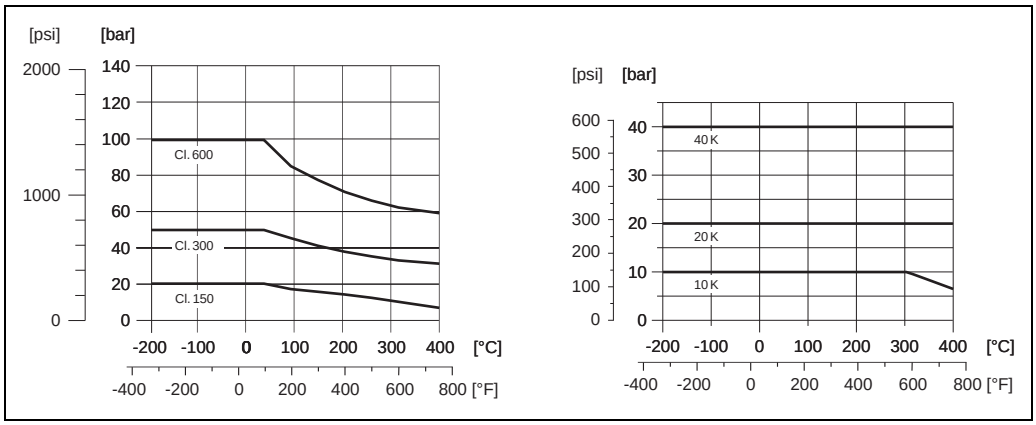
Pressure-temperature curve to ANSI B16.5 and JIS B2220, stainless steel
ANSI B16.5:
Class 150 to 300 → Prowirl 73W and 73F
Class 600 → Prowirl 73F (under development)

JIS B2220:
10 to 20K → Prowirl 73W and 73F
40K → Prowirl 73F (under development)



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Limiting flow

See data on Page 70 ff. ("measuring range")

Pressure loss

The pressure loss can be determined with the aid of the Applicator. The Applicator is software for selecting and planning flowmeters. The software is available both via the Internet (www.applicator.com) and on a CD-ROM for local PC installation.

10.1.10 Frequency ranges for air and water

You will find information on other media, such as steam for example, in the Applicator.

Prowirl 73W (SI units)

DN (DIN)	**Air** (at 0 °C, 1.013 bar) Corrected volume flow ($\dot{V}$) in [m^3/h]			**Water** (at 20 °C) Volume flow ($\dot{V}$) in [m^3/h]			**K-factor** [Pulse/dm^3]
	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	min to max
DN 15	4	35	330 to 2600	0.19	7	10.0 to 520	245 to 280
DN 25	11	160	180 to 2300	0.41	19	5.7 to 300	48 to 55
DN 40	31	375	140 to 1650	1.1	45	4.6 to 200	14 to 17
DN 50	50	610	100 to 1200	1.8	73	3.3 to 150	6 to 8
DN 80	112	1370	75 to 850	4.0	164	2.2 to 110	1.9 to 2.4
DN 100	191	2330	70 to 800	6.9	279	2.0 to 100	1.1 to 1.4
DN 150	428	5210	38 to 450	15.4	625	1.2 to 55	0.27 to 0.32

Prowirl 73W (US units)

DN (ANSI)	**Air** (at 32 °F, 14.7 psia) Corrected volume flow ($\dot{V}$) in [scfm]			**Water** (at 68 °F) Volume flow ($\dot{V}$) in [gpm]			**K-factor** [Pulse/dm³]
	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	min to max
½"	2.35	20.6	330 to 2600	0.84	30.8	10.0 to 520	245 to 280
1"	6.47	94.2	180 to 2300	1.81	83.7	5.7 to 300	48 to 55
1½"	18.2	221	140 to 1650	4.84	198	4.6 to 200	14 to 17
2"	29.4	359	100 to 1200	7.93	321	3.3 to 150	6 to 8
3"	65.9	806	75 to 850	17.6	722	2.2 to 110	1.9 to 2.4
4"	112	1371	70 to 800	30.4	1228	2.0 to 100	1.1 to 1.4
6"	252	3066	38 to 450	67.8	2752	1.2 to 55	0.27 to 0.32

Prowirl 73F (SI units)

DN (DIN)	**Air** (at 0 °C, 1.013 bar) Corrected volume flow ($\dot{V}$) in [m³/h]			**Water** (at 20 °C) Volume flow ($\dot{V}$) in [m³/h]			**K-factor** [Pulse/dm³]
	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	min. to max.
DN 15	3	25	380 to 2850	0.16	5	14.0 to 600	390 to 450
DN 25	9	125	200 to 2700	0.32	15	6.5 to 340	70 to 85
DN 40	25	310	150 to 1750	0.91	37	4.5 to 220	18 to 22
DN 50	42	510	120 to 1350	1.5	62	3.7 to 170	8 to 11
DN 80	95	1150	80 to 900	3.4	140	2.5 to 115	2.5 to 3.2
DN 100	164	2000	60 to 700	5.9	240	1.9 to 86	1.1 to 1.4
DN 150	373	4540	40 to 460	13.4	550	1.2 to 57	0.3 to 0.4
DN 200	715	8710	27 to 322	25.7	1050	1.0 to 39	0.1266 to 0.14
DN 250	1127	13 740	23 to 272	40.6	1650	0.8 to 33	0.0677 to 0.0748
DN 300	1617	19 700	18 to 209	58.2	2360	0.6 to 25	0.0364 to 0.0402

Prowirl 73F (US units)

DN (ANSI)	**Air** (at 32 °F, 14.7 psia) Corrected volume flow ($\dot{V}$) in [scfm]			**Water** (at 68 °F) Volume flow ($\dot{V}$) in [gpm]			**K-factor** [Pulse/dm³]
	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	$\dot{V}_{min}$	$\dot{V}_{max}$	Frequency range [Hz]	min. to max.
½"	1.77	14.7	380 to 2850	0.70	22.0	14.0 to 600	390 to 450
1"	5.30	73.6	200 to 2700	1.41	66.0	6.5 to 340	70 to 85
1½"	14.7	182	150 to 1750	4.01	163	4.5 to 220	18 to 22
2"	24.7	300	120 to 1350	6.6	273	3.7 to 170	8 to 11
3"	55.9	677	80 to 900	15.0	616	2.5 to 115	2.5 to 3.2
4"	96.5	1177	60 to 700	26.0	1057	1.9 to 86	1.1 to 1.4
6"	220	2672	40 to 460	59.0	2422	1.2 to 57	0.3 to 0.4
8"	421	5126	27 to 322	113	4623	1.0 to 39	0.1266 to 0.14
10"	663	8087	23 to 272	179	7265	0.8 to 33	0.0677 to 0.0748
12"	952	11 595	18 to 209	256	10 391	0.6 to 25	0.0364 to 0.0402

10.1.11 Mechanical construction

Design, dimensions	See Technical Information TI070D/06/en
Weight	See Technical Information TI070D/06/en
Material	Transmitter housing: ■ Powder-coated die-cast aluminum AlSi10Mg – In accordance with EN 1706/EN AC-43400 (EEx d/XP version: cast aluminum EN 1706/EN AC-43000) Sensor: ■ Flanged version: – Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR0175-2003 and MR0103-2003 ■ Wafer version – Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR0175-2003 and MR0103-2003 Flanges: ■ EN (DIN) – Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR0175-2003 and MR0103-2003 – DN 15 to 150 with pressure ratings to PN 40 and all devices with integrated nominal diameter reduction (R-type, S-type): construction with weld-on flanges made of 1.4404 (AISI 316L). PN 63 to 160 (under development), nominal diameters DN 200 to 300: fully cast construction A351-CF3M (1.4404 (AISI 316L)), in conformity with NACE MR0175-2003 and MR0103-2003 ■ ANSI and JIS – Stainless steel, A351-CF3M, in conformity with NACE MR0175-2003 and MR0103-2003 – ½ to 6" with pressure ratings to Class 300 and DN 15 to 150 with pressure ratings to 20K and all devices with integrated nominal diameter reduction (R-type, S-type): construction with weld-on flanges made of 316/316L, in conformity with NACE MR0175-2003 and MR0103-2003. Class 600 (under development), DN 15 to 150 with pressure rating 40K (under development), nominal diameters 8 to 12": fully cast construction A351-CF3M; in conformity with NACE MR0175-2003 and MR0103-2003 DSC sensor (differential switched capacitor; capacitive sensor): ■ Wetted parts (marked as "wet" on the DSC sensor flange). – Standard for pressure ratings up to PN 40, Class 300, JIS 20K: Stainless steel 1.4435 (316L), in conformity with NACE MR0175-2003 and MR0103-2003 – Pressure ratings PN 63 to 160, Class 600, 40K (under development): Inconel 2.4668/N 07718 (B637) (Inconel 718), in conformity with NACE MR0175-2003 and MR0103-2003 Non-wetted parts: ■ Stainless steel 1.4301 (304) Pipe stand: ■ Stainless steel, 1.4308 (CF8) Seals: ■ Graphite: – Pressure rating PN 10 to 40, Class 150 to 300, JIS 10 to 20K: Sigraflex Foil Z (BAM-tested for oxygen applications) – Pressure rating PN 63 to 160, Class 600, JIS 40K: Sigraflex Hochdruck™ with smooth sheet metal insert made of 316(L) (BAM-tested for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act") ■ Viton ■ Kalrez 6375 – Gylon (PTFE) 3504 (BAM-tested for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act")

10.1.12 Human interface

Display elements	■ Liquid crystal display, two-line, plain text display, 16 characters per line ■ Custom configurations for presenting different measured value and status variables, totalizers.
Operating elements	No local operating elements, remote operation possible.
Remote operation	Operation via: ■ FOUNDATION Fieldbus ■ FieldCare (software package from Endress+Hauser for complete configuration, commissioning and diagnosis)

10.1.13 Certificates and approvals

CE approval	The measuring device 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 device meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	More information on the Ex approvals can be found in the separate Ex documentation.
Pressure measuring device approval	The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary. ■ With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC. ■ Devices with this identification (with PED) are suitable for the following types of fluid: – Fluids of Group 1 and 2 with a steam pressure of greater or less than 0.5 bar (7.3 psi) – Unstable gases ■ Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.
FOUNDATION Fieldbus certification	The Prowirl 72 flowmeter has successfully passed all the test procedures implemented and has been certified and registered by the Fieldbus Foundation. The flowmeter thus meets all the requirements of the specifications listed below: ■ Certified to the FOUNDATION Fieldbus Specification ■ The device meets all the Specifications of the FOUNDATION Fieldbus H1. ■ Interoperability Test Kit (ITK), revision status 4.5x: the device may also be operated using certified devices from other manufacturers. ■ Physical Layer Conformance Test of the Fieldbus Foundation

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: Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NACE Standard MR0103-2003: Standard Material Requirements – Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments
- NACE Standard MR0175-2003: Standard Material Requirements – Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment
- VDI 2643: Measurement of fluid flow by means of vortex flowmeters
- ANSI/ISA-S82.01: Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment – General Requirements. Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 No. 1010.1-92: Safety Standard for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II.
- American Gas Association (1962): A.G.A. Manual for the Determination of Supercompressibility Factors for Natural Gas – PAR Research Project NX-19.
- The International Association for the Properties of Water and Steam – Release on the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam.
- ASME International Steam Tables for Industrial Use (2000).

10.1.14 Ordering information

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

10.1.15 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor (see Page 48). Your Endress+Hauser service organization can provide detailed information on the order codes of your choice.

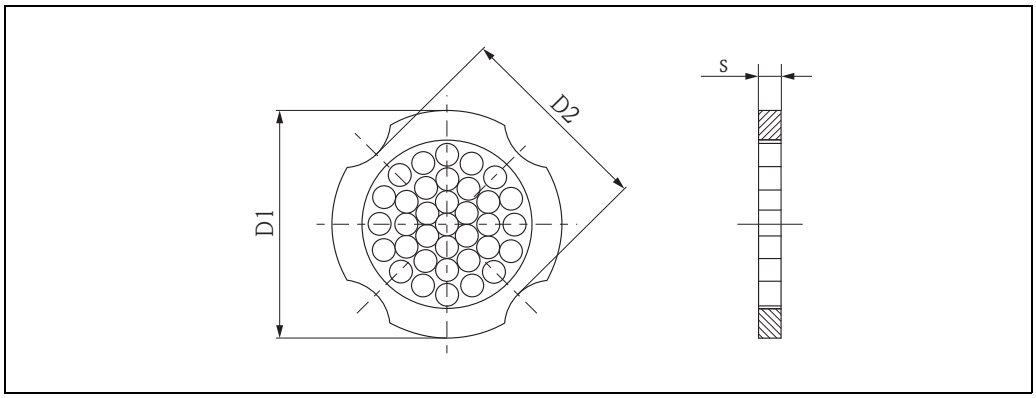
10.1.16 Documentation

- Flow measuring technology (FA005D/06/en)
- Technical Information Proline Prowirl 72F, 72W, 73F, 73W (TI070/06/en)
- Associated Ex-documentation: ATEX, FM, CSA etc.
- Related documentation for Pressure Equipment Directive for Proline Prowirl 72/73 (SD072D/06/en)

10. 2 Dimensions of flow conditioner

Dimensions as per:
- EN 1092-1 (DIN 2501)
- ANSI B16.5
- JIS B2220

Material 1.4435 (316L), in conformity with NACE MR0175-2003 and MR0103-2003



A0001941

D1: The flow conditioner is fitted at the outer diameter between the bolts.
D2: The flow conditioner is fitted at the indentations between the bolts.

Dimensions of flow conditioner to EN (DIN)

DN	Pressure rating	Centering diameter [mm]	D1 / D2 *	s [mm]	Weight [kg]
15	PN 10 to 40 PN 63	54.3 64.3	D2 D1	2.0	0.04 0.05
25	PN 10 to 40 PN 63	74.3 85.3	D1 D1	3.5	0.12 0.15
40	PN 10 to 40 PN 63	95.3 106.3	D1 D1	5.3	0.3 0.4
50	PN 10 to 40 PN 63	110.0 116.3	D2 D1	6.8	0.5 0.6
80	PN 10 to 40 PN 63	145.3 151.3	D2 D1	10.1	1.4
100	PN 10/16 PN 25/40 PN 63	165.3 171.3 176.5	D2 D1 D2	13.3	2.4
150	PN 10/16 PN 25/40 PN 63	221.0 227.0 252.0	D2 D2 D1	20.0	6.3 7.8 7.8
200	PN 10 PN 16 PN 25 PN 40	274.0 274.0 280.0 294.0	D1 D2 D1 D2	26.3	11.5 12.3 12.3 15.9
250	PN 10/16 PN 25 PN 40	330.0 340.0 355.0	D2 D1 D2	33.0	25.7 25.7 27.5
300	PN 10/16 PN 25 PN 40	380.0 404.0 420.0	D2 D1 D1	39.6	36.4 36.4 44.7

* D1 → The flow conditioner is fitted at the outer diameter between the bolts.
D2 → The flow conditioner is fitted at the indentations between the bolts.

Dimensions of flow conditioner to ANSI

DN		Pressure rating	Centering diameter mm (inch)	D1 / D2 *	s mm (inch)	Weight kg (lbs)
15	½"	Cl. 150 Cl. 300	50.1 (1.97) 56.5 (2.22)	D1 D1	2.0 (0.08)	0.03 (0.07) 0.04 (0.09)
25	1"	Cl. 150 Cl. 300	69.2 (2.72) 74.3 (2.93)	D2 D1	3.5 (0.14)	0.12 (0.26)
40	1½"	Cl. 150 Cl. 300	88.2 (3.47) 97.7 (3.85)	D2 D2	5.3 (0.21)	0.3 (0.66)
50	2"	Cl. 150 Cl. 300	106.6 (4.20) 113.0 (4.45)	D2 D1	6.8 (0.27)	0.5 (1.1)
80	3"	Cl. 150 Cl. 300	138.4 (5.45) 151.3 (5.96)	D1 D1	10.1 (0.40)	1.2 (2.6) 1.4 (3.1)
100	4"	Cl. 150 Cl. 300	176.5 (6.95) 182.6 (7.19)	D2 D1	13.3 (0.52)	2.7 (6.0)
150	6"	Cl. 150 Cl. 300	223.9 (8.81) 252.0 (9.92)	D1 D1	20.0 (0.79)	6.3 (14) 7.8 (17)
200	8"	Cl. 150 Cl. 300	274.0 (10.8) 309.0 (12.2)	D2 D1	26.3 (1.04)	12.3 (27) 15.8 (35)
250	10"	Cl. 150 Cl. 300	340.0 (13.4) 363.0 (14.3)	D1 D1	33.0 (1.30)	25.7 (57) 27.5 (61)
300	12"	Cl. 150 Cl. 300	404.0 (15.9) 402.0 (16.5)	D1 D1	39.6 (1.56)	36.4 (80) 44.6 (98)

* D1 → The flow conditioner is fitted at the outer diameter between the bolts.
D2 → The flow conditioner is fitted at the indentations between the bolts.

Dimensions of flow conditioner to JIS

DN	Pressure rating	Centering diameter [mm]	D1 / D2 *	s [mm]	Weight [kg]
15	10K	60.3	D2	2.0	0.06
	20K	60.3	D2	2.0	0.06
	40K	66.3	D1	2.0	0.06
25	10K	76.3	D2	3.5	0.14
	20K	76.3	D2	3.5	0.14
	40K	81.3	D1	3.5	0.14
40	10K	91.3	D2	5.3	0.31
	20K	91.3	D2	5.3	0.31
	40K	102.3	D1	5.3	0.31
50	10K	106.6	D2	6.8	0.47
	20K	106.6	D2	6.8	0.47
	40K	116.3	D1	6.8	0.5
80	10K	136.3	D2	10.1	1.1
	20K	142.3	D1	10.1	1.1
	40K	151.3	D1	10.1	1.3
100	10K	161.3	D2	13.3	1.8
	20K	167.3	D1	13.3	1.8
	40K	175.3	D1	13.3	2.1
150	10K	221.0	D2	20.0	4.5
	20K	240.0	D1	20.0	5.5
	40K	252.0	D1	20.0	6.2
200	10K	271.0	D2	26.3	9.2
	20K	284.0	D1	26.3	9.2
250	10K	330.0	D2	33.0	15.8
	20K	355.0	D2	33.0	19.1
300	10K	380.0	D2	39.6	26.5
	20K	404.0	D1	39.6	26.5

* D1 → The flow conditioner is fitted at the outer diameter between the bolts.
D2 → The flow conditioner is fitted at the indentations between the bolts.

11 Operation via FOUNDATION Fieldbus

11. 1 Block model

In the FOUNDATION Fieldbus interface, all the device parameters are categorized according to their functional properties and task and are generally assigned to three different blocks. A block may be regarded as a container in which parameters and the associated functionalities are contained. A FOUNDATION Fieldbus device has the following block types:

- A Resource Block (device block):
  The Resource Block contains all the device-specific features of the unit.

- One or more Transducer Blocks: A Transducer Block contains all the device's measurement-related and device-specific parameters. The measurement principles (e.g. flow, temperature) are depicted in the Transducer Blocks in accordance with the FOUNDATION Fieldbus Specification.

- One or more function blocks: function blocks contain the device's automation functions. We distinguish between different function blocks, e.g. Analog Input Function Block, Analog Output Function Block. Each of these function blocks is used to execute different application functions.

Depending on how the individual function blocks are arranged and connected, various automation tasks can be realized. In addition to these blocks, a field device may have other blocks, e.g. several Analog Input Function Blocks if more than one process variable is available from the field device.

Proline Prowirl 73 FOUNDATION Fieldbus has the following blocks:
- A Resource Block (device block)
- Eight Transducer Blocks
- Nine function blocks consisting of:
  – Seven Analog Input Function Blocks
  – An Analog Output
  – A Discrete Output

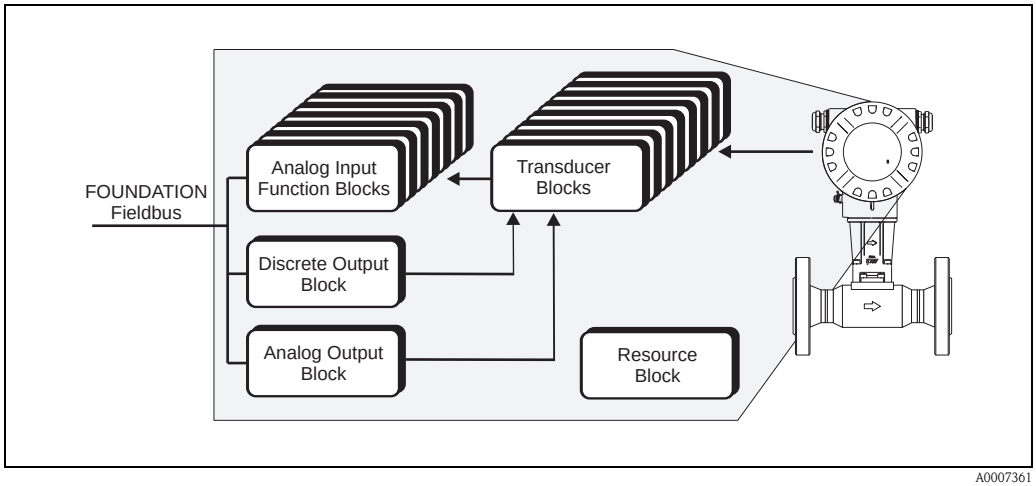


Fig. 30: Prowirl 73 FF block model

11. 2 Resource Block (device block)

A Resource Block contains all the data that clearly identify and characterize the field device. It is an electronic version of a nameplate on the field device. Parameters of the Resource Block include the device type, device name, manufacturer ID, serial number, etc.

A further task of the Resource Block is the management of overall parameters and functions that have an influence on the execution of the remaining blocks in the field device. The Resource Block is thus the central unit that also checks the device status and thereby influences or controls the operability of the other blocks and thus also of the device. As the Resource Block does not have any block input and block output data, it cannot be linked to other blocks.

The most important functions and parameters of the Resource Block are listed below.

11.2.1 Selecting the operating mode

The operating mode is set by means of the MODE_BLK parameter group. The Resource Block supports the following operating modes:

– AUTO (automatic mode)

– OOS (out of service)

✎ Note!
The OOS operating mode is also displayed by means of the BLOCK_ERR parameter. In the OOS operating mode, all write parameters can be accessed without restriction if write protection has not been enabled.

11.2.2 Block status

The current operating status of the Resource Block is displayed in the RS_STATE parameter.

The Resource Block can assume the following states:

– STANDBY	The Resource Block is in the OOS mode. It is not possible to execute the other blocks.
– ONLINE LINKING	The configured connections between the function blocks have not yet been established.
– ONLINE	Normal operating status, the Resource Block is in the AUTO operating mode. The configured connections between the function blocks have been established.

11.2.3 Write protection and simulation

The write protection of the device parameters and the simulation in the Analog Input, Analog Output and Discrete Output Function Block can be enabled or disabled via DIP switches on the FOUNDATION Fieldbus I/O board or the amplifier board (see Page 35).

The WRITE_LOCK parameter shows the status of the hardware write protection. The following statuses are possible:

- LOCKED = The device data cannot be altered via the FOUNDATION Fieldbus interface.
- NOT LOCKED = The device data can be altered via the FOUNDATION Fieldbus interface.

The BLOCK_ERR parameter indicates whether simulation in the Analog Input, Analog Output and Discrete Output Function Block is possible.

- Simulation active = Simulation possible in the Analog Input and Analog Output Function Block via the SIMULATE parameter and in the Discrete Output Function Block via the SIMULATE_D parameter.

11.2.4 Alarm detection and processing

Process alarms provide information on certain block states and events.
The status of the process alarms is communicated to the fieldbus host system by means of the BLOCK_ALM parameter. The ACK_OPTION parameter allows you to specify whether an alarm has to be acknowledged by means of the fieldbus host system.

The following process alarms are generated by the Resource Block:

Block process alarms
The following block process alarms of the Resource Block are displayed by means of the BLOCK_ALM parameter:

- OUT OF SERVICE
- SIMULATE ACTIVE

Write protection process alarm
If the write protection is disabled (see Page 35), the alarm priority specified in the WRITE_PRI parameter is checked before the status change is relayed to the fieldbus host system. The alarm priority specifies the behavior in the event if an active write protection alarm WRITE_ALM.

Note!
- If the option of a process alarm was **not** activated in the ACK_OPTION parameter, this process alarm must only be acknowledged in the BLOCK_ALM parameter.

11.2.5 Resource Block parameters

The following table shows all the Endress+Hauser-specific parameters of the Resource Block.

Resource Block (device block) / base index 400		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Serial Number	**Read only**	The serial number of the sensor appears on the display.
Sensor - Type	**Read only**	The sensor type (e.g. Prowirl F) appears on the display.
Sensor - Serial Number DSC Sensor	**Read only**	The serial number of the DSC sensor appears on the display.
Amplifier - HW Revision No.	**Read only**	The hardware revision number of the amplifier appears on the display.
Amplifier - HW Identification	**Read only**	The hardware identification number of the amplifier appears on the display.
Amplifier - SW Revision No.	**Read only**	The software revision number of the amplifier appears on the display.
Amplifier - SW Identification	**Read only**	The software identification number of the amplifier appears on the display.
Amplifier - Production No.	**Read only**	The production number of the amplifier appears on the display.
I/O Module - HW Revision No.	**Read only**	The hardware revision number of the I/O module appears on the display.
I/O Module - HW Identification	**Read only**	The hardware identification number of the I/O module appears on the display.
I/O Module - SW Revision No.	**Read only**	The software revision number of the I/O module appears on the display.
I/O Module - SW Identification	**Read only**	The software identification number of the I/O module appears on the display.
I/O Module - Production No.	**Read only**	The production number of the I/O module appears on the display.

11. 3 Transducer Block

The Transducer Block of the Proline Prowirl 73 FOUNDATION Fieldbus contains all the measuring and device-specific parameters of the flowmeter. Here, settings are made which are directly connected to the flow measurement / application.
It forms the interface between sensor-specific measured value pre-processing and the function blocks required for automation.

A Transducer Block allows you to influence the input and output variables of a function block. The parameters of a Transducer Block include information on the sensor configuration, physical units, calibration, damping, error messages, etc. as well as the device-specific parameters.

The device-specific parameters and functions of Proline Prowirl 73 FOUNDATION Fieldbus are split into several Transducer Blocks, each covering different task areas (Fig. 31, Page 91).

Transducer Block "Flow" / base index 500:
This block contains all the flow-specific parameters and functions, e.g. calibration functions, sensor data, etc. → Page 96.

Transducer Block "Totalizer 1" / base index 600 or
Transducer Block "Totalizer 2" / base index 700:
This block contains all the parameters for configuring totalizer 1 or totalizer 2 → Page 114

Transducer Block "Flow Computer" / base index 800:
This block contains all the parameters for configuring the flow computer. → Page 118

Transducer Block "Adv. Diagnostic" / base index 900:
This block contains all the parameters for configuring the advanced diagnosis functions. This software option is enabled by entering a special activation code → Page 133

Transducer Block "Display" / base index 1000:
This block contains all the parameters for configuring the local display → Page 142

Transducer Block "Diagnosis" / base index 1100:
This block contains all the parameters for system diagnosis, e.g. current system status etc.
→ Page 147

Transducer Block "Service" / base index 1200:
This block contains all the service parameters. Access is by entering the special service code.
→ Page 149

Caution!
Changing the settings of the service functions can result in a malfunction or device failure. Should this occur, remove the device and return it to Endress+Hauser Flowtec.

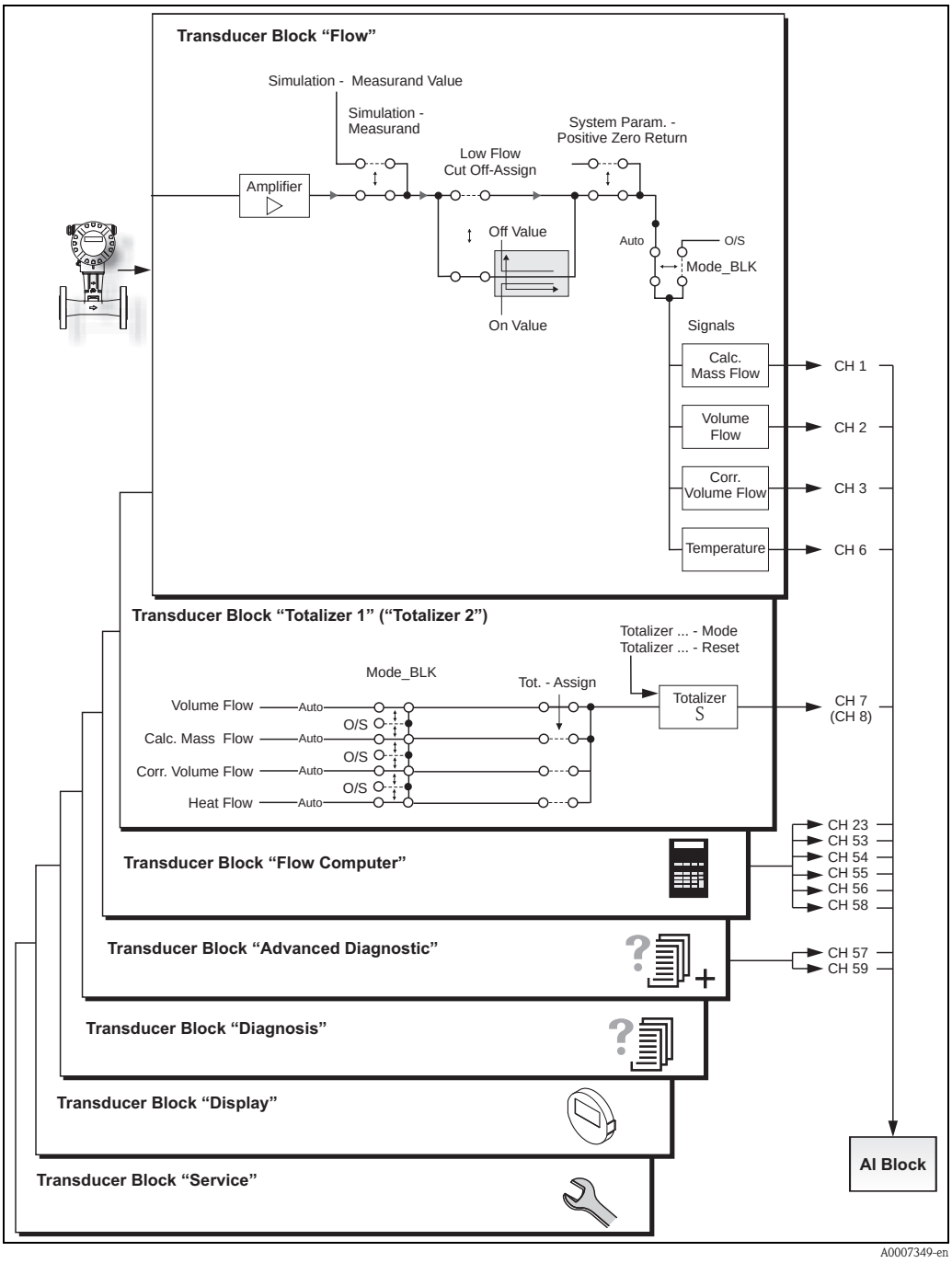


Fig. 31: Structure and function of the individual Transducer Blocks of Proline Prowirl 73 FOUNDATION Fieldbus

11.3.1 Block output variables

The following table shows which output variables (process variables) the Transducer Blocks make available.
Transducer Block "Diagnosis", "Display" and "Service" do not have any output variables.
The CHANNEL parameter in the Analog Input Function Block is used to assign which process variable is read in and processed in the downstream Analog Input Function Block.

Block	Process variable	Channel parameter (AI Block)
Transducer Block "Flow"	Mass Flow	1
	Volume Flow	2
	Corr. Volume Flow	3
	Temperature	6
Transducer Block "Totalizer 1"	Totalizer 1	7
Transducer Block "Totalizer 2"	Totalizer 2	8
Transducer Block "Flow Computer"	Flow Velocity	23
	Heat Flow	53
	Spec. Enthalpy	54
	Calc. Sat. Pressure (calculated steam pressure, saturated steam)	55
	Z Factor	56
	Frequency (Vortex Frequency)	58
Transducer Block "Advanced Diagnostic"	*Reynolds Number	57
	*Elec. Temperature (Electronics Temperature)	59

Note!
- *Only available with the software option "Advanced diagnosis". If the software option is not enabled, the value NaN (not-a-number) is transmitted or displayed as the value for the process variable. For enabling see the "Activ. Adv. Diag" parameter in the Transducer Block "Adv. Diagnostic" (see Page 134).
- The availability of the process variables depends on the fluid selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). For process variables that are not available for a certain option, the value NaN (not-a-number) is transmitted or displayed. "– – – –" appears on the local display.

11.3.2 Selecting the operating mode

The operating mode is set by means of the MODE_BLK parameter group (see Page 94). The Transducer Blocks support the following operating modes:
- AUTO (automatic mode)
- OOS (out of service)

Note!
- The OOS block status mode is also displayed by means of the BLOCK_ERR parameter (see Page 95). In the OOS operating mode, all write parameters can be accessed without restriction if write protection has not been enabled and the Access Code is entered.
- If problems occur during the configuration of the function blocks see Page 51, Section 9. 1.

11.3.3 Alarm detection and processing

The Transducer Blocks do not generate any process alarms. The status of the process variables is evaluated in the downstream Analog Input Function Blocks. If the Analog Input Function Block does not receive an input value that can be evaluated from the Transducer Blocks "Flow" or "Totalizer", then a process alarm is generated. This process alarm is displayed in the BLOCK_ERR parameter of the Analog Input Function Block.
The BLOCK_ERR parameter (Transducer Block "Diagnosis", see Page 95) displays the device error that produced an input value that could not be evaluated and thus triggered the process alarm in the Analog Input Function Block. In addition, the active device error is displayed via the Transducer Block "Diagnosis" in the "Diagnosis - Actual System Condition" parameter (see Page 147).
More information on eliminating errors can be found on Page 50.

11.3.4 Accessing the manufacturer-specific parameters

To access the manufacturer-specific parameters, the following requirements must be met:

1. Hardware write protection must be disabled (see Page 35).
2. The correct code must be entered by means of the corresponding Transducer Block in the "Un-/Locking - Access Code" parameter.

11.3.5 Selecting the units

The system units selected in the Transducer Blocks do not have any effect on the desired units which should be transmitted by means of the FOUNDATION Fieldbus interface. This setting is made separately by means of the corresponding AI Block in the XD_SCALE parameter group (see Page 149). The unit selected in the Transducer Blocks is only used for the local display, low flow cut off and for simulation.

11. 4 FOUNDATION Fieldbus parameters

The following table lists all the specified FOUNDATION Fieldbus parameters of the Transducer Blocks. The E+H-specific parameters are described as of Page 96.

FOUNDATION Fieldbus parameters (Transducer Blocks)		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
ST_REV	**Read only**	The revision status of the static data appears on the display. ✎ Note! The revision status parameter is incremented with every change of the static data.
TAG_DESC	**AUTO - OOS**	Use this function to enter a user-specific text of max. 32 characters for unique identification and assignment of the block. **Factory setting:** (_____) no text
STRATEGY	**AUTO - OOS**	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory setting:** 0 ✎ Note! These data are neither checked nor processed by the Transducer Blocks.
ALERT_KEY	**AUTO - OOS**	Use this function to enter the identification number of the plant unit. This information can be used by the fieldbus host system for sorting alarms and events. **User input:** 1 to 255 **Factory setting:** 0
MODE_BLK	**AUTO - OOS**	For displaying the current (Actual) and the desired (Target) operating mode of the relevant Transducer Block, the permitted modes supported by the Transducer Block in question (Permitted) and the normal operating mode (Normal). **Display:** AUTO OOS ✎ Note! The Transducer Blocks support the following operating modes: ■ AUTO (automatic mode): The block is executed. ■ OOS (out of service): The block is in the "out of service" mode.

FOUNDATION Fieldbus parameters (Transducer Blocks)		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
BLOCK_ERR	**Read only**	The active block errors appear on the display. **Display:** ■ OUT OF SERVICE The block is in the "out of service" operating mode. *Block errors which are only shown in the Transducer Block "Diagnosis"* ■ SIMULATE ACTIVE Simulation via the "Simulation - Measurand" parameter (see Page 112) in the Transducer Block "Flow" is active. ■ MAINTENANCE NEEDED The device must be checked since an active device error is pending. A detailed display of the cause of the error can be called up in the Transducer Block "Diagnosis" by means of the "Diagnosis - Actual System Condition" parameter (see Page 147).
UPDATE_ EVT	**AUTO - OOS**	Indicates whether static block data have been altered, including date and time.
BLOCK_ALM	**AUTO - OOS**	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. ✎ Note! ■ In addition, the active block alarm can be acknowledged in this parameter group. ■ Prowirl 73 FF does not use this parameter to display a process alarm since this is generated in the BLOCK_ALM parameter of the Analog Input Function Block.
Transducer Type	**Read only**	The Transducer Block type appears on the display. **Display:** Standard flow with calibration
Transducer Error	**Read only**	The active device error appears on the display. **Possible display:** ■ No Error (normal status) ■ Electronis Failure ■ Data Integrity Error ■ Mechanical Error ■ Configuration Error ■ General Error ✎ Note! ■ The display of the device error is standardized. Precise information on the error pending is available by means of the manufacturer-specific error display which can be read off via the Transducer Block "Diagnosis" in the "Diagnosis - Actual System Condition" parameter. ■ An exact error description as well as information on rectifying errors can be found on Page 53 ff.

11. 5 E+H parameters: Transducer Block "Flow"

The following table shows all the E+H-specific parameters of the Transducer Block "Flow". These can only be changed after entering an enabling code in the "Un-/Locking - Access Code" parameter.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
✎ Note! The FOUNDATION Fieldbus parameters of this block are described on Page 94		
Un-/Locking - Access Code	**AUTO - OOS**	All data of the measuring system are protected against inadvertent change. Programming of the manufacturer-specific parameters is disabled and the settings cannot be changed until a code is entered in this function. You can enable programming by entering the: ■ Code 73 (factory setting) ■ Personal code, see "Un-/Locking – Define Private Code" parameter (see Page 142) Transducer Block "Display" **User input:** Max. 4-digit number (0 to 9999) ✎ Note! ■ If write protection is enabled, access to manufacturer-specific parameters is denied even if the right code is entered. Write protection can be enabled or disabled by means of DIP switches (see Page 35). ■ You can disable programming again by entering any number in this function (other than the Access Code). ■ The Endress+Hauser service organization can be of assistance if you mislay your private code. ■ Certain parameters can only be altered if a special Service Code is entered. This Service Code is known to your Endress+Hauser service organization. Please contact your Endress+Hauser service point if anything needs clarification.
Un-/Locking - Access Status	**Read only**	Use this function to display the current status of the possibilities for accessing the manufacturer-specific parameters of the device. **Display:** ■ LOCKED (parameters cannot be modified) ■ ACCESS CUSTOMER (parameters can be modified) ■ ACCESS SERVICE (parameters can be modified, access to service level)
System Value - Volume Flow	**Read only**	The current volume flow appears on the display. ✎ Note! The unit is displayed in the "System Unit - Volume Flow" parameter (see Page 97).

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Unit - Volume Flow	**AUTO - OOS**	Use this function to select the unit for the volume flow (volume/time). The unit you select here is also valid for: ■ Simulation ■ Low flow cut off ■ Display value (local display) ✎ 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 → ozf/time unit* – *Gallon → US gal/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:** In accordance with order, otherwise depends on country.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Value - Calc. Mass Flow	**Read only**	✎ Note! This value is not available unless the SATURATED STEAM, SUPERHEATED STEAM, WATER, COMPRESSED AIR, REAL GAS, NATURAL GAS NX-19 or USER-DEFINED LIQUID option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. The calculated mass flow appears on the display. **Display:** 5-digit floating-point number, incl. unit (e.g. 462.87 kg/h; 731.63 lb/min; etc.) ✎ Note! ■ The mass flow is calculated using the measured volume flow and measured temperature. ■ The unit is displayed in the "System Unit - Calc. Mass Flow" parameter (see Page 98)
System Unit - Calc. Mass Flow	**AUTO - OOS**	Use this function to select the unit for the calculated mass flow. The unit you select here is also valid for: ■ Simulation ■ On-value low flow cut off ■ Display value (local display) ✎ Note! The following units of time can be selected: s = second, m = minute, h = hour, d = day **Options:** Metric: gram → g/time unit kilogram → kg/time unit Metric ton → t/time unit US: ounce → oz/time unit US pound → lb/time unit ton → ton/time unit **Factory setting:** In accordance with order, otherwise depends on country.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Value - Corr. Volume Flow	**Read only**	✎ Note! This value is not available unless the SATURATED STEAM, SUPERHEATED STEAM, WATER, COMPRESSED AIR, REAL GAS, NATURAL GAS NX-19 or USER-DEFINED LIQUID option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. The corrected volume flow appears on the display. **Display:** 5-digit floating-point number, incl. unit (e.g. 462.87 kg/h; 731.63 lb/min; etc.) ✎ Note! ■ The mass flow is calculated using the measured volume flow and measured temperature. ■ The unit is displayed in the "System Unit - Corr. Volume Flow" parameter (see Page 99).
System Unit - Corr. Volume Flow	**AUTO - OOS**	Use this function to select the unit for the corrected volume flow. The unit you select here is also valid for: ■ Simulation ■ On-value low flow cut off ■ Display value (local display) ✎ Note! The following units of time can be selected: s = second, m = minute, h = hour, d = day **Options:** Metric: Norm liter → Nl/time unit Norm cubic meter → Nm^3/time unit US: Standard cubic meter → Sm^3/time unit Standard cubic feet → Scf/time unit **Factory setting:** In accordance with order, otherwise depends on country.

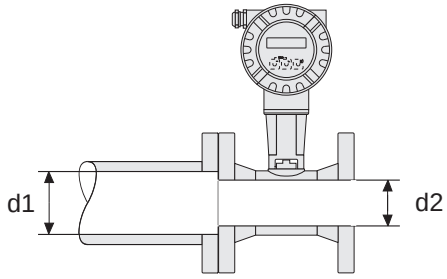
Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Value - Heat Flow	**Read only**	✎ Note! This value is not available unless the "saturated steam", "superheated steam" or "water" option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. The heat flow determined appears on the display. **Display:** 5-digit floating-point number, including unit, corresponds to 0.1000 to 6.000 MJ/h, (e.g. 1.2345 MJ/h, 993.5 MW, etc.) ✎ ■ The heat flow is determined from the fluid selected in the "Select Fluid" parameter (Transducer Block "Flow Computer") and the measured temperature. ■ The related unit is taken in the "System Unit - Heat Flow" parameter (see Page 100).
System Unit - Heat Flow	**AUTO - OOS**	For selecting the unit required and displayed for the heat flow. ✎ Note! The following units of time can be selected: s = second, m = minute, h = hour, d = day **Options:** Metric: Megawatt → MW Kilowatt→ kW Kilocalories → kcal/time unit Megacalories → Mcal/time unit Kilojoule → kJ/time unit Megajoule → MJ//time unit Gigajoule → GJ/time unit Kilocalories → kcal/time unit Gigacalories → Gcal/time unit US: ton x second → tons British Thermal Unit BTU: Kilo BTU → kBtu/time unit Mega BTU → MBtu/time unit Giga BTU → GBtu/time unit **Factory setting:** In accordance with order, otherwise depends on country.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Value - Density	**Read only**	✎ Note! This value is not available unless the "Gas Volume" or "Liquid Volume" option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. The density determined appears on the display. **Display:** 5-digit floating point number, incl. unit, corresponds to 0.100000 to 6.00000 kg/dm³, (e.g. 1.2345 kg/dm³, 1.0015 SG 20 °C, etc.) ✎ Note! ■ The density is determined from the fluid selected in the "Select Fluid" parameter (Transducer Block "Flow Computer") and the measured temperature. ■ The related unit is taken in the "System Unit – Density" parameter (see Page 101).
System Unit - Density	**AUTO - OOS**	For selecting the unit required and displayed for the density. **Options:** Metric: g/cm³; g/cc; kg/dm³; kg/l; kg/m³; SD 4 °C, SD 15 °C, SD 20 °C; SG 4 °C, SG 15 °C, SG 20 °C US: lb/ft³; lb/US gal; lb/US bbl NORM (normal fluids); lb/US bbl BEER (beer); lb/US bbl PETR. (petrochemicals); lb/US bbl TANK (filling tanks) Imperial: lb/imp. gal; lb/imp. bbl BEER (beer); l b/imp. bbl PETR. (petrochemicals) **Factory setting:** Depends on country. SD = Specific Density, SG = Specific Gravity The specific density is the ratio between the fluid density and the density of the water (at water temperature = 4, 15, 20 °C)
System Value - Temperature	**Read only**	The temperature currently measured appears on the display. **Display:** Max. 4-digit fixed point number, incl. unit and sign (e.g. –23.4 °C, 160.0 °F, etc.) ✎ Note! The unit is displayed in the "System Unit – Temperature" parameter. (see Page 102)

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Unit - Temperature	**AUTO - OOS**	For selecting the unit required and displayed for the temperature. **Options:** °C (Celsius) K (Kelvin) °F (Fahrenheit) R (Rankine) **Factory setting:** Depends on country.
System Value - Spec. Enthalpy	**Read only**	✎ Note! This value is not available unless the "SATURATED STEAM", "WATER" or "SUPERHEATED STEAM" option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. The specific enthalpy determined appears on the display. **Display:** 5-digit floating point number, (e.g. 5.1467 kJ/kg, etc.) ✎ Note! ■ The enthalpy is determined from the fluid selected in the "Select Fluid" parameter (Transducer Block "Flow Computer") and the measured temperature. ■ The unit is displayed in the "System Unit - Spec. Enthalpy" parameter (see Page 102) ■ The enthalpy output by the device refers in accordance with IAPWSIF97 to the specific enthalpy of the boiling liquid at the triple point. This means that the specific inner enthalpy and the specific entropy of the boiling liquid are set to zero at the triple point. This results in the display of the specific enthalpy
System Unit - Spec. Enthalpy	**AUTO - OOS**	For selecting the unit required and displayed for the specific enthalpy of saturated steam, superheated steam or water. **Options:** Kilowatt hour → kWh/kg Kilojoule → kJ/kg Megajoule → MJ/kg Kilocalories → kcal/kg British Thermal Unit → Btu/kg **Factory setting:** Depends on country.

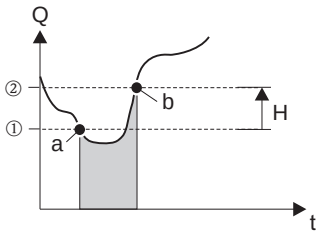
Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Value - Calc. Sat. Pressure	**Read only**	✎ Note! This value is not available unless the SATURATED STEAM option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. The calculated steam pressure (of the saturated steam) appears on the display. **Display:** 5-digit floating point number, (e.g. 5.1467 bara, etc.) ✎ Note! ■ The steam pressure of the saturated steam is determined from the fluid selected in the "Select Fluid" parameter (Transducer Block "Flow Computer") and the measured temperature. ■ The unit is displayed in the "System Unit - Pressure" parameter. (see Page 103)
System Unit-Pressure	**AUTO - OOS**	For selecting the unit required and displayed for the pressure. **Options:** Metric: – BAR A US: – PSI A **Factory setting:** Depends on country.
System Value - Vortex Frequency	**Read only**	The vortex frequency currently measured appears on the display in Hz. **Display:** 5-digit floating-point number, incl. unit Hz, (e.g. 120.23 Hz) ✎ Note! This function is only used for a plausibility check.
System Value - Velocity	**Read only**	The flow velocity through the device appears on the display. This is determined from the current flow through the device and the cross-sectional area the fluid flows through. **Display:** 5-digit floating-point number, incl. unit ✎ Note! The unit is displayed in the "System Unit - Velocity" parameter. (see Page 104)

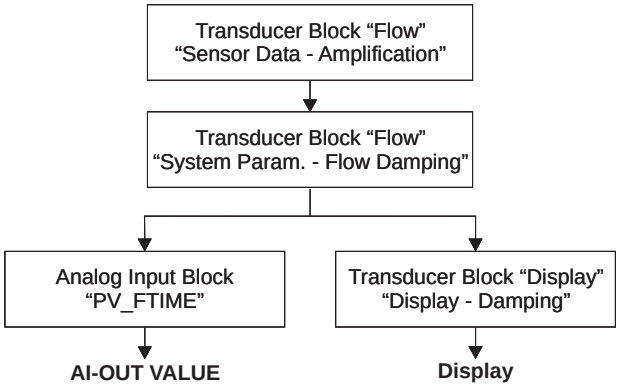
Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Unit - Velocity	**Read only**	The unit for the velocity appears on the display. **Display:** Meter/second → m/s Feet/second → ft/s **Factory setting:** Depends on country. ✎ Note! The unit displayed in this function depends on the option selected in the "System Unit - Length" parameter (see Page 86): ■ If the option "System Unit - Length" = mm is chosen → Unit in this function = m/s ■ If the option "System Unit - Length" = inch is chosen → Unit in this function = ft/s
System Value - Z-Factor	**Read only**	✎ Note! This value is not available unless the COMPRESSED AIR or NATURAL GAS NX-19 option was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). ■ If COMPRESSED AIR is selected, the calculated real gas constant Z is displayed. ■ If NATURAL GAS NX-19 is selected, the "Supercompressibility Factor" is displayed. If another option was selected, NaN (not-a-number) appears for the value for the process variable and "– – – –" appears on the local display. **Display:** 5-digit floating point number, e.g. 0.9467 ✎ Note! The real gas constant Z indicates how far a real gas differs from an ideal gas which exactly fulfills the general gas law (p x V / T = constant, Z = 1). The real gas constant approaches the value 1 the further the real gas is from its liquefaction point.
System Unit - Length	**AUTO - OOS**	Use this function to select the unit for the length of the nominal diameter. The unit you select here is valid for: ■ Sensor nominal diameter (see Page 110, "Sensor Data - Nominal Diameter") ■ Mating pipe diameter, (see Page 106, "Process Param. – Mating Pipe Diameter Unit") ■ Unit for velocity (see Page 104, "System Unit - Velocity") **Options:** – *Millimeter → mm* – Inch → inch **Factory setting:** Depends on country.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Process Param. - Mating Pipe Diameter	**AUTO - OOS**	The measuring device has diameter jump correction. This can be activated by entering the actual value of the mating pipe in this function (see Fig. 32). If the mating pipe (d1) and the measuring pipe (d2) have different diameters, this alters the flow profile. A diameter jump can occur if: ■ The mating pipe has a different pressure rating to that of the measuring device. ■ The mating pipe has another schedule to that of the measuring pipe (e.g. 80 instead of 40), for ANSI. ■ The mating pipe is made of another material, for DIN. To correct any resulting shift in the calibration factor, enter the actual value of the mating pipe (d1) in this function.  *Fig. 32: Mating pipe/measuring tube* *d1 > d2* *d1 = Diameter of mating pipe* *d2 = Diameter of measuring pipe* **User input:** Depends on the meter body type MB **Factory setting:** 0 ✎ Note! ■ Inlet correction is switched off if 0 is entered in this function. ■ The associated unit is displayed in the "Process Param. – Mating Pipe Diameter Unit" parameter (see Page 106). ■ Only diameter jumps within the same nominal diameter class (e.g. DN 50/2") can be corrected. ■ If the internal diameter of the process mating flange is larger than the internal diameter ot the Vortex flange, you must reckon with an additional uncertainty of typically 0.1% (of the reading) per 1 mm deviation. ■ If the internal diameter of the process mating flange is smaller than the internal diameter ot the Vortex flange, you must reckon with an additional uncertainty of typically 0.2% (of the reading) per 1 mm deviation. ■ The diameter jump should only be corrected within the following limit values (for which test measurements have also been performed). Flange connection: DN 15 (½"): ±20% of the internal diameter DN 25 (1"): ±15% of the internal diameter DN 40 (1½"): ±12% of the internal diameter DN ≥ 50 (2"): ±10% of the internal diameter Continued on next page

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Process Param. - Mating Pipe Diameter (continued)		Wafer: DN 15 (½"): ±15% of the internal diameter DN 25 (1"): ±12% of the internal diameter DN 40 (1½"): ±9% of the internal diameter DN ≥ 50 (2"): ±8% of the internal diameter
Process Param. - Mating Pipe Diameter Unit	**Read only**	The unit for the diameter jump correction appears on the display. ✎ Note! The unit for the diameter jump correction is determined by means of the "System Unit - Length" function (see Page 104).
Low Flow Cut Off - Assign	**AUTO - OOS**	Use this parameter to specify which process variable the low flow cut off acts on. **Options:** Off Volume Flow Calc. Mass Flow Corr. Volume Flow Heat Flow *Reynolds-No. **Factory setting:** Volume Flow * This option should only be used if the option SATURATED STEAM, WATER, COMPRESSED AIR, SUPERHEATED STEAM or NATURAL GAS NX-19 was selected in the "Select Fluid" parameter (Transducer Block "Flow Computer"). ✎ Note! Low flow cut off is not taken into account if an option was selected which cannot be calculated for the fluid selected (e.g. standard volume for saturated steam).

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Low Flow Cut Off - On Value	**AUTO - OOS**	Use this function to enter the on-value for low flow cut off. If VOLUME FLOW, MASS FLOW, CORRECTED VOLUME FLOW or HEAT FLOW is selected in the "Low Flow Cut Off - Assign" parameter (see Page 106): Low flow cut off is switched on if the value entered is not equal to 0. **User input:** 5-digit floating-point number **Factory setting:** Below the standard measuring range ✎ Note! The associated unit is displayed in the "Low Flow Cut Off. – Unit" parameter. If REYNOLDS NUMBER is selected in the "Low Flow Cut Off - Assign" parameter (see Page 106): If the Reynolds number entered here is undershot, low flow cut off becomes active. **User input:** 4000 to 99999 **Factory setting:** 20000 Device behavior in event of active low flow cut off: ■ A flow value of "0" is output. ■ The totalizers stop adding up. ■ An inverted plus sign is shown on the local display of the flow value.
Low Flow Cut Off - Unit	**Read only**	The unit for the low flow cut off appears on the display. ✎ Note! The unit for low flow cut off is determined depending on the option selected in the "Low Flow Cut Off – Assign" parameter (see Page 106).

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Low Flow Cut Off - Off Value	**AUTO - OOS**	Use this function to enter the off-value (b) for low flow cut off. Enter the off-value as a positive hysteresis (H) from the on-value (a). **User input:** Integer 0 to 100% **Factory setting:** 50%  A0003882 ① = *On-value,* ② = *Off-value* *a = Low flow cut off is switched on* *b = Low flow cut off is switched off (a + a · H)* *H = Hysteresis value: 0 to 100%* ▒ = *Low flow cut off active* *Q = Flow*
System Param. - Positive Zero Return	**AUTO - OOS**	Use this function to interrupt evaluation of measured variables. This is necessary when a pipe is being cleaned, for example. This setting acts on all parameters and calculations of the measuring device. **Options:** Off On (signal output is set to the "ZERO FLOW" value) **Factory setting:** Off. Device behavior in event of active positive zero return: ■ A flow value of "0" is output. ■ The totalizers stop adding up. ■ Device status → Notice message #601 "POSITIVE ZERO RETURN" active, see Page 60 ✎ Note! Positive zero return can also be controlled via FOUNDATION Fieldbus using cyclic data transfer via the Discrete Output Function Block (see Page 154 ff.).

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Param. - Flow Damping	**AUTO - OOS**	For setting the filter depth. 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. **User input:** 0 to 100 **Factory setting:** 1 s ✎ Note! Damping acts on all parameters and on all downstream FOUNDATION Fieldbus Analog Input Function Blocks.  *Fig. 33: Setting the filter depth*
Sensor Data - K-Factor	**AUTO - OOS**	The current calibration factor of the sensor appears on the display. **Display:** e.g. 100 P/l (pulse per liter) ✎ Note! The K-factor is also given on the nameplate, the sensor and the calibration protocol under "K-fct.". ☞ Caution! Do not change this value, because a change will inevitably affect the accuracy of the measuring device.
Sensor Data - K-Factor Compens.	**AUTO - OOS**	The current compensated calibration factor of the sensor appears on the display. The temperature-dependent expansion of the sensor and diameter jumps in the inlet of the device are compensated. **Display:** e.g. 100 P/l (pulse per liter) ☞ Caution! Do not change this value, because a change will inevitably affect the accuracy of the measuring device.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Sensor Data - Nominal Diameter	**AUTO - OOS**	The nominal diameter of the sensor appears on the display. **Display:** e.g. "DN 25 mm -1 Inch" Caution! Do not change this value, because a change will inevitably affect the accuracy of the measuring device.
Sensor Data - Meter Body MB	**AUTO - OOS**	The type of meter body (MB) of the sensor appears on the display. **Display:** e.g. 71 Note! Use this function to specify the nominal diameter and the sensor type. Caution! Do not change this value, because a change will inevitably affect the accuracy of the measuring device.
Sensor Data - Temperature Coeff.	**AUTO - OOS**	The temperature effect on the calibration factor appears on the display. Due to changes in temperature, the meter body expands differently, depending on the material. The expansion has an effect on the K-factor. **Display:** 4.88 e-5/K $\rightarrow$ $4.88*10^{-5}$ (stainless steel) Caution! Do not change this value, because a change will inevitably affect the accuracy of the measuring device.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Sensor Data - Amplification	**AUTO - OOS**	Devices are always optimally configured for the process conditions you specified. Under certain process conditions, however, interference signals (e.g. strong vibrations) can be suppressed or the measuring range extended by adjusting the amplification. The amplification is configured as follows: ■ A larger value can be entered for the amplification if the fluid is slow-flowing, the density is low and there are minor disturbance influences (e.g. plant vibrations). ■ A smaller value can be entered for the amplification if the fluid is fast-flowing, the density is high and there are strong disturbance influences (e.g. plant vibrations). Caution! Incorrectly configured amplification can have the following effects: ■ The measuring range is limited in such a way that small flows cannot be recorded or displayed. In this instance, the value for the amplification must be increased. ■ Undesired interference signals are registered by the device which means that a flow is recorded and displayed even if the fluid is at a standstill. In this instance, the value for the amplification must be reduced. **Options:** 1 to 5 (1 = smallest amplification, 5= largest amplification) **Factory setting:** 3
Sensor Data - Offset T-Sensor	**AUTO - OOS**	Use this function to enter the zero offset value for the temperature sensor. The value entered in this function is added to the measured temperature value. **User input:** -10 to 10 °C (-18 to 18°F; converted to "System Unit - Temperature") **Factory setting:** 0.00 °C

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Sensor Data - Cable Length	**AUTO - OOS**	Use this function to enter the cable length for the remote version. ✎ Note! ■ A cable length of 0 m is specified for the compact version. ■ If the cable supplied for connecting the device is shortened, the new cable length must be entered here in this function. The cable length can be rounded up or off since the value entered is in steps of a meter (example: new cable length = 7.81 m → Value entered = 8 m) ■ If a cable is used which does not correspond to the cable specification, the value for this function must be calculated (see Note in the Cable Specifications Section on Page 23). **User input:** 0-30 m or 0-98 ft **Unit:** The unit depends on the option selected in the "System Unit - Length" parameter (Page 104): ■ If the option "System Unit - Length" = mm is chosen → Unit in this function = m ■ If the option "System Unit - Length" = inch is chosen → Unit in this function = ft **Factory setting:** ■ For compact version: 0 m or 0 ft ■ For remote version 10 m or 30 ft: 10 m or 30 ft ■ For remote version 30 m or 98 ft: 30 m or 98 ft
Simulation - Measurand	**AUTO - OOS**	Use this parameter to activate the simulation of the process variables of the volume flow/mass flow. **Options:** Off Volume Flow Temperature Calc. Mass Flow Corr. Volume Flow Heat Flow **Factory setting:** Off Device behavior in event of active simulation: Device status → Notice message #692 "SIMULATION MEASURAND" active, see Page 60 ☝ Caution! ■ The measuring device cannot be used for measuring while this simulation is in progress. ■ The simulation acts regardless of the setting of the DIP switch for the simulation mode. ■ The setting is not saved if the power supply fails.

Transducer Block "Flow" (E+H parameters) / base index 500		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Simulation - Measurand Value	**AUTO - OOS**	✎ Note! This function is not effective unless the "Simulation - Measurand" function is active. Use this function to specify a selectable value (e.g. 12 dm^3/s). This is used to check the assigned parameters in the device itself and downstream signal circuits. **User input:** 5-digit floating-point number **Factory setting:** 0 ✎ Note! The unit is displayed in the "Simulation - Unit" parameter. ☝ Caution! The setting is not saved if the power supply fails.
Simulation - Unit	**Read only**	The current unit for the simulation value in the "Simulation - Measurand Value" parameter appears on the display. ✎ Note! The unit depends on the option selected in the "Simulation – Measurand" parameter (see Page 112)
Serial Number	**Read only**	The serial number of the sensor appears on the display.
Sensor - Type	**Read only**	The sensor type (e.g. Prowirl F) appears on the display.
Sensor - Serial Number DSC Sensor	**Read only**	The serial number of the DSC sensor appears on the display.

11. 6 E+H parameters: Transducer Block "Totalizer 1" or "Totalizer 2"

The following table shows all the E+H-specific parameters of the Transducer Block "Totalizer 1" or "Totalizer 2". These can only be changed after entering an enabling code in the "Un-/Locking - Access Code" parameter.

Transducer Block "Totalizer 1" / "Totalizer 2" (E+H parameter) / base index 600/700		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
✎ Note! The FOUNDATION Fieldbus parameters are described on Page 94		
Un-/Locking - Access Code	**AUTO - OOS**	All data of the measuring system are protected against inadvertent change. Programming of the manufacturer-specific parameters is disabled and the settings cannot be changed until a code is entered in this function. You can enable programming by entering the: ■ Code 73 (factory setting) ■ Personal code, see "Un-/Locking – Define Private Code" parameter (see Page 142) Transducer Block "Display" **User input:** Max. 4-digit number (0 to 9999) ✎ Note! ■ If write protection is enabled, access to manufacturer-specific parameters is denied even if the right code is entered. Write protection can be enabled or disabled by means of DIP switches (see Page 35). ■ You can disable programming again by entering any number in this function (other than the Private Code). ■ The Endress+Hauser service organization can be of assistance if you mislay your private code. ■ Certain parameters can only be altered if a special Service Code is entered. This Service Code is known to your Endress+Hauser service organization. Please contact your Endress+Hauser service point if anything needs clarification.
Un-/Locking - Access Status	**Read only**	Use this function to display the current status of the possibilities for accessing the manufacturer-specific parameters of the device. **Display:** ■ LOCKED (parameters cannot be modified) ■ ACCESS CUSTOMER (parameters can be modified) ■ ACCESS SERVICE (parameters can be modified, access to service level)
Totalizer - System Value	**Read only**	The total for the totalizer's measured variable aggregated since measuring commenced appears on the display. The value of the totalizer is made available as a process variable to the downstream Analog Input Function Blocks. ✎ Note! ■ The unit is displayed in the "Totalizer - System Unit" parameter (see Page 115). ■ The behavior of the totalizers in the event of a fault is determined in the "Totalizer - Failsafe Mode" parameter (see Page 117).

Transducer Block "Totalizer 1" / "Totalizer 2" (E+H parameter) / base index 600/700		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Totalizer - System Unit	**AUTO - OOS**	Use this function to define the unit for the totalizer. The suitable units have to be configured depending on the option selected in the "Totalizer - Assign" parameter (see Page 116) (volume or mass or standard volume). **Options:** ■ For function "Totalizer - Assign" = Volume Flow 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 Million gallon → US Mgal Barrel → US bbl NORM.FL. (normal fluids) Barrel → US bbl BEER (beer) Barrel → US bbl PETROCH.(petrochemicals) Barrel → US bbl TANK (filling tanks) 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. ■ For function "Totalizer - Assign" = Calc. Mass Flow Metric: Gram → g Kilogram → kg Metric ton → t US: Ounce → oz Pound → lb Ton → ton

Transducer Block "Totalizer 1" / "Totalizer 2" (E+H parameter) / base index 600/700		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Continued		■ For function "Totalizer - Assign " = Corr. Volume Flow Metric: Norm liter → Nl Norm cubic meter → Nm^3 US: Standard cubic meter → Sm^3 Standard cubic feet → Scf ■ For function "Totalizer - Assign" = Heat Flow Metric: Kilowatt hour → kWh Megawatt hour → MWh Kilojoule → kJ Megajoule → MJ Gigajoule → GJ Kilocalories → kcal Megacalories → Mcal Gigacalories → Gcal US: Ton/hour → tonh British Thermal Unit BTU: Kilo BTU → kBtu Mega BTU → MBtu Giga BTU → GBtu **Factory setting** Depends on country.
Totalizer - Assign	**AUTO - OOS**	Use this function to assign a measured variable for the totalizer. **Options:** Off Volume Flow Calc. Mass Flow Corr. Volume Flow Heat Flow **Factory setting:** Volume Flow ✎ Note! ■ The totalizer is reset to "0" as soon as the selection is changed. ■ If the option selected is changed, the related unit must be adjusted in the "Totalizer - System Unit" parameter (Page 115)!

Transducer Block "Totalizer 1" / "Totalizer 2" (E+H parameter) / base index 600/700		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Totalizer - Reset	**AUTO - OOS**	Use this function to reset the totalizer ("Totalizer – System Value" parameter) to 0 (= RESET). **Options:** No Yes **Factory setting:** No ✎ Note! Totalizer resetting can be controlled or triggered via FOUNDATION Fieldbus by means of cyclic data transfer via the Discrete Output Function Block (see Page 154 ff.).
Totalizer - Reset All	**AUTO - OOS**	Use this function to reset totalizers 1 and 2 simultaneously to the value 0 (= RESET). **Options:** No Yes **Factory setting:** No ✎ Note! Totalizer resetting can be controlled or triggered via FOUNDATION Fieldbus by means of cyclic data transfer via the Discrete Output Function Block (see Page 154 ff.).
Totalizers - Failsafe Mode	**AUTO - OOS**	Use this function to define the response of the totalizers to 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. 7 E+H parameters: Transducer Block "Flow Computer"

The following table shows all the E+H-specific parameters of the Transducer Block "Flow Computer". These can only be changed after entering an enabling code in the "Un-/Locking - Access Code" parameter.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
✎ Note! The FOUNDATION Fieldbus parameters of this block are described on Page 39		
Un-/Locking - Access Code	**AUTO - OOS**	This parameter is described on Page 96.
Un-/Locking - Access Status	**Read only**	This parameter is described on Page 96.
Activation NX-19	**AUTO - OOS**	For entering the activation code for the "Natural gas NX-19" software option (only relevant when replacing the amplifier board). With the software option "Natural gas NX-19", the selection of the fluid 'Natural gas NX-19' is enabled in the "Select Fluid" parameter. **User input:** 8-digit number: 0 to 99999999 ✎ Note! If you purchased the measuring device with the software option, you can also take the activation code from the service plate in the electronics compartment cover.
System Value - Volume Flow	**Read only**	This parameter is described on Page 96.
System Unit - Volume Flow	**AUTO - OOS**	This parameter is described on Page 96.
System Value - Calc. Mass Flow	**Read only**	This parameter is described on Page 96.
System Unit - Calc. Mass Flow	**AUTO - OOS**	This parameter is described on Page 96.
System Value - Corr. Volume Flow	**Read only**	This parameter is described on Page 96.
System Unit - Corr. Volume Flow	**AUTO - OOS**	This parameter is described on Page 96.
System Value - Heat Flow	**Read only**	This parameter is described on Page 96.
System Unit - Heat Flow	**AUTO - OOS**	This parameter is described on Page 96.
System Value - Density	**Read only**	This parameter is described on Page 96.
System Unit - Density	**AUTO - OOS**	This parameter is described on Page 96.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System Value - Temperature	**Read only**	This parameter is described on Page 96.
System Unit - Temperature	**Read only**	This parameter is described on Page 96.
System Value - Spec. Enthalpy	**Read only**	This parameter is described on Page 96.
System Unit - Spec. Enthalpy	**AUTO - OOS**	This parameter is described on Page 96.
System Value - Calc. Sat. Pressure	**Read only**	This parameter is described on Page 96.
System Unit- Pressure	**AUTO - OOS**	This parameter is described on Page 96.
System Value - Vortex Frequency	**Read only**	This parameter is described on Page 96.
System Value - Velocity	**Read only**	This parameter is described on Page 96.
System Unit - Velocity	**Read only**	This parameter is described on Page 96.
System Value - Z-Factor	**Read only**	This parameter is described on Page 96.
Select Fluid	**AUTO - OOS**	**Options:** Saturated Steam Sup. Steam Water Real Gas; see Note Compressed Air *Nat. Gas NX-19 User Def. Liquid Gas Volume Liquid Volume *Only available with software option "Natural gas NX-19"; for activation, see "Activation NX-19" function. **Factory setting:** See parameter printout supplied

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Continued	**AUTO - OOS**	**Information on the fluids which can be selected:** **Option selected for fluid → Saturated Steam** *Applications:* Calculation of the mass flow and the enthalpy it contains at the output of a steam generator or an individual consumer. *Calculated variables:* The mass flow, heat flow, density and the specific enthalpy are calculated from the measured volume flow and the measured temperature, with the aid of the saturated steam curve to the international standard IAPWSIF97 (ASME steam data). *Formulae for calculation:* ■ Mass flow: $m = q \cdot \rho(T)$ ■ Enthalpy: $E = q \cdot \rho(T) \cdot h_D(T)$ m = Mass flow E = Enthalpy q = Volume flow (measured) h_D = Specific density T = Operating temperature (measured) ρ = Density (from saturated steam curve in accordance with IAPWS-IF97 (ASME)) **Option selected for fluid → Sup. Steam (superheated steam)** *Applications:* Calculation of the mass flow and the enthalpy it contains at the output of a steam generator or an individual consumer. ✎ Note! The average operating pressure (p) in the steam line is needed for calculating the process variables and the measuring range limit values. The operating pressure can be specified as follows: ■ Continuous operating pressure → Cyclically from a pressure measuring instrument via FOUNDATION Fieldbus interface by means of the Analog Output Function Block (see Page 155 ff.) ■ Constant operating pressure → Entry in the "Operating Pressure" parameter (see Page 122). Calculated variables: The mass flow, heat flow, density and the specific enthalpy are calculated from the measured volume flow, the measured temperature and the specified operating pressure, with the aid of the saturated steam curve to the international standard IAPWS-IF97 (ASME steam data).

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Continued	**AUTO - OOS**	*Formulae for calculation:* ■ Mass flow: $m = q \cdot \rho(T, p)$ ■ Enthalpy: $E = q \cdot \rho(T, p) \cdot h_D(T, p)$ m = Mass flow E = Enthalpy q = Volume flow (measured) h_D = Specific density T = Operating temperature (measured) p = Operating pressure (from "Operating Pressure" function, see Page 128) ρ = Density (from saturated steam curve in accordance with IAPWS-IF97 (ASME)) **Option selected for fluid → Water** *Applications:* Calculation of the enthalpy in a flow of water, e.g. to determine the residual heat in the return of a heat exchanger. ✎ Note! The average operating pressure (p) in the steam line is needed for calculating the process variables and the measuring range limit values. The operating pressure can be specified as follows: ■ Continuous operating pressure → Cyclically from a pressure measuring instrument via FOUNDATION Fieldbus interface by means of the Analog Output Function Block (see Page 155 ff.) ■ Constant operating pressure → Entry in the "Operating Pressure" parameter (see Page 122). *Calculated variables:* The mass flow, heat flow, density and the specific enthalpy are calculated from the measured volume flow, the measured temperature and the specified operating pressure, with the aid of the saturated steam curve to the international standard IAOWS-IF97 (ASME water data).

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Continued	**AUTO - OOS**	*Formulae for calculation:* ■ Mass flow: $m = q \cdot \rho(T, p)$ ■ Enthalpy: $E = q \cdot \rho(T, p) \cdot h(T)$ ■ Corrected volume flow: $q_{ref} = q \cdot \frac{\rho(T, p)}{\rho_{ref}}$ m = Mass flow E = Enthalpy q = Volume flow (measured) q_{ref} = Corrected volume flow h = Specific density of water T = Operating temperature (measured) p = Operating pressure (from "Operating Pressure" function see Page 128) ρ = Density (from saturated steam curve in accordance with IAPWS-IF97 (ASME)) ρ_{ref} = Reference density (from "Process Param. - Ref. Density" function, see Page 129) **Option selected for fluid → Real Gas, Compressed Air, Nat. Gas NX-19** *Applications:* Calculation of the mass flow and the corrected volume flow of gases. ✎ Note! The average operating pressure (p) in the steam line is needed for calculating the process variables and the measuring range limit values. The operating pressure can be specified as follows: ■ Continuous operating pressure → Cyclically from a pressure measuring instrument via FOUNDATION Fieldbus interface by means of the Analog Output Function Block (see Page 155 ff.) ■ Constant operating pressure → Entry in the "Operating Pressure" parameter (see Page 122). *Calculated variables:* The mass flow, density and the corrected volume flow are calculated from the measured volume flow, the measured temperature and the specified operating pressure using data stored in the device. ✎ Note! The NX-19 equation is suitable for natural gas up to a specific density of 0.75. The specific density describes the ratio of the reference density of the natural gas to the reference density of air (see Page 112).

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Continued	**AUTO - OOS**	*Formulae for calculation:* ■ Mass flow: $m = q \cdot \rho(T)$ ■ Density: $\rho(T, p) = \rho_{ref} \cdot \frac{p}{p_{ref}} \cdot \frac{T_{ref}}{T} \cdot \frac{Z_{ref}}{Z}$ ■ Corrected volume flow: $q_{ref} = q \cdot \left(\frac{\rho(T, p)}{\rho_{ref}}\right)$ m = Mass flow q = Volume flow (measured) q_{ref} = Corrected volume flow T = Operating temperature (measured) T_{ref} = Reference temperature ("Ref. Temperature" function, see Page 130) p = Operating pressure (from "Operating Pressure" function see Page 128) p_{ref} = Reference pressure (from "Ref. Pressure" function, see Page 129) ρ = Density ρ_{ref} = Reference density (from "Process Param. - Ref. Density" function, see Page 129) Z = Operating Z-Factor (from "Operating Z-Factor" function, see Page 128)* Z_{ref} = Reference Z-factor (from "Ref. Z-Factor" function, see Page 130)* * The values from the functions are only used for real gas. For compressed air and natural gas NX-19, the necessary data are taken from tables stored in the device. **Option selected for fluid → User Def. Liquid** *Applications:* Calculation of the mass flow of a user-defined liquid, e.g. a thermal oil. *Calculated variables:* The mass flow, density and the corrected volume flow are calculated from the measured volume flow and the measured temperature.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Continued	**AUTO - OOS**	*Formulae for calculation:* ■ Mass flow: $m = q \cdot \rho(T)$ ■ Density: $\rho = \rho_1 \cdot \frac{(T_1)}{(1 + \beta_p \cdot (T - T_1))}$ ■ Corrected volume flow: $q_{ref} = q \cdot \frac{\rho(T)}{\rho_{ref}}$ m = Mass flow q = Volume flow (measured) q_{ref} = Corrected volume flow T = Operating temperature (measured) T_1 = Reference temperature, temperature at which the value for >1 applies ("Temperature Value" function, see Page 125) p = Operating pressure (from "Operating Pressure" function see Page 128) ρ = Density ρ_{ref} = Reference density (from Process Param. Ref. Density function, see Page 129) ρ_1 = Density at which the value for T_1 applies (from "Density Value" function, see Page 126) β_p = Expansion coefficient of the liquid at T1 (from "Expansion Coef." function, see Page 127 **Option selected for fluid → Gas Volume, Liquid Volume** *Applications:* The measured volume flow and the measured temperature are made available for further external processing via the FOUNDATION Fieldbus interface. *Calculated variables:* None in the device; calculation takes place externally.
Error -> Temperature	**AUTO - OOS**	Use this function to enter a temperature value for temperature measurement failure. If temperature measurement fails, the device continues to work with the temperature value entered here. **User input:** 5-digit floating-point number **Factory setting:** 20 °C ✎ Note! The related unit is taken from the "Error-> Temperature Unit" function (see Page 125).

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Error -> Temperature Unit	**Read only**	The unit for the temperature appears on the display. ✎ Note! ■ The related unit is taken from the "System Unit - Temperature" function (see Page 102). ■ If the value in this function is changed, we recommend you reset the totalizers.
Temperature Value	**AUTO - OOS**	✎ Note! The fluid temperature is only evaluated if the USER DEF. LIQUID option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the fluid temperature for the density specified in the "Density Value" parameter (see Page 126) for calculating the operating density of user-defined liquids (formula for calculation, see "Select Fluid" function (Page 119). **User input:** 5-digit floating-point number **Factory setting:** 298.15 K (25 °C) ✎ Note! ■ The related unit is taken from the "System Unit Temperature" function (see Page 102). ■ If the value in this function is changed, we recommend you reset the totalizers. ■ A table with sample values (for the "Temperature Value", "Density Value" (see Page 126) and "Expansion Coef." functions (see Page 127) for various fluids can be found on Page 132. ☝ Caution! This setting does not change the permitted temperature range of the measuring system. Please pay particular attention to the temperature application limits specified in the product specification (see Page 76).
Temperature Value Unit	**Read only**	The unit for the "Temperature Value" appears on the display. ✎ Note! ■ The related unit is taken from the "System Unit - Temperature" function (see Page 102). ■ If the value in this function is changed, we recommend you reset the totalizers.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Density Value	**AUTO - OOS**	✎ Note! The fluid density is only evaluated if the USER DEF. LIQUID option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the fluid density for the fluid temperature specified in the "System Value - Temperature" parameter (see Page 119) for calculating the operating density of user-defined liquids (formula for calculation, see "Select Fluid" function (Page 119). **User input:** 5-digit floating-point number **Factory setting:** 1.0000 kg/dm³) ✎ Note! ■ The associated unit is displayed in the "Density Value Unit" parameter. ■ If the value in this function is changed, we recommend you reset the totalizers. ■ A table with sample values (for the "Temperature Value", "Density Value" (see Page 126) and "Expansion Coef." functions (see Page 127) for various fluids can be found on Page 132.
Density Value Unit	**Read only**	The unit for the "Density Value" appears on the display. ✎ Note! ■ The related unit is taken from the "System Unit - Density" function (see Page 118). ■ If the value in this function is changed, we recommend you reset the totalizers.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Expansion Coef.	**AUTO - OOS**	✎ Note! The expansion coefficient is only evaluated if the USER DEF. LIQUID option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the expansion coefficient for calculating the operating density of user-defined liquids (formula for calculation, see "Select Fluid" function (see Page 119). **User input:** 5-digit floating point number, incl. unit (10^{-4} · 1/unit temperature) **Factory setting:** 2.0700 [10^{-4} 1/K] (expansion coefficient for water at 20 °C) ✎ Note! ■ If the value in this function is changed, we recommend you reset the totalizers. ■ You can determine the expansion coefficient with the aid of the Applicator ("Fluid Properties" tab). Applicator is software from Endress+Hauser for selecting and planning flowmeters. The Applicator is available both via the Internet (www.applicator.com) and on a CD-ROM for local PC installation. ■ If two value pairs are known for temperature and density (density $\rho 1$ at temperature T1 and density $\rho 2$ at temperature T2), the expansion coefficient can be calculated as follows: $$\beta_p = \frac{\frac{\rho_1}{\rho_2} - 1}{T_2 - T_1}$$ ■ A table with sample values (for the "Temperature Value", "Density Value" (see Page 126) and "Expansion Coef." functions (see Page 127) for various fluids can be found on Page 132. ✎ Note! The associated unit is displayed in the "Expansion Coef. Unit" parameter.
Expansion Coef. Unit	**Read only**	For selecting the unit for "Expansion Coef.". **Options:** 10^{-4} 1/°C → E-04 [1/°C] 10^{-4} 1/K → E-04 [1/K] 10^{-4} 1/°F → E-04 [1/°F] 10^{-4} 1/°R → E-04 [1/°R] **Factory setting:** Depends on country.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Operating Pressure	**AUTO - OOS**	✎ Note! The operating pressure is only evaluated if the REAL GAS, COMPRESSED AIR, SUPERHEATED STEAM, NATURAL GAS NX-19 or WATER option was selected in the "Select Fluid" parameter (see Page 119). Use this function to enter a constant medium pressure for calculating the operating density (formula for calculation, see "Select Fluid" function (Page 119)) or for displaying the pressure measured value transmitted by the Analog Output Function Block (see Page 156 ff.) via FOUNDATION Fieldbus. **User input:** 5-digit floating-point number **Factory setting:** 1 (unit in bara) ✎ Note! ■ The associated unit is displayed in the "Expansion Coef. Unit" parameter. ■ If the value is permanently specified via this parameter, exact calculation can only take place at a constant operating pressure. ■ By means of the Analog Output Function Block, a value for the operating pressure can be read in continuously (cyclically) from a pressure measuring instrument via the FOUNDATION Fieldbus interface. If this transmission is active, the transmitted value is displayed in this parameter and cannot be changed.
Operating Pressure Unit	**Read only**	The unit for the "Operating Pressure" appears on the display. ✎ Note! ■ The related unit is taken from the "System Unit - Pressure" function (see Page 119).
Operating Z-Factor	**AUTO - OOS**	✎ Note! The Z-factor is only evaluated if the REAL GAS option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the Z-factor for gas under operating conditions, i.e. for the average temperature to be expected (formula for calculation, see "Select Fluid" function (Page 119). The real gas constant Z indicates how far a real gas differs from an ideal gas which exactly fulfills the general gas law ($p \cdot V / T$ = constant, $Z = 1$). The real gas constant approaches the value 1 the further the real gas is from its liquefaction point. **User input:** 5-digit floating-point number (value entered must be > 0) **Factory setting:** 1.0000 ✎ Note! You can determine the Z-factor with the aid of the Applicator. Applicator is software from Endress+Hauser for selecting and planning flowmeters. The Applicator is available both via the Internet (www.applicator.com) and on a CD-ROM for local PC installation.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Process Param. - Ref. Density	**AUTO - OOS**	✎ Note! The reference density is only evaluated if the REAL GAS or USER DEF. LIQUID option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the reference density of the fluid to calculate the standard volume and the density of real gas (formula for calculation, see "Select Fluid" function (see Page 119), as well as the standard volume of a user-defined liquid. **User input:** In accordance with order, otherwise 1 ✎ Note! ■ The unit is displayed in the "Process Param. – Ref. Density Unit" parameter ■ If the value in this function is changed, we recommend you reset the totalizer.
Process Param. - Ref. Density Unit	**Read only**	**The unit for the reference density appears on the display.** ✎ Note! ■ The related unit is taken from the "System Unit - Density" function (see Page 118). ■ If the value in this function is changed, we recommend you reset the totalizers.
Ref. Pressure	**AUTO - OOS**	✎ Note! The reference pressure is only evaluated if the REAL GAS, COMPRESSED AIR or NATURAL GAS NX-19 option was selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the reference pressure of the fluid for calculating the operating density of real gas and natural gas NX-19 (formula for calculation, see "Select Fluid" function (P. 119), as well as for the standard volume calculation of compressed air and natural gas NX-19. **User input:** 5-digit floating-point number **Factory setting:** 1.0000 ✎ Note! The associated unit is displayed in the "Ref. Pressure Unit" parameter.
Ref. Pressure Unit	**Read only**	**The unit for the reference pressure appears on the display.** ✎ Note! The related unit is taken from the "System Unit - Pressure" function (see Page 119).

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Ref. Temperature	**AUTO - OOS**	✎ Note! The reference temperature is only evaluated if the REAL GAS, COMPRESSED AIR or NATURAL GAS NX-19 option was selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the reference temperature of the fluid for calculating the operating density of real gas and natural gas NX-19 (formula for calculation, see "Select Fluid" function (see Page 119), as well as for the standard volume calculation of compressed air and natural gas NX-19. **User input:** 5-digit floating-point number **Factory setting:** 273.15K ✎ Note! The associated unit is displayed in the "Ref. Temperature Unit" parameter. ☝ Caution! This setting does not change the permitted temperature range of the measuring system. Please pay particular attention to the temperature application limits specified in the product specification (see Page 76).
Ref. Temperature Unit	**Read only**	**The unit for the reference temperature appears on the display.** ✎ Note! ■ The related unit is taken from the "System Unit Temperature" function (see Page 102).
Ref. Z-Factor	**AUTO - OOS**	✎ Note! The Z-factor is only evaluated if the REAL GAS option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the Z-factor for gas under reference conditions. The reference conditions are the values defined in the "Ref. Pressure" (Page 129) and "Ref. Temperature" functions (Page 130) (formula for calculation, see "Select Fluid" function (see Page 119). The real gas constant Z indicates how far a real gas differs from an ideal gas which exactly fulfills the general gas law ($p \times V / T$ = constant, $Z = 1$). The real gas constant approaches the value 1 the further the real gas is from its liquefaction point. **User input:** 5-digit floating-point number **Factory setting:** 1.0000 ✎ Note! You can determine the Z-factor with the aid of the Applicator. Applicator is software from Endress+Hauser for selecting and planning flowmeters. The Applicator is available both via the Internet (www.applicator.com) and on a CD-ROM for local PC installation.

Transducer Block "Flow Computer" (E+H parameters) / base index 800		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Spec. Gravity	**AUTO - OOS**	✎ Note! The specific density is only evaluated if the NATURAL GAS NX-19 option is selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the specific density of natural gas (ratio of density of natural gas at reference conditions to density of air at reference conditions; corresponds to "relative density" in accordance with ISO 14532-2003). **User input:** 5-digit floating-point number **Factory setting:** 0.6640 ✎ Note! The values entered in the "Spec. Gravity", "Mol-% N2"and "Mol-% CO2" functions are interdependent. For this reason, if the value in one of these functions is changed, you have to adjust the values in the other functions accordingly.
Mol-% N2	**AUTO - OOS**	✎ Note! The value for mol-% nitrogen is only evaluated if the NATURAL GAS NX-19 option was selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the mol-% nitrogen in the expected natural gas mixture. **User input:** 5-digit floating-point number **Factory setting:** 0.0000 ✎ Note! The values entered in the "Spec. Gravity", "Mol-% N2"and "Mol-% CO2" functions are interdependent. For this reason, if the value in one of these functions is changed, you have to adjust the values in the other functions accordingly.
Mol-% CO2	**AUTO - OOS**	✎ Note! The value for mol-% carbon dioxide is only evaluated if the NATURAL GAS NX-19 option was selected in the "Select Fluid" parameter (see Page 119). Use this function to enter the mol-% carbon dioxide in the expected natural gas mixture. **User input:** 5-digit floating-point number **Factory setting:** 0.0000 ✎ Note! The values entered in the "Spec. Gravity", "Mol-% N2"and "Mol-% CO2" functions are interdependent. For this reason, if the value in one of these functions is changed, you have to adjust the values in the other functions accordingly.

11.7.1 Sample values

The following sample values for the functions "Temperature Value" (Page 125), "Density Value"(Page 126) and "Expansion Coef." (Page 127). The calculation of the density for user-defined liquids (Page 119) is better the closer the operating temperature is to the value in question in the temperature value column. If the operating temperature deviates a lot from the value in the temperature value column, the expansion coefficient should be calculated as per the formula on Page 127.

Fluid (liquid)	**"Temperature Value" [K]**	**"Density Value" [kg/m^3]**	**"Expansion Coef." [10^{-4} 1/K]**
Air	123.15	594	18.76
Ammonia	298.15	602	25
Argon	133.15	1028	111.3
n-butane	298.15	573	20.7
Carbon dioxide	298.15	713	106.6
Chlorine	298.15	1398	21.9
Cyclohexane	298.15	773	11.6
n-decane	298.15	728	10.2
Ethane	298.15	315	175.3
Ethylene	298.15	386	87.7
n-heptane	298.15	351	12.4
n-hexane	298.15	656	13.8
Hydrogen chloride	298.15	796	70.9
i-butane	298.15	552	22.5
Methane	163.15	331	73.5
Nitrogen	93.15	729	75.3
n-octane	298.15	699	11.1
Oxygen	133.15	876	95.4
n-pentane	298.15	621	16.2
Propane	298.15	493	32.1
Vinyl chloride	298.15	903	19.3
Table values from Carl L. Yaws (2001): Matheson Gas Data Book, 7th edition			

11. 8 E+H parameters: Transducer Block "Adv. Diagnostic"

The following table shows all the E+H-specific parameters of the Transducer Block "Adv. Diagnostic". These can only be changed after entering an enabling code in the "Un-/Locking - Access Code" parameter.

✎ Note!
Access to the parameters and functions of the Transducer Block "Adv. Diagnostic" is only possible with the "Advanced diagnosis" software option. If the software option is not enabled, the value NaN (not-a-number) or "Not licensed" is displayed in the functions. For enabling, see "Activ. adv. Diag" functions, Page 134.

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
✎ Note! The FOUNDATION Fieldbus parameters of this block are described on Page 94.		
Un-/Locking - Access Code	**AUTO - OOS**	All data of the measuring system are protected against inadvertent change. Programming of the manufacturer-specific parameters is disabled and the settings cannot be changed until a code is entered in this function. You can enable programming by entering the: ■ Code 73 (factory setting) ■ Personal code, see "Un-/Locking – Define Private Code" parameter (see Page 142) Transducer Block "Display" **User input:** Max. 4-digit number (0 to 9999) ✎ Note! ■ If write protection is enabled, access to manufacturer-specific parameters is denied even if the right code is entered. Write protection can be enabled or disabled by means of DIP switches (see Page 35). ■ You can disable programming again by entering any number in this function (other than the Access Code). ■ The Endress+Hauser service organization can be of assistance if you mislay your private code. ■ Certain parameters can only be altered if a special Service Code is entered. This Service Code is known to your Endress+Hauser service organization. Please contact your Endress+Hauser service point if anything needs clarification.
Un-/Locking - Access Status	**Read only**	Use this function to display the current status of the possibilities for accessing the manufacturer-specific parameters of the device. **Display:** ■ LOCKED (parameters cannot be modified) ■ ACCESS CUSTOMER (parameters can be modified) ■ ACCESS SERVICE (parameters can be modified, access to service level)

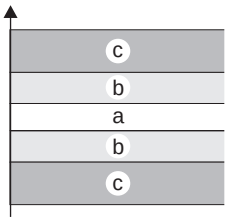
Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Activ. Adv. Diag	**AUTO - OOS**	For entering the activation code for the "Advanced diagnosis" software option (only relevant when replacing the amplifier board). The corresponding functions and parameters are enabled in the Transducer Block "Adv. Diagnostic" by means of the software option "Advanced diagnosis". **User input:** 8-digit number: 0 to 99999999 ✎ Note! If you purchased the measuring device with the software option, you can also take the activation code from the service plate in the electronics compartment cover.
System Value-Temperature	**Read only**	This parameter is described on Page 101.
System Value-Electronics Temperature	**Read only**	The temperature currently measured at the amplifier board appears on the display. **Display:** 4-digit floating-point number, incl. unit and sign (e.g. –23.5 °C; 160.0 °F; 295.4 K; etc.) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
System Unit - Temperature	**Read only**	This parameter is described on Page 102.
System Value-Reynolds-No.	**Read only**	✎ Note! This value is not available unless the SATURATED STEAM, SUPERHEATED STEAM, NATURAL GAS NX-19, WATER or COMPRESSED AIR option was selected in the "Select Fluid" parameter (see Page 119). If another option was selected, NaN (not-a-number) appears for the value for the process variable. The Reynolds number appears on the display. The Reynolds number is determined using the selected fluid and the measured temperature. **Display:** 8-digit fixed-point number (e.g. 25800)
System Value-Velocity	**Read only**	This parameter is described on Page 103.
System Unit - Velocity	**Read only**	This parameter is described on Page 104.

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Fluid Temperature - Diag. Status	**Read only**	The current status of the fluid temperature monitoring appears on the display. **Display:** Good No error or limit value violation active Bad The DSC temperature sensor is defect Low Warn The limit value for the minimum fluid temperature allowed is undershot → "Fluid Temperature - Warning Low" function High Warn The limit value for the maximum fluid temperature allowed is overshot → "Fluid Temperature - Warning High" function Low Limit The limit value for the minimum permitted fluid temperature for the device (-200 °C) is undershot High Limit The limit value for the maximum permitted fluid temperature for the device (+400 °C) is overshot
Fluid Temperature - Min.Value	**Read only**	Smallest measured fluid temperature since the last reset ("Fluid Temperature - Reset" function). **Display:** 5-digit floating-point number, including unit and sign (e.g. 95.3 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
Fluid Temperature - Max.Value	**Read only**	Largest measured fluid temperature since the last reset ("Fluid Temperature - Reset" function). **Display:** 5-digit floating-point number, including unit and sign (e.g. 218.1 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
Fluid Temperature - Reset	**AUTO - OOS**	Reset the values in the "Fluid Temperature - Min.Value" and "Fluid Temperature - Max.Value" functions. **Options:** No Yes **Factory setting:** No

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Fluid Temperature - Warning Low	**AUTO - OOS**	Use this function to enter the lower limit value for monitoring the fluid temperature. This limit value is used to generate a fault message which should indicate a change in the temperature of the fluid in the direction of the specification limits of the device in order to prevent device failure or prevent the process undercooling. Device behavior in event of limit value undershooting: ■ Device status → Fault message #381 "FLUIDTEMP. MIN" active, see Page 57 ■ The status message "Low Warn" is displayed in the "Fluid Temperature - Diag. Status" parameter. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** –195 °C (device specification: –200 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
Fluid Temperature - Warning High	**AUTO - OOS**	Use this function to enter the upper limit value for monitoring the fluid temperature. This limit value is used to generate a fault message which should indicate a change in the temperature of the fluid in the direction of the specification limits of the device in order to prevent device failure or prevent the process overheating. Device behavior in event of limit value overshooting: ■ Device status → Fault message #382 "FLUIDTEMP. MAX" active, see Page 57 ■ The status message "High Warn" is displayed in the "Fluid Temperature - Diag. Status" parameter. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** 400 °C ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Electronics Temperature - Diag. Status	**Read only**	The current status of the temperature monitoring on the amplifier board appears on the display . **Display:** Good No error or limit value violation active Bad The temperature sensor on the amplifier board is defect Low Warn The limit value for the minimum ambient temperature allowed is undershot → "Electronics Temperature - Warning Low" function High Warn The limit value for the maximum ambient temperature allowed is overshot → "Electronics Temperature - Warning High" function Low Limit The limit value for the minimum permitted ambient temperature for the device (-40 °C) is undershot High Limit The limit value for the maximum permitted ambient temperature for the device (compact version 70 °C, remote version 80 °C) is overshot
Electronics Temperature - Min. Value	**Read only**	Smallest measured temperature on the amplifier board since the last reset ("Electronic Temperature - Reset" function). **Display:** 5-digit floating-point number, including unit and sign (e.g. 20.2 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
Electronics Temperature - Max. Value	**Read only**	Largest measured temperature on the amplifier board since the last reset ("Electronic Temperature - Reset" function). **Display:** 5-digit floating-point number, including unit and sign (e.g. 65.3 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
Electronics Temperature - Reset	**AUTO - OOS**	Reset the values in the "Electronic Temperature - Max. Value" and "Electronic Temperature - Min. Value" functions. **Options:** No Yes **Factory setting:** No

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Electronics Temperature - Warning Low	**AUTO - OOS**	Use this function to enter the lower limit value for monitoring the temperature on the amplifier board. This limit value is used to generate a fault message which should indicate a change in the temperature in the direction of the specification limits of the device in order to prevent device failure. Device behavior in event of limit value undershooting: ■ Device status → Fault message #397 "T ELECT. MIN" active, see Page 59 ■ The status message "Low Warn" is displayed in the "Electronics Temperature - Diag. Status" parameter. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** –35 °C (device specification: –40 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.
Electronics Temperature - Warning High	**AUTO - OOS**	Use this function to enter the upper limit value for monitoring the temperature on the amplifier board. This limit value is used to generate a fault message which should indicate a change in the temperature in the direction of the specification limits of the device in order to prevent device failure. Device behavior in event of limit value overshooting: ■ Device status → Fault message #398 "T ELECT. MAX" active, see Page 59 ■ The status message "High Warn" is displayed in the "Electronics Temperature - Diag. Status" parameter. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** 75 °C (device specification: compact version 70 °C, remote version 80 °C) ✎ Note! The related unit is displayed in the "System Unit - Temperature" parameter.

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Sensor - Adv. Diag. Status	**Read only**	The advanced diagnosis status of the sensor appears on the display. **Display:** Good No error active S 316 The temperature sensor has failed or no temperature sensor is available S 379 The device is being operated in the resonance frequency S 394 The DSC sensor is defective, measurement no longer takes place S 395 The DSC sensor is being operated near application limits, device failure is probable soon
Sensor - Adv. Diagnosis	**AUTO - OOS**	Use this function to monitor the capacitive signal of the DSC sensor. The monitoring checks in which area the capacitive signal of the DSC sensor is located (see graphic): a = Signal correct b = Warning prior to measurement failure → Error mess. #395 "DSC SENS LIMIT" active, see Page 58 c = Measurement failure → Error message #394 "DSC SENS DEFCT" active, see Page 58  A0001986 **Options:** Off (error message #395 "DSC SENS LIMIT" switched off) Standard **Factory setting:** Standard
Reynolds - Diag. Status	**Read only**	The current status of the Reynolds number monitoring appears on the display. **Display:** Good No error or no limit value violation of the permitted Reynolds number active Bad Reynolds number monitoring not possible Low Limit The Reynolds number of 20000 is undershot. The accuracy is reduced if the Reynolds number <20000.

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Reynolds - Warning	**AUTO - OOS**	✎ Note! This function is not executed unless the SATURATED STEAM, SUPERHEATED STEAM, NATURAL GAS NX-19, WATER or COMPRESSED AIR option was selected in the "Select Fluid" parameter (see Page 119). Use this function to activate monitoring of the Reynolds number. If a Reynolds number of <20000 is determined during active monitoring, fault message #494 "RE <20 000" (see Page 61) is displayed. ✎ Note! ■ With a Reynolds number of <20000, reduced accuracy of the device must be reckoned with. ■ There is no fault message at zero flow. ■ The fault message does not occur if the "Reynolds-No." option was selected in the "Low Flow Cut Off - Assign" parameter (Page 106). **Options:** Off (function switched off) On **Factory setting:** Off
Velocity - Diag. Status	**Read only**	The current status of the velocity monitoring appears on the display. **Display:** Good No error or no limit value violation of the maximum fluid velocity active High Limit The limit value for the maximum permitted fluid velocity is overshot → "Velocity - Limit" function
Velocity - Warning	**AUTO - OOS**	Use this function to activate monitoring of the fluid velocity. If, during active monitoring, the fluid velocity exceeds the value for the limit velocity, (Velocity - Limit parameter) a fault message is displayed. **Options:** Off (function switched off) On **Factory setting:** Off

Transducer Block "Advanced Diagnostic" (E+H parameters) / base index 900		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Velocity - Limit	**AUTO - OOS**	Use this function to specify the fluid velocity. If the maximum specified fluid velocity is overshot, the fault message #421 "FLOW RANGE" (Page 61) is output. The status message "High Limit" is displayed in the "Velocity - Diag. Status" parameter. **User input:** 5-digit floating-point number **Factory setting:** 75 m/s ✎ Note! The unit used in this function depends on the option selected in the "System Unit - Length" parameter (see Page 104): ■ Selected option "System Unit - Length" = mm → Unit in this function = m/s ■ Selected option "System Unit - Length" = inch → Unit in this function = ft/s

11. 9 E+H parameters: Transducer Block "Display"

The following table shows all the E+H-specific parameters of the Transducer Block "Display". These can only be changed after entering an enabling code in the "Un-/Locking - Access Code" parameter.

Transducer Block "Display" (E+H parameters) / base index 1000		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
✎ Note! The FOUNDATION Fieldbus parameters of this block are described on Page 94.		
Un-/Locking - Access Code	**AUTO - OOS**	All data of the measuring system are protected against inadvertent change. Programming of the manufacturer-specific parameters is disabled and the settings cannot be changed until a code is entered in this function. You can enable programming by entering the: ■ Code 73 (factory setting) ■ Personal code, see "Un-/Locking – Define Private Code" parameter (see Page 142) Transducer Block "Display" **User input:** Max. 4-digit number (0 to 9999) ✎ Note! ■ If write protection is enabled, access to manufacturer-specific parameters is denied even if the right code is entered. Write protection can be enabled or disabled by means of DIP switches (see Page 35). ■ You can disable programming again by entering any number in this function (other than the Access Code). ■ The Endress+Hauser service organization can be of assistance if you mislay your private code. ■ Certain parameters can only be altered if a special Service Code is entered. This Service Code is known to your Endress+Hauser service organization. Please contact your Endress+Hauser service point if anything needs clarification.
Un-/Locking - Access Status	**Read only**	Use this function to display the current status of the possibilities for accessing the manufacturer-specific parameters of the device. **Display:** ■ LOCKED (parameters cannot be modified) ■ ACCESS CUSTOMER (parameters can be modified) ■ ACCESS SERVICE (parameters can be modified, access to service level)
Un-/Locking - Define Private Code	**AUTO - OOS**	Use this function to specify the personal code used to enable the configuration of the manufacturer-specific parameters in the Transducer Blocks. **User input:** Max. 4-digit number: 0 to 9999 **Factory setting:** 73 ✎ 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.

Transducer Block "Display" (E+H parameters) / base index 1000		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Line 1 - Assign	**AUTO - OOS**	Use this function to define which display value is assigned to the main line (top line of the local display) for display during normal measuring operation. **Options:** Off Volume Flow Volume Flow in % Mass Flow Mass Flow in % Corr. Volume Flow Corr. Volflow in % Heat Flow Heat Flow in % Temperature Totalizer 1 Totalizer 2 AI1 - OUT VALUE . . AI7 - OUT VALUE A0 - Pressure Value **Factory setting:** Volume Flow (if no data specified or LIQUID VOLUME or GAS VOLUME specified as fluid when ordering), otherwise Mass Flow
Line 1 - 100%-Value	**AUTO - OOS**	✎ Note! The entry made only becomes effective if one of the following options was selected in the "Line 1 - Assign" parameter: Volume Flow in % Mass Flow in % Corr. Volflow in % For entering the flow value which should be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting** 10 l/s (with volume flow) 10 kg/h (with mass flow) 10 Nm³/h (with corrected volume flow) 10 kW (with heat flow)

Transducer Block "Display" (E+H parameters) / base index 1000		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Line 2-Assign	**AUTO - OOS**	Use this function to define which display value is assigned to the additional line (bottom line of the local display) for display during normal measuring operation. **Options:** Off Volume Flow Volume Flow in % Volume Flow Bargr. % Mass Flow Mass Flow in % Mass Fl.Bargr.% Corr. Volume Flow Corr. Volflow in % Corr. Vol.Fl.Bar.% Heat Flow Heat Flow in % Heat Flow Bar. % Temperature Totalizer 1 Totalizer 2 Oper/Sys.Condit. Tag Name AI1 - OUT VALUE . . AI7 - OUT VALUE A0 - Pressure Value **Factory setting:** Temperature
Line 2-100%-Value	**AUTO - OOS**	✎ Note! The entry made only becomes effective if one of the following options was selected in the "Line 2 - Assign" parameter: Volume Flow in % Volume Flow Bargr. % Mass Flow in % Mass Fl.Bargr.% Corr. Volflow in % Corr. VolFl.Bar.% For entering the flow value which should be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting** 10 l/s (with volume flow) 10 kg/h (with mass flow) 10 Nm^3/h (with corrected volume flow) 10 kW (with heat flow)

Transducer Block "Display" (E+H parameters) / base index 1000		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Display - Language	**AUTO - OOS**	Use this function to select the language for all texts, parameters and messages shown on the local display. **Options:** English Deutsch Francais Espanol Italiano Nederlands Norsk Svenska Suomi Portugues Polski Cesky **Factory setting** Depends on country (see factory settings, Page 158 ff.)
Display - Format	**AUTO - OOS**	Use this function to define the maximum number of places after the decimal point for the value displayed 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 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.
Display - Damping	**AUTO - OOS**	Use this function to enter a time constant defining 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 s **Factory setting** 5 s ✎ Note! ■ The setting 0 seconds switches off damping. ■ The parameter reaction time depends on the time specified by the "System Param. - Flow Damping" parameter (Page 109).

Transducer Block "Display" (E+H parameters) / base index 1000		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
Display - Contrast LCD	**AUTO - OOS**	Use this function to optimize the display contrast to suit local operating conditions. **User input:** 10 to 100% **Factory setting** 50%
Display - Test	**AUTO - OOS**	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 displays the option "Off".

11. 10 E+H parameters: Transducer Block "Diagnosis"

The following table shows all the E+H-specific parameters of the Transducer Block "Diagnosis". These can only be changed after entering an enabling code in the "Un-/Locking - Access Code" parameter.

Transducer Block "Diagnosis" (E+H parameters) / base index 1100		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
✎ Note! The FOUNDATION Fieldbus parameters of this block are described on Page 94.		
Diagnosis - Actual System Condition	**Read only**	The current system status appears on the display. **Display:** "SYSTEM OK" or the fault/notice message with the highest priority. ✎ Note! An exact error description as well as information on rectifying errors can be found on Page 53 ff..
Diagnosis - Previous System Condition	**Read only**	The last error message to occur appears on the display.
Un-/Locking - Access Code	**AUTO - OOS**	All data of the measuring system are protected against inadvertent change. Programming of the manufacturer-specific parameters is disabled and the settings cannot be changed until a code is entered in this function. You can enable programming by entering the: ■ Code 73 (factory setting) ■ Personal code, see "Un-/Locking – Define Private Code" parameter (see Page 142) Transducer Block "Display" **User input:** Max. 4-digit number (0 to 9999) ✎ Note! ■ If write protection is enabled, access to manufacturer-specific parameters is denied even if the right code is entered. Write protection can be enabled or disabled by means of DIP switches (see Page 35). ■ You can disable programming again by entering any number in this function (other than the Access Code). ■ The Endress+Hauser service organization can be of assistance if you mislay your private code. ■ Certain parameters can only be altered if a special Service Code is entered. This Service Code is known to your Endress+Hauser service organization. Please contact your Endress+Hauser service point if anything needs clarification.
"Diagnosis" Un-/Locking - Access Status	**Read only**	Use this function to display the current status of the possibilities for accessing the manufacturer-specific parameters of the device. **Display:** ■ LOCKED (parameters cannot be modified) ■ ACCESS CUSTOMER (parameters can be modified) ■ ACCESS SERVICE (parameters can be modified, access to service level)

Transducer Block "Diagnosis" (E+H parameters) / base index 1100		
Parameter	**Write access for operating mode (MODE_BLK)**	**Description**
System - Alarm Delay	**AUTO - OOS**	Use this function to define a time span for which the criteria for an error have to be satisfied without interruption before a fault or notice message is generated. ✎ Note! Depending on the setting and type of error, this alarm delay affects both the display and the outputs of the FOUNDATION Fieldbus. **User input:** 0 s to 100 s (in steps of one second) **Factory setting:** 0 s ☝ Caution! If this parameter is used, fault and notice messages are delayed by the time corresponding to the setting before being forwarded to the downstream function blocks or the fieldbus host system. It is therefore imperative to check in advance whether a delay of this nature could affect the safety requirements of the process. If fault and notice messages may not be suppressed, a value of 0 seconds must be entered here.
System - Simulation Failsafe Mode	**AUTO - OOS**	Use this function to set the totalizers to their defined failsafe modes, in order to check whether they respond correctly. The failsafe mode of the totalizer is defined via the "Totalizer - Failsafe Mode" parameter in the Transducer Block "Totalizer 1 or 2" (see Page 117). Device behavior in event of active error simulation: Device status → Notice message #691 "SIM. FAILSAFE" active, see Page 60 **Options:** Off On **Factory setting:** Off
System - Reset	**AUTO - OOS**	Use this function to reset the measuring system. **Options:** *No* *Restart System* Restart without disconnecting main power. *Reset Delivery* Restart without disconnecting main power, the saved settings of the delivery status (factory settings) are applied. **Factory setting:** No

11. 11 E+H parameters: Transducer Block "Service"

All the parameters required for service purposes are located in the Transducer Block "Service" (base index 1200). As these parameters affect the accuracy and the functionality of the device, changes may only be carried out by E+H service technicians. The parameters of the Transducer Block "Service" are not described in these Operating Instructions.

11. 12 Analog Input Function Block

In the Analog Input (AI) Function Block, the process variables of the Transducer Blocks are prepared for subsequent automation functions (e.g. scaling and limit value processing). The automation function is defined by connecting up the outputs.

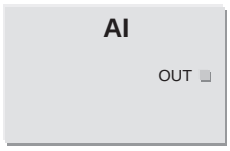


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Fig. 34: Defining the automation function in the Analog Input Function Block

OUT = output value and status of the Analog Input Function Block

11.12.1 Signal processing

The figure schematically illustrates the internal structure of the Analog Input Function Blocks available:

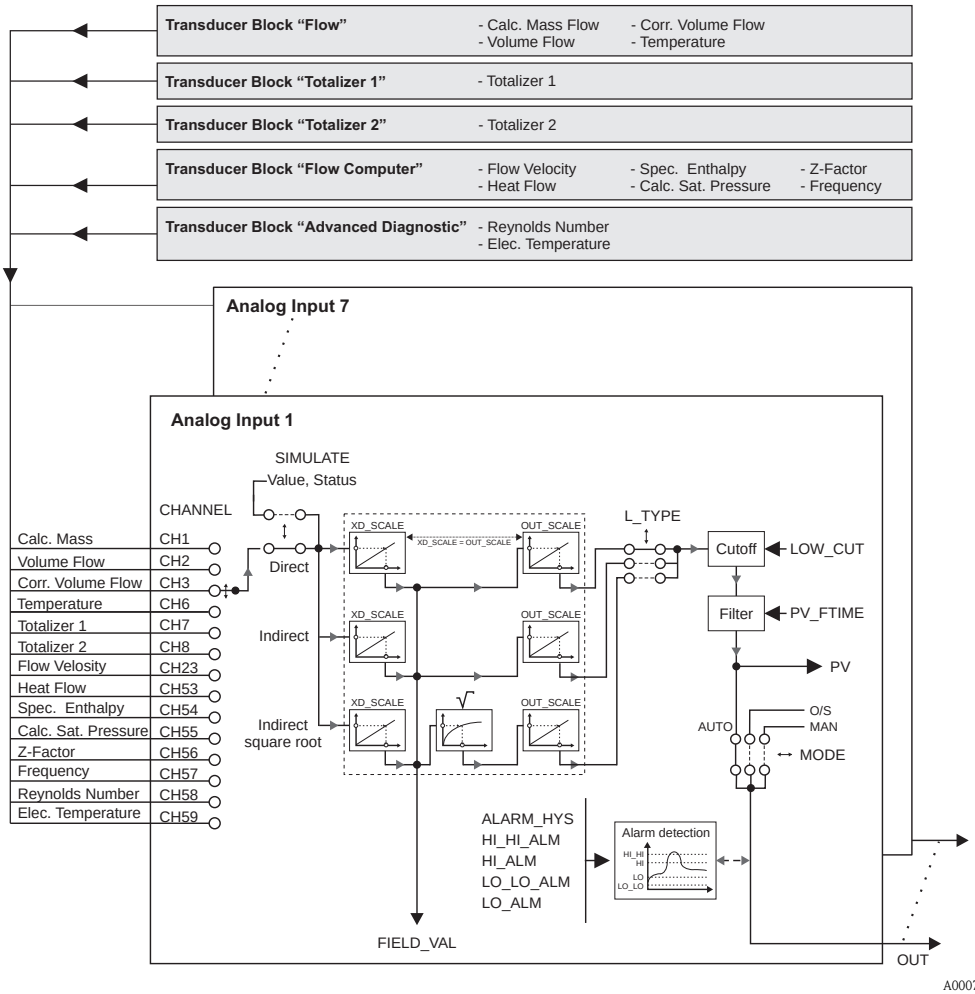

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Fig. 35: Signal processing and structure of the Analog Input Function Blocks

The Analog Input Function Block receives its input value from the Transducer Blocks (see Page 96 ff.). The CHANNEL parameter is used to select which input value should be processed by the Analog Input Function Block.
→ Selection of the process variable see Page 92.

The SIMULATE parameter group allows you to replace the input value with a simulation value and activate simulation. By specifying the status and the simulation value, the reaction of the complete Analog Input Function Block can be tested.

✎ Note!
The simulation mode is enabled by means of a DIP switch (see Page 152)

The L_TYPE parameter is used to select the type of linearization of the input and/or simulation value (see Page 43 ff.):
- Direct signal conversion
  The input value is forwarded without any conversion (XD_SCALE = OUT_SCALE). This is selected if the input value is already in the physical units you want.

- Indirect signal conversion
  In this setting, the input value is rescaled linearly via the input scaling XD_SCALE to the desired output range OUT_SCALE (further information on rescaling the input value can be found on Page 153).

- Indirect signal conversion with root
  In this setting, the input value is rescaled via the XD_SCALE parameter group and calculated again using a root function. Further rescaling follows to the desired output range via the OUT_SCALE parameter group.

The LOW_CUT parameter can be used to specify a limit value for low flow cut off. Low flow cut off is activated via the IO_OPTS parameter. If the converted input value (PV) is below the limit value, it is set to "Zero".

In the PV_FTIME parameter, a filter time can be specified for filtering the converted input value (PV). If a time of 0 seconds is specified, the input value is not filtered.

The MODE_BLK parameter group (Page 94) is used to select the operating mode of the Analog Input Function Block. If the MAN (manual) operating mode is selected, the output value OUT can be specified directly.

The OUT output value is compared against early warning and alarm limits (e.g. HI_LIM, LO_LO_LIM, etc.) that can be entered via various parameters. If one of these limit values is violated, a limit value process alarm (e.g. HI_ALM, LO_LO_ALM, etc.) is triggered.

The most important functions and parameters of the Analog Input Function Block are listed below.

11.12.2 Selecting the operating mode

The operating mode is set by means of the MODE_BLK parameter group (see Page 94). The Analog Input Function Block supports the following operating modes:
- AUTO
- MAN
- OOS

Note!
The OOS block status mode is also displayed by means of the BLOCK_ERR parameter (see Page 95). In the OOS operating mode, all write parameters can be accessed without restriction if write protection has not been enabled.

11.12.3 Selecting the process variable

Prowirl 73 FF has seven Analog Input Function Blocks. The input value (process variable) to be processed is assigned via the CHANNEL parameter:
→ Selection of the process variable see Page 92.

11.12.4 Linearization types

In the Analog Input Function Block, the input value from the Transducer Block can be linearized via the L_TYPE parameter (see Page 43 ff.). The following linearization types are available:

- Direct
  In this setting, the input value bypasses the linearization function and is looped unchanged with the XD_SCALE unit through the Analog Input Function Block.

- Indirect
  In this setting, the input value is rescaled linearly via the XD_SCALE input scaling to the desired output range OUT_SCALE.

- Indirect Square Root
  In this setting, the input value is rescaled via the XD_SCALE parameter group and calculated again using a root function. Further rescaling follows to the desired output range via the OUT_SCALE parameter group.

11.12.5 Selecting the units

The XD_SCALE parameter group is used to determine with which physical unit the input value from the Transducer Blocks should be read in and processed in the Analog Input Function Block. Make sure that the unit selected suits the input value chosen in the CHANNEL parameter. The output value OUT is specified via the OUT_SCALE parameter group.

Note!
- Example for rescaling the input value see Page 153
- The system units selected in the Transducer Blocks in question do not have any effect on the setting of the system units in the Analog Input Function Block. The units are specified independently of one another and must be configured separately. The unit selected in the Transducer Blocks is only used for the local display, low flow cut off and for simulation.

11.12.6 Status of the output value OUT

The status of the Analog Input Function Block and the validity of the output value OUT are relayed to the downstream function blocks by means of the status of the OUT parameter group. The following statuses can be displayed:

■ GOOD_NON_CASCADE
The Analog Input Function Block is in the AUTO operating mode, i.e. the output value OUT is valid and can be used for further processing.

■ UNCERTAIN
The output value OUT can only be used for further processing to a limited extent. The "UNCERTAIN" status signals to the downstream function blocks that a "notice message" is present in the device, e.g. arising from active positive zero return or simulation.

■ BAD
The output value OUT is not valid. The following causes are possible:
– The Analog Input Function Block is in the OOS operating mode.
– The Resource Block is in the OOS operating mode.
– The "BLOCK CONFIGURATION" status is displayed by means of the BLOCK_ERR parameter (see Page 43 ff.).
– A "fault message" is present in the device arising from a critical device error, e.g. an electronics module defect.

✎ Note!
In the Transducer Block "Diagnosis", the cause of the error message (notice/fault message) is displayed via the "Diagnosis - Actual System Condition" parameter in the Transducer Block "Diagnosis". A list of all the error messages, incl. remedial measures, can be found on Page 53 ff.

11.12.7 Simulation of input/output

Certain parameters of the Analog Input Function Block allow simulation of the input and output of the function block:

1. Simulating the input of the Analog Input Function Block: The input value (measured value and status) can be specified by means of the SIMULATE parameter group (see Page 112). Since the simulation value runs through the entire function block, all the parameter settings of the block can be checked.

✎ Note!
If simulation is not enabled by means of the DIP switch (see Page 35), the simulation mode cannot be activated in the SIMULATE parameter (see Page 112). The BLOCK_ERR parameter (see Page 95) in the Resource Block indicates whether simulation of the Analog Input Function Block is possible.

2. Simulating the output of the Analog Input Function Block: Set the operating mode in the MODE BLK parameter group (see Page 94) to MAN and directly specify the desired output value in the OUT parameter.

11.12.8 Diagnosis

Block errors and diagnosis information are displayed in the Analog Input Function Block via the BLOCK_ERR parameter.

✎ Note!
Further information on troubleshooting and fault elimination during the configuration of the Analog Input Function Block can be found on Page 50

11.12.9 Rescaling the input value

In the Analog Input Function Block, the input value or input range can be scaled in accordance with the automation requirements.

Example:
- The measuring range of the sensor is 0 to 30 m3/h.
- The output range to the automation system should be 0 to 100%.

The Analog Input Function Block must be configured as follows:
- Select the input value in the CHANNEL parameter
  Select CHANNEL = 2 → Volume flow

L_TYPE parameter (see Page 43 ff.)
Select: L_TYPE = Indirect
The process variable "Volume Flow" of the Transducer Block "Flow" is rescaled linearly in the AI Block via the input scaling XD_SCALE to the desired output range OUT_SCALE.

XD_SCALE parameter group (see Page 43 ff.)
XD_SCALE 0 % = 0
XD_SCALE 100 % = 30
XD_SCALE UNIT = m3/h

OUT_SCALE parameter group (see Page 43 ff.)
OUT_SCALE 0 % = 0
OUT_SCALE 100 % = 100
OUT_SCALE UNIT = %

The result is that with an input value of, for example, 15 m³/h an output value of 50% is output via the OUT parameter.

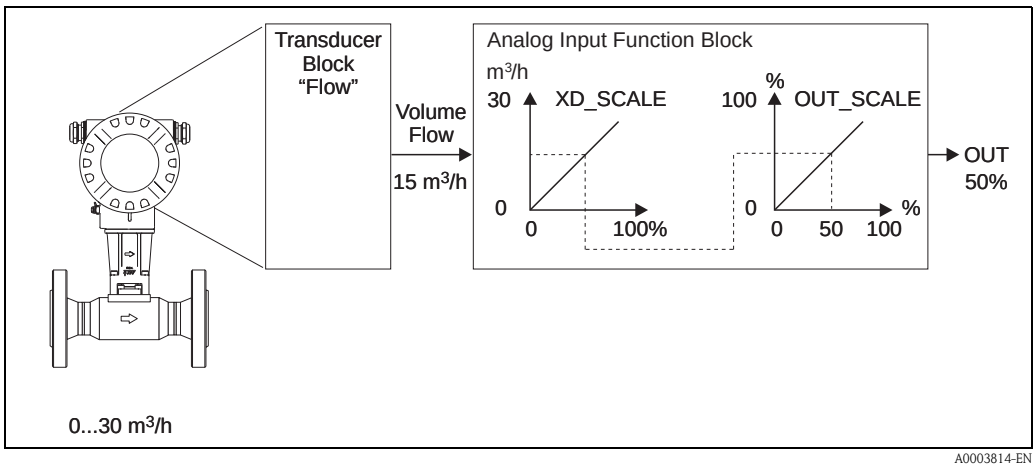


Fig. 36: Rescaling the input value

12 Discrete Output Function Block

The Discrete Output Function Block (DO) processes the discrete set point received from an upstream function block or higher-level process control system which can be used to trigger various device functionalities (e.g. totalizer reset) in the downstream Transducer Blocks.

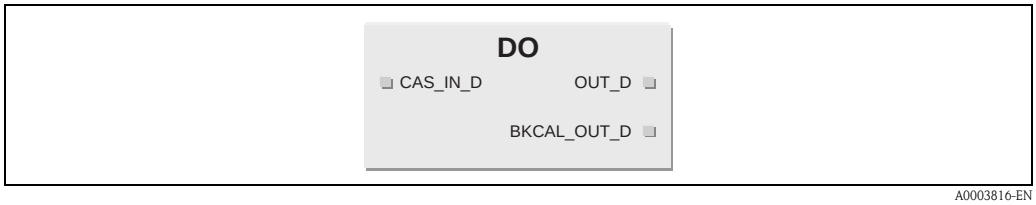


Fig. 37: Example for Discrete Output Function Block

CAS_IN _D = External input value and status from an upstream block
OUT_D = Discrete output value and status
BKCAL_OUT_D = Output value and status for the BCAL_IN_D input of another block

Note!
For a description of the most important parameters and functions of the Discrete Output Function Block, please refer to Operating Instructions "FOUNDATION Fieldbus Overview" (BA013S). Available at: → www.endress.com → Download.
The most important parameter settings of the Discrete Output Function Block are listed below.

12. 1 Assignment: Discrete Output Function Block / Transducer Blocks

The assignment or connection between the Discrete Output Function Block and the Transducer Blocks is established by means of the CHANNEL parameter (option "16" = Discrete Output Function Block).

12. 2 Values for the CAS_IN_D, RCAS_IN_D, OUT_D, and SP_D parameters

By means of the Discrete Output Function Block, various device functionalities can be triggered in the Transducer Blocks in question via manufacturer-specific, specified set points from an upstream function block.
Here, you must note that the desired function is not executed until a change of state from the value 0 (Discrete state 0) to the corresponding function value takes place (see Table). Thus, the value = 0 always serves as the starting point for triggering the device functions. A change of status from a value other than 0 to another value does not have any effect.

Input assignment of the CAS_IN_D, RCAS_IN_D, OUT_D, SP_D parameters

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 totalizers 1 + 2
Discrete state 0	→	Discrete state 8	Reset totalizer 1
Discrete state 0	→	Discrete state 9	Reset totalizer 2
Discrete state 0	→	Discrete state 25	System/process error messages* are not displayed and evaluated (application e.g. for rinsing the pipework)
Discrete state 0	→	Discrete state 26	System/process error messages* are displayed and evaluated

* Affects the following system/process error messages (Page 53 ff.):
- System error message: # 381, 382, 396, 515, 516, 517, 601
- Process error message: # 412, 421, 494

Example for controlling positive zero return via the Discrete Output Function Block
The following example is intended to illustrate how positive zero return can be activated and deactivated during a rinsing process by an upstream function block via the Discrete Output Function Block.

1. First of all, the connection between the Discrete Output Function Block and the Transducer Blocks must be established. For this purpose, the value "16" (= Discrete Output) has to be assigned to the CHANNEL parameter.
2. By means of the SHED_OPT parameter, select the response in the event of the monitoring time being exceeded (SHED_OPT) in the RCAS operating mode.

   ✎ Note!
   The option SHED_OPT = 0 (uninitialized) is not valid!

3. Download all the data and parameters into the field device.

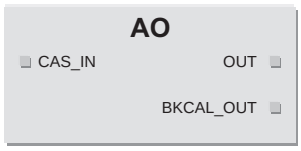
In the CAS operating mode, the Discrete Output Function Block processes the set point specified by an upstream function block at the CAS_IN_D input and transmits this to the Transducer Blocks.

Switching on positive zero return
Starting from the output value 0 (Discrete state 0), positive zero return is switched on through a change in state from 0 → 2 at the CAS_IN_D input.

Switching off positive zero return:
Positive zero return can only be switched off again if the input value at CAS_IN_D is set to the output value 0 (Discrete state 0) beforehand. Only then can positive zero return be switched off by a change in state from 0 → 3 at the CAS_IN_D input.

13 Analog Output Function Block

By means of the Analog Output (AO) Function Block, a value for the operating pressure ("Operating Pressure" parameter, see Page 128) can be read in continuously (cyclically) from a pressure measuring instrument (e.g. Cerabar S) by means of the FOUNDATION Fieldbus interface. The value for the operating pressure is used for continuous density calculation for the following fluids (see "Operating Pressure" parameter in the Transducer Block "Flow Computer", see Page 128): REAL GAS, COMPRESSED AIR, SUPERHEATED STEAM, NATURAL GAS NX-19 or WATER



A0007355

CAS_IN	= External input value and status from an upstream block
OUT	= Output value and status
BKCAL_OUT	= Output value and status for the BCAL_IN input of another block

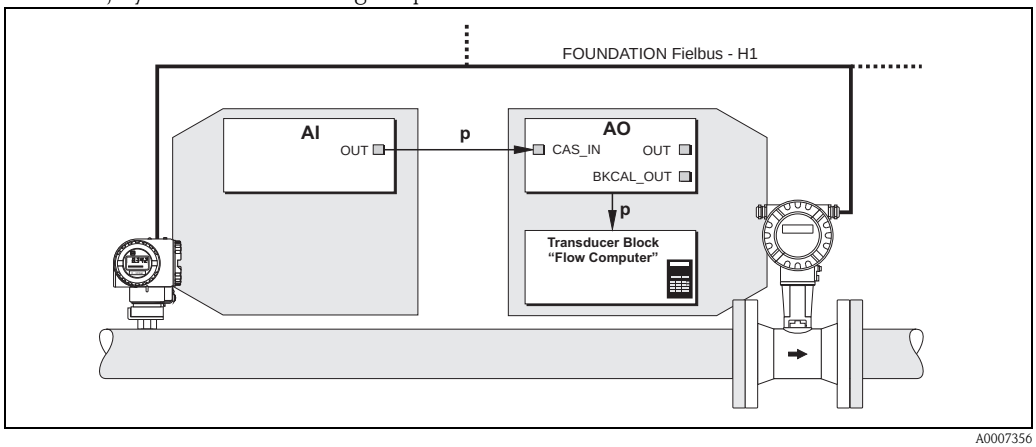
Note!
Please refer to the Operating Instructions BA 013S/04/en "FOUNDATION Fieldbus Overview: Installation and Commissioning Guidelines" for a description of the most important parameters and functions of the Analog Output Function Block. The most important parameter settings of the Analog Output Function Block are listed below.

13. 1 Assignment: Analog Output Function Block / Transducer Block "Flow Computer"

The assignment or connection between the Analog Output Function Block and the "Operating Pressure" parameter in the Transducer Block "Flow Computer" is established by means of the CHANNEL parameter (option "17" = Analog Output Function Block).

13. 2 Basic settings in the Analog Output Function Block

The following example is intended to illustrate how the value for the operating pressure ("Operating Pressure" parameter, see Page 128) can be read in from a pressure measuring instrument (e.g. Cerabar S) by means of the Analog Output Function Block.



A0007356

Fig. 38: The operating pressure is read in directly from the pressure measuring instrument via the AO Function Block p = operating pressure

Configuration steps:

1. First of all, the connection between the Analog Output Function Block and the "Operating Pressure" parameter in the Transducer Block "Flow Computer" must be established. For this purpose, the value "17" (= Analog Output) has to be assigned to the CHANNEL parameter.
2. By means of the SHED_OPT parameter, select the response in the event of the monitoring time being exceeded (SHED_OPT) in the RCAS operating mode.

   ✎ Note!
   The option SHED_OPT = 0 (uninitialized) is not valid!

3. In the XD_SCALE parameter group, select the desired engineering unit and the measuring range for the pressure measured value. The operating pressure data always refer to the absolute pressure. The following pressure units are supported:

Units
Pa
GPa
MPa
kPa
mPa
µPa
bar
mbar
torr
psia

✎ Note!
If a unit not listed in the table is selected in the XD_SCALE parameter group, the BLOCK_ERROR parameter displays the "Block Configuration Error" error message and the operating mode of the block cannot be set to CAS.

4. Download all the data and parameters into the field device.

In the CAS operating mode, the operating pressure is now read in via the Analog Output Function Block and transmitted to the Transducer Block "Flow Computer" for continuous density calculation.

14 Factory settings

14.0.1 SI units (not for USA and Canada)

Flow units (Transducer Block "Flow" or "Flow Computer")

Flow	Units - factory setting
System Unit - Volume Flow	m^3/h
System Unit - Calc. Mass Flow	kg/h
System Unit - Corr. Volume Flow	Nm^3/h
System Unit - Heat Flow	kW

Other units

	Units - factory setting
System Unit - Density	kg/m^3
System Unit - Length	mm
System Unit - Temperature	°C
System Unit - Spec. Enthalpy	kWh/kg
System Unit- Pressure	bara

Language

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

Totalizer unit (Transducer Block "Totalizer 1 or 2")

Depending on the option selected in the "Totalizer - Assign" parameter, the following units are configured:

Option selected in the "Totalizer - Assign" parameter	Unit
Volume Flow	m^3
Calc Mass Flow	kg
Corr. Volume Flow	Nm^3
Heat Flow	kW

14.0.2 US units (only for USA and Canada)

Flow unit (Transducer Block "Flow" or "Flow Computer")

Flow	Units - factory setting
System Unit - Volume Flow	US gal/h
System Unit - Calc. Mass Flow	lb/min
System Unit - Corr. Volume Flow	Sm^3/h
System Unit - Heat Flow	tons

Density, length, temperature units

	Units - factory setting
System Unit - Density	lb/ft^3
System Unit - Length	Inch
System Unit - Temperature	°F
System Unit - Spec. Enthalpy	Btu/lb
System Unit- Pressure	psia

Totalizer unit (Transducer Block "Totalizer 1 or 2")

Depending on the option selected in the "Totalizer - Assign" parameter, the following units are configured:

Flow	Unit
Volume Flow	US gal
Calc Mass Flow	lb
Corr. Volume Flow	Sm^3
Heat Flow	tons

Language

Country	Language
USA	English
Canada	English

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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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