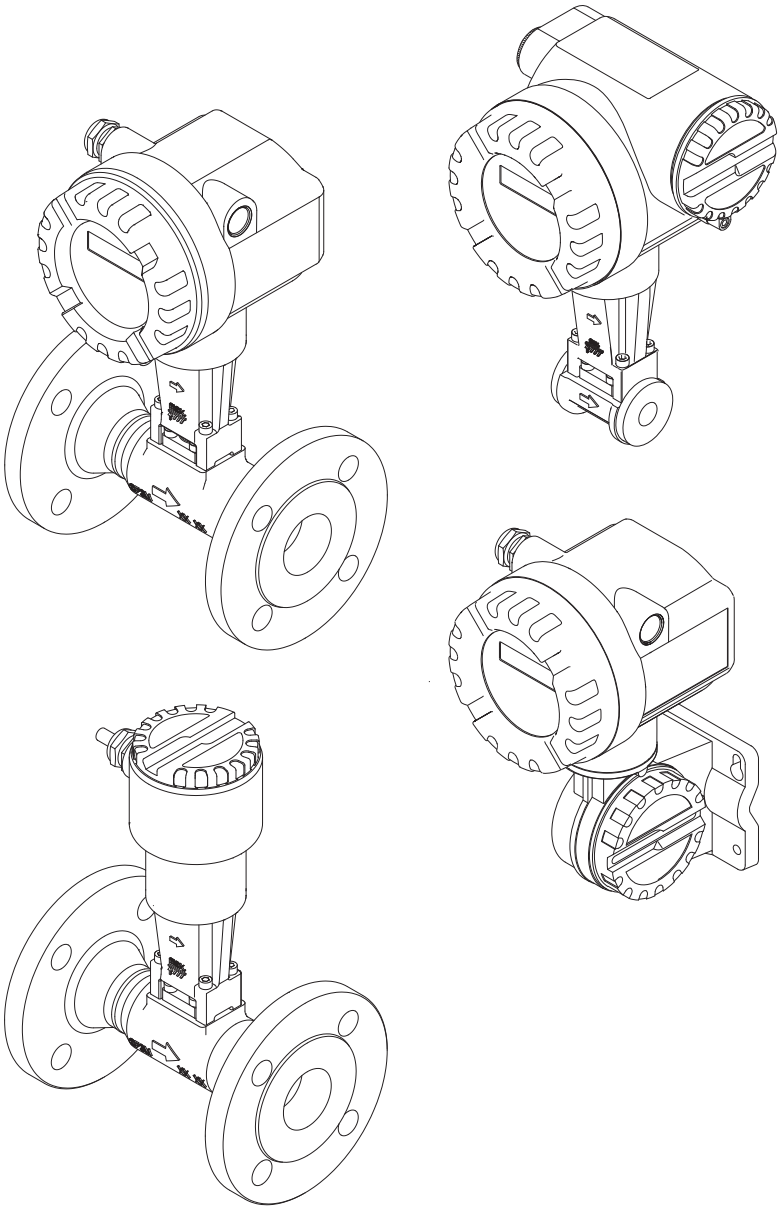
Füllstand | Druck | Durchfluss | Temperatur | Flüssigkeits-analyse | Registrierung | Systeme Komponenten | Services | Solutions

Operating Instructions

Proline Prowirl 73

Vortex Flow Measuring System

PROFIBUS PROCESS FIELD BUS



BA00093D/06/EN/13.11
71154515

valid as of version:
V 1.03.XX (device software)

Endress+Hauser

People for Process Automation

Table of Contents

1 Safety instructions

1.1 Designated use

The measuring system is used to measure the flow of saturated steam, superheated steam, gases and liquids. The measured variables volume flow and temperature are measured primarily. From these values, the device can used stored data on the density and enthalpy to calculate and output the mass flow and heat flow for example.

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

1.2 Installation, commissioning and operation

Note the following points:
- Installation, 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, for example, 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.

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.

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

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

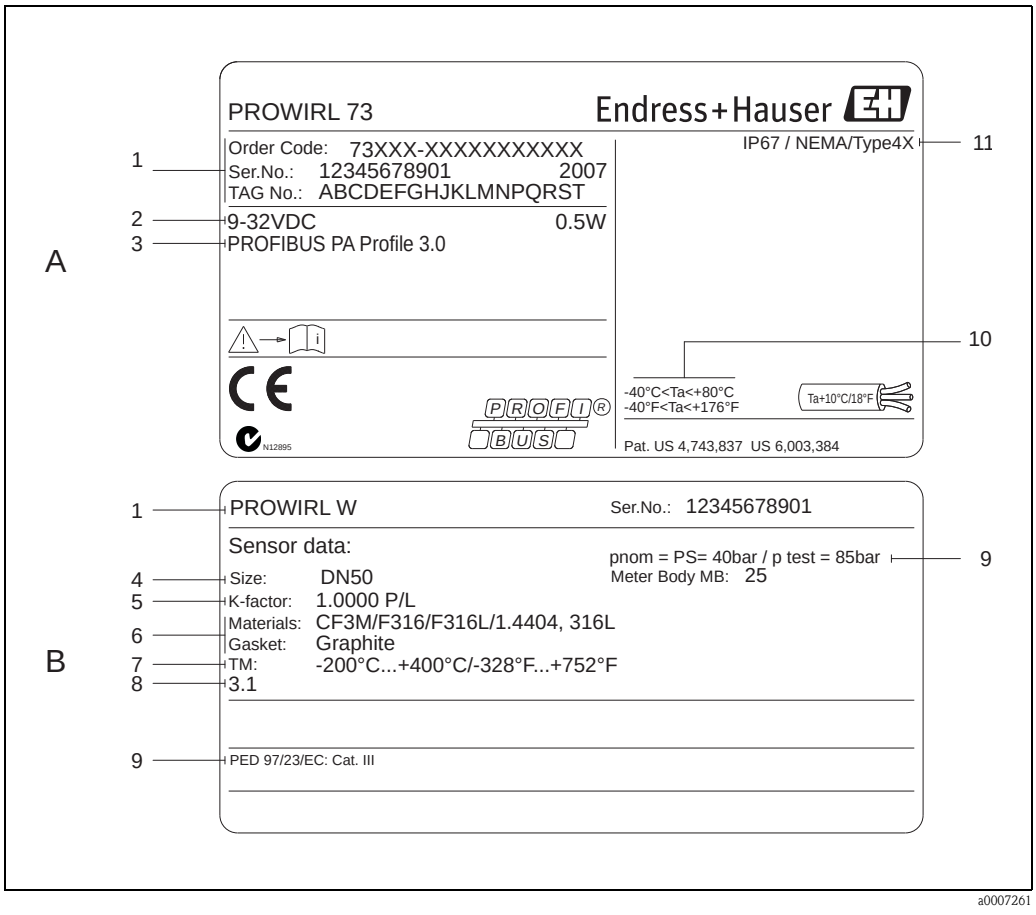
2.1 Device designation

The "Proline Prowirl 73 PROFIBUS PA" flowmeter system consists of the following components:

- Transmitter Proline Prowirl 73 PROFIBUS PA
- Prowirl F and 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

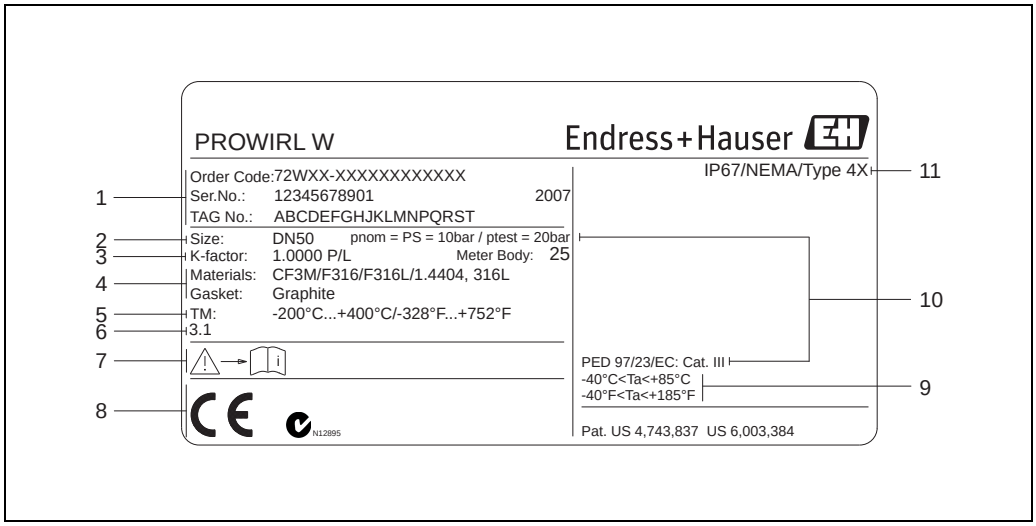


a0007261

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 PROFIBUS PA, Profile 3.0
4 Nominal diameter
5 Calibration factor
6 Measuring pipe and seal material
7 Medium 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

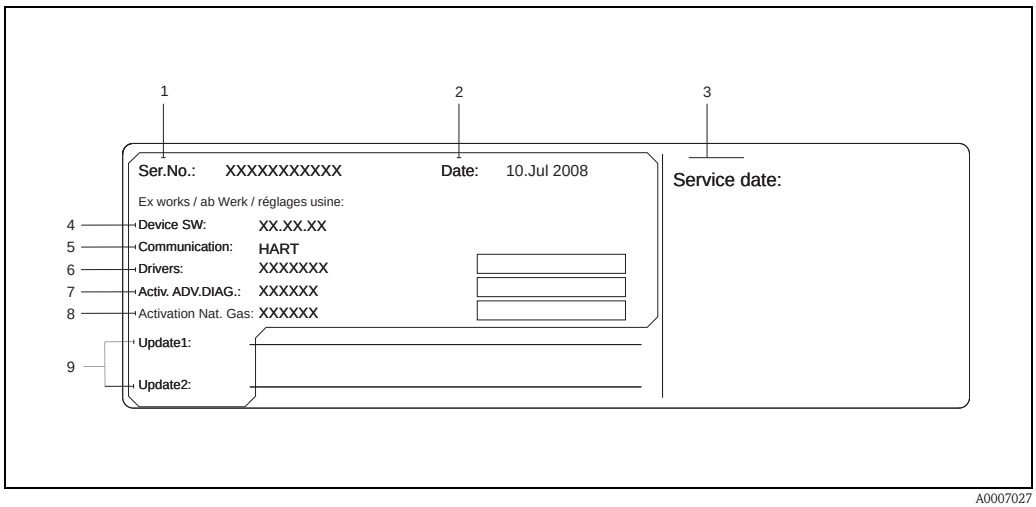


a0001872

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



A0007027

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. PROFIBUS PA)*
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 meets 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

PROFIBUS ®
Registered trademark of PROFIBUS User Organization e.V., Karlsruhe, Germany

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 center of gravity of the entire measuring device might be higher than the points around which the slings are slung. Therefore, when transporting, make sure that the device does not unintentionally turn or slip.

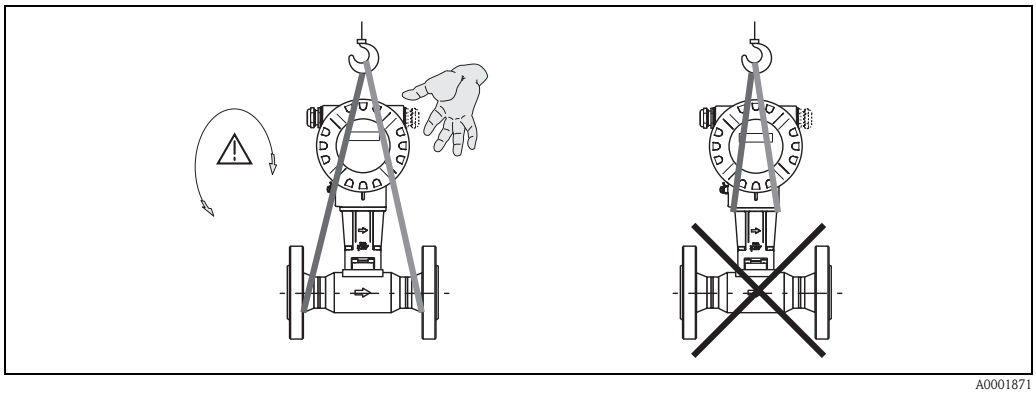


Fig. 4: Transportation instructions for sensors with DN 40 to 300 (1½ to 12")

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 12).
- The maximum permitted ambient temperatures (see Page 86) and fluid temperatures (see Page 87) must be observed.
- Pay particular attention to the notes on orientation and piping insulation (see Page 10).
- 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 MATING PIPE DIAMETER function on Page 116).
- 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. For weight information, please refer to Technical Information TI070D/06/en.

3.2.1 Dimensions

The dimensions and lengths of the sensor and transmitter can be found in the Technical Information 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).

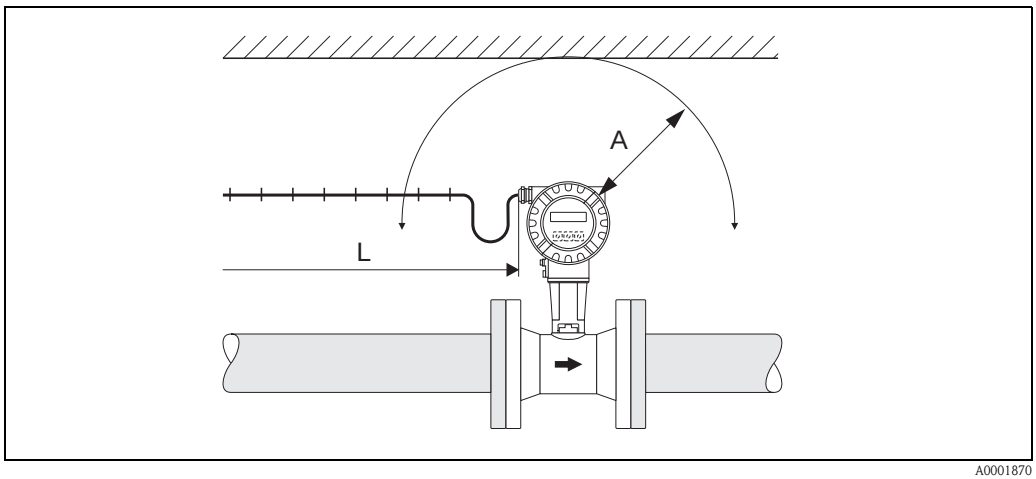


Fig. 5: A = Minimum spacing in all directions, L = cable length

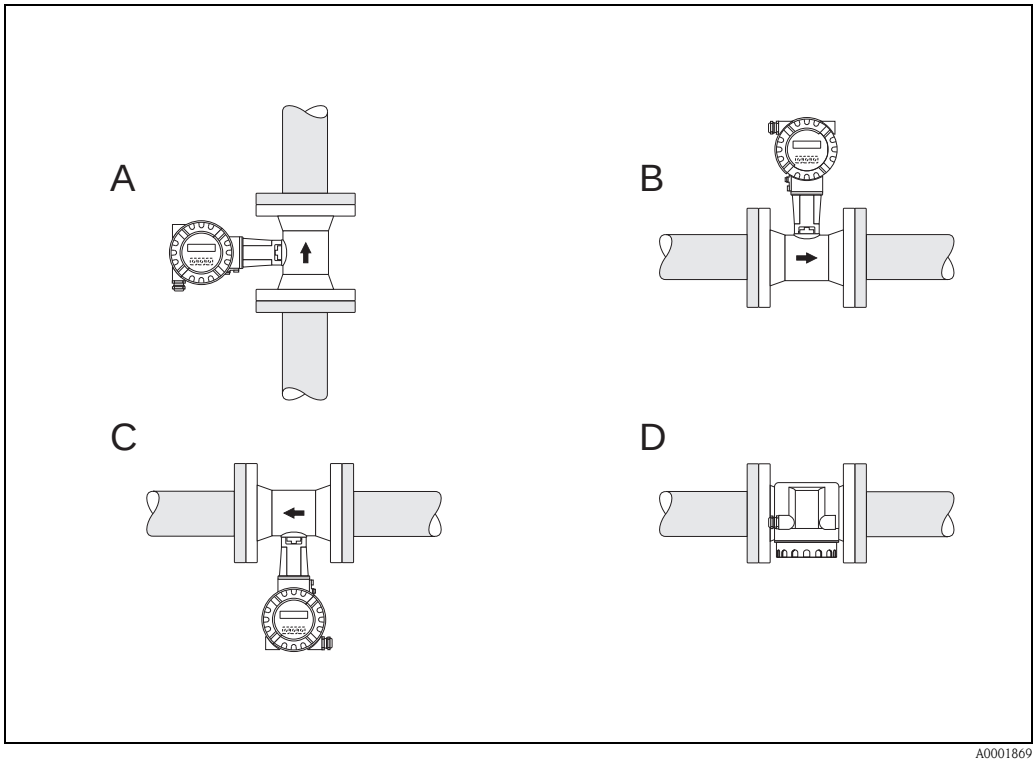
3.2.3 Orientation

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 86) 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 72 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.



A0001869

Fig. 6: Possible orientations of the device

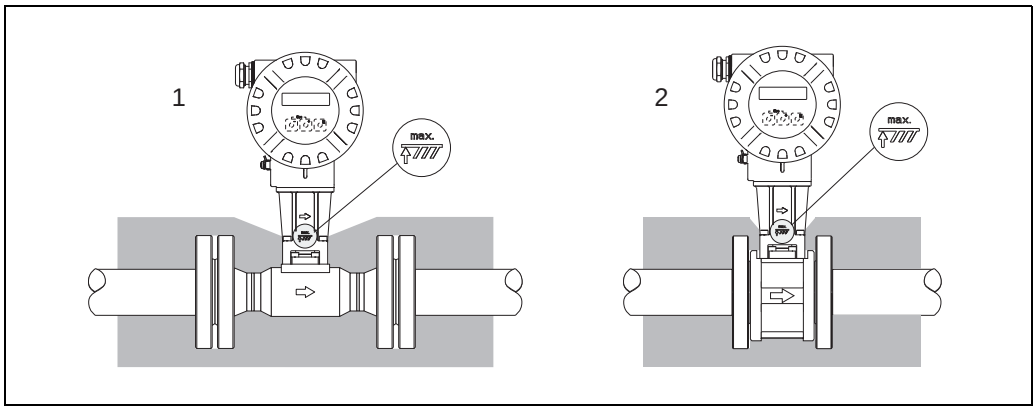
High fluid temperature:
– horizontal piping: orientation C or D
– vertical piping: orientation A

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. 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 Fig. 7. These apply equally to both the compact version and the sensor in the remote version.



A0001868

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 is always exposed.
- Note that a certain orientation might be required, depending on the fluid temperature → Page 10.
- Information on permissible temperature ranges → Page 86.

3.2.5 Inlet and outlet run

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

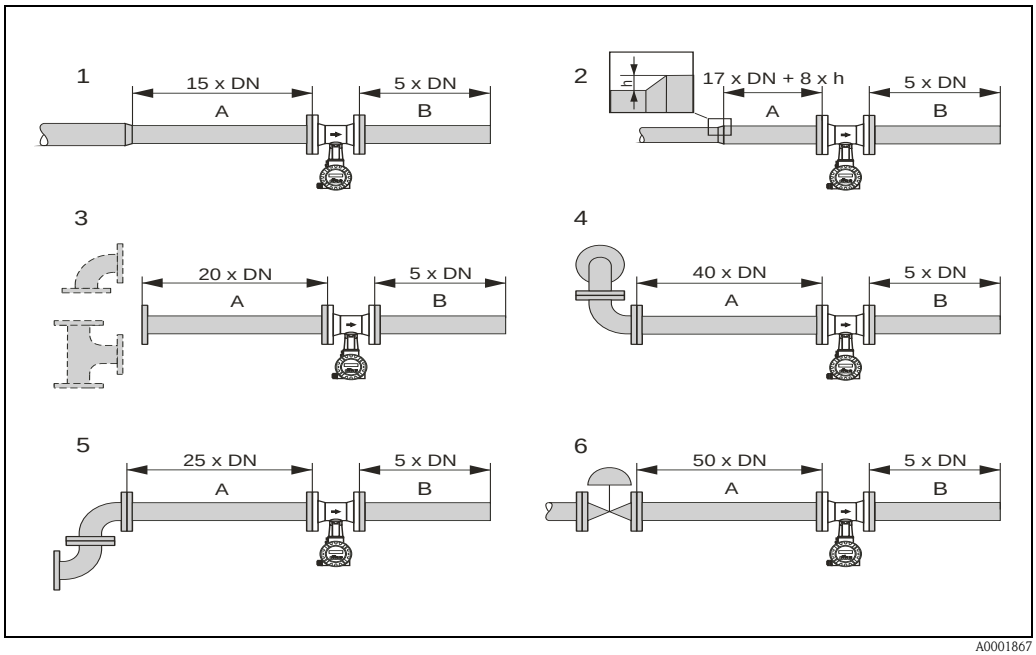


Fig. 8: Minimum inlet and outlet runs with various flow obstructions

A Inlet run
B Outlet run

1 = Reduction
2 = Expansion
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 13).

Outlet runs with pressure and temperature 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.

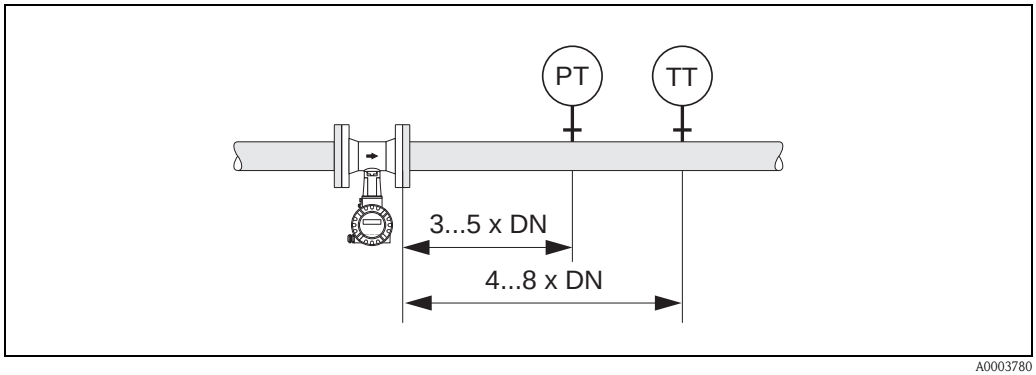


Fig. 9: Installation of pressure measuring point (PT) and temperature measuring point (TT)

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.

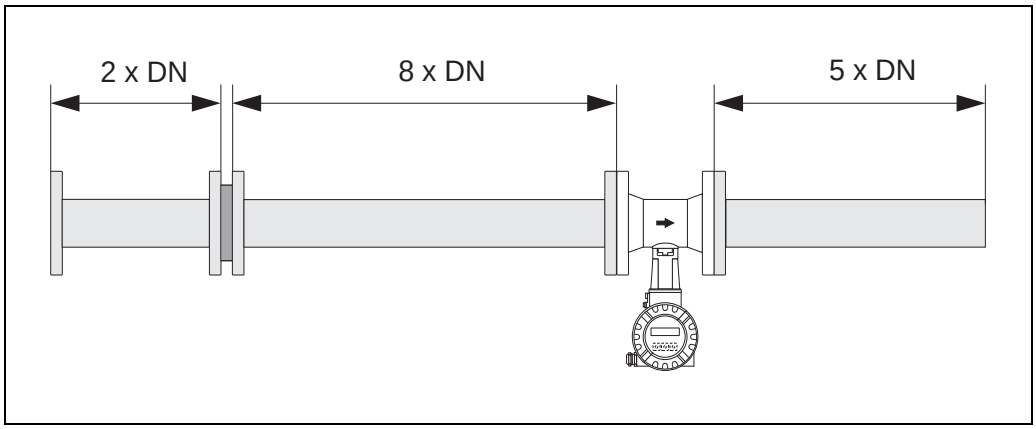


Fig. 10: Perforated plate flow conditioner

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 82 and 88.

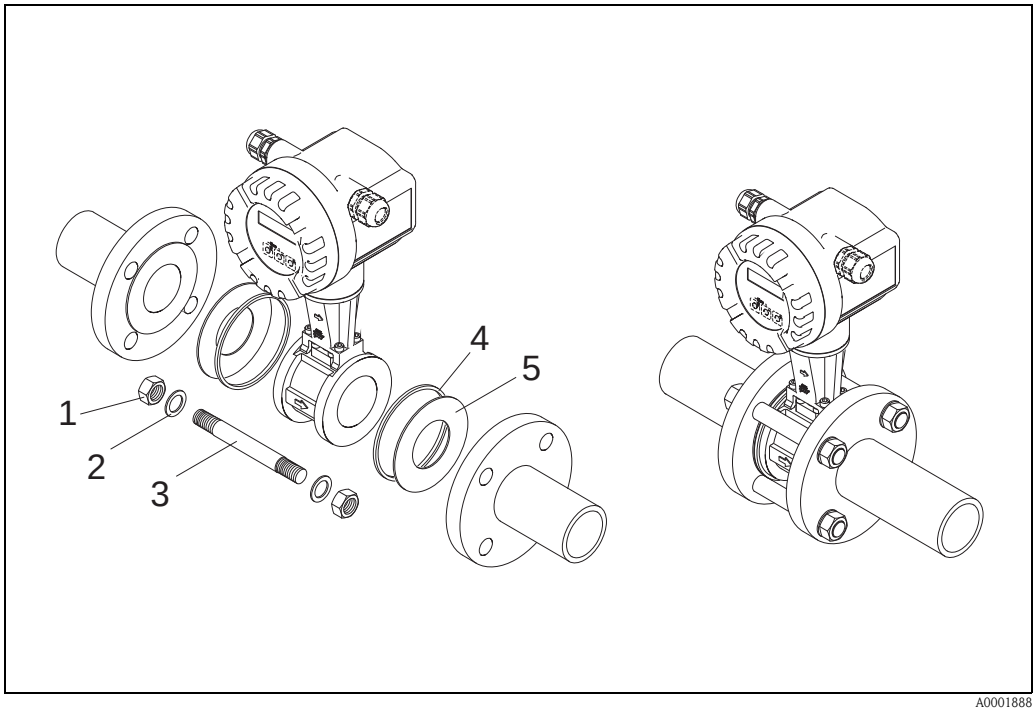
3.3 Installation instructions

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.



A0001888

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.

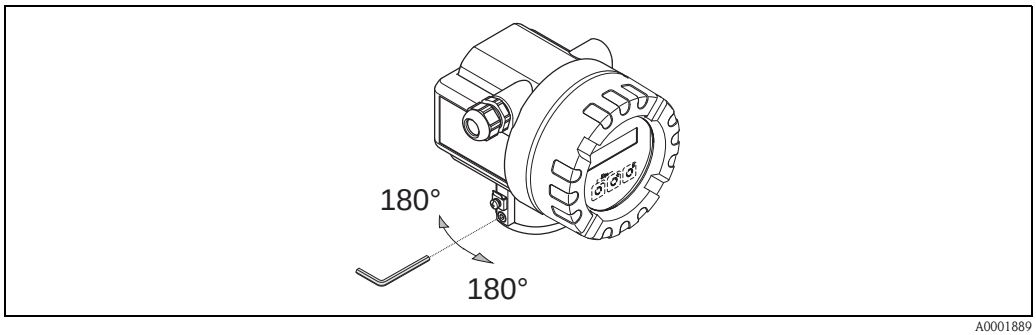


Fig. 12: Rotating the transmitter housing

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.

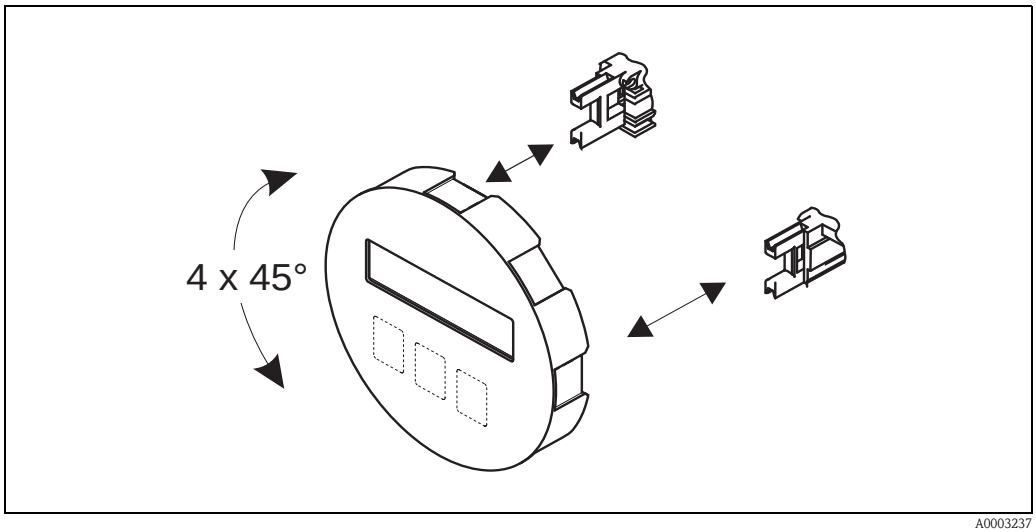


Fig. 13: Rotating the local display

3.3.4 Mounting transmitter (remote)

The transmitter can be mounted in the following ways:
- Wall mounting
- Pipe mounting (with separate mounting kit, accessories → Page 66)

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.

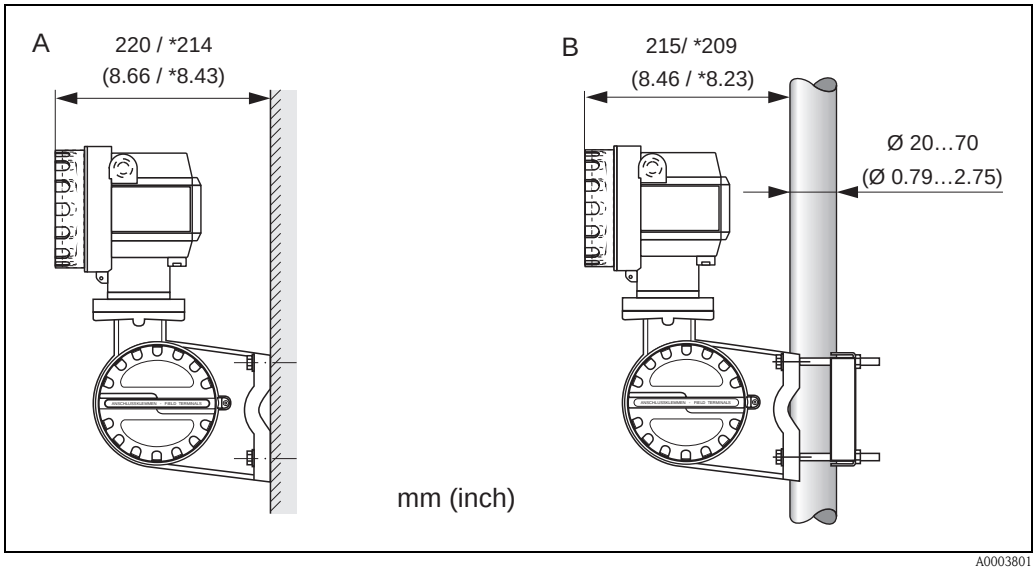


Fig. 14: Mounting the transmitter (remote version)

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

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 82 ff.
Installation	Notes
Does the arrow on the pipe stand or on the sensor match the 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 9 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 PROFIBUS PA cable specifications

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

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

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

	Type A	**Type B**
Cable structure	Twisted pair, shielded	One or more twisted pairs, fully shielded
Wire size	0.8 mm^2 (AWG 18)	0.32 mm^2 (AWG 22)
Loop-resistance (direct current)	44 Ω/km	112 Ω/km
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 (>3 ft))	1900 m (6200 ft)	1200 m (4000 ft)

* Not specified

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

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

Maximum overall cable length

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

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

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

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

Maximum spur length

The line between the distribution box and field device is described as a spur.
In the case of non-Ex applications, the max. length of a spur depends on the number of spurs (>1 m) (>3 ft):

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

Number of field devices

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

Bus termination

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

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

Further information

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

4.1.1 Shielding and grounding

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

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

Caution!
The legal EMC requirements are met **only** when the cable shield is grounded at both ends!.

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. Compatibility errors (e.g. the incorrect K-factor will be used) can occur if the devices are not connected in this way.

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 connection diagram:
   → Fig. 15
   → Wiring diagram in the screw caps
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.

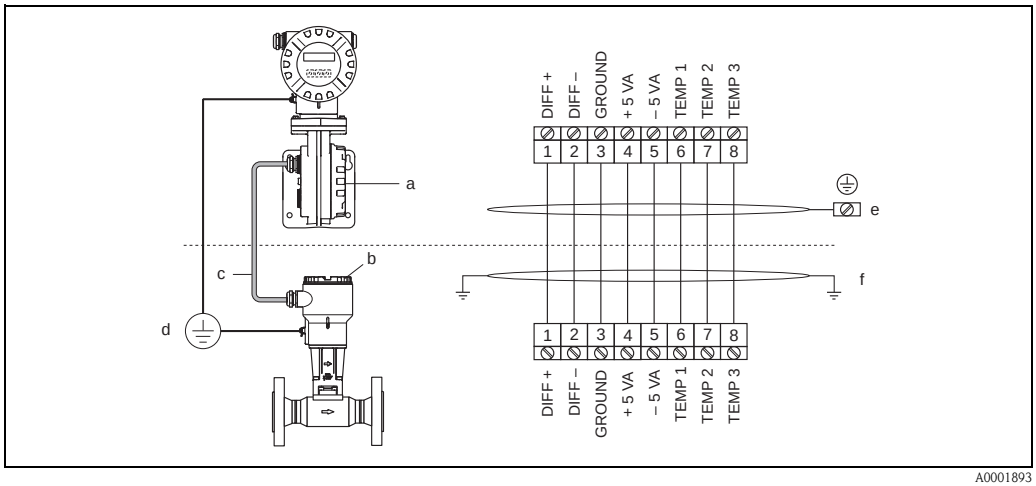


Fig. 15: Connecting the remote version

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):

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 mm^2 (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 according 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 specification, 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 mm^2 (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 according 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 specified as 39 Ω/km in accordance with the standard, 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 CABLE LENGTH function (see Page 124).

$$\frac{\text{Cable resistance of the cable used [Ω/km]}}{\text{Cable resistance in accordance with specification [Ω/km]}} \bullet \text{Actual cable length [m]} = \text{cable length to be entered [m]}$$

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

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

Conclusion:
In the CABLE LENGTH function (see Page 124) the value 10 m (32.81 ft), depending on the unit selected in the UNIT LENGTH function, must be entered.

4.3 Connecting the measuring unit

4.3.1 Connecting the transmitter

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 equalization.
- The national regulations governing the installation of electrical equipment must be observed.
- When connecting the transmitter, use a connecting cable with a continuous use temperature range between –40 °C (–40 °F) and the maximum permitted ambient temperature plus 10 °C (plus 18 °F).
- A shielded cable must be used for the connection.
- The terminals for the PROFIBUS PA connection (terminal 1 = PA+, terminal 2 = PA –) have integrated reverse polarity protection. This ensures correct signal transmission via the fieldbus even if lines are confused.
- Cable cross-section: max 2.5 mm²
- Observe the grounding concept.

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

Connecting the transmitter, non-Ex, Ex i/IS and Ex n version (∅ Fig. 16)

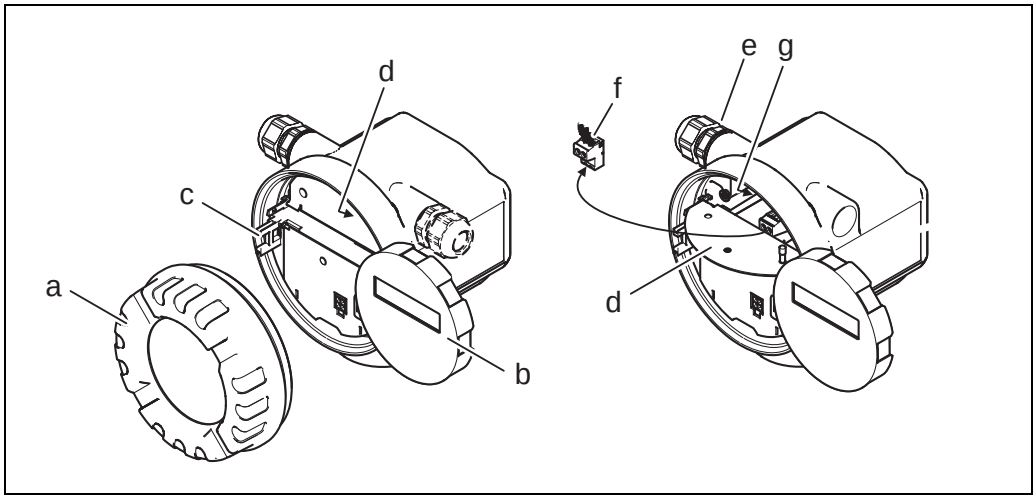
1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.
2. Remove the display module (b) from the retaining rails (c) and refit onto right retaining rail with the left side (this secures the display module).
3. Loosen screw (d) of the cover of the connection compartment and fold down the cover.
4. Push the power supply/PROFIBUS 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/PROFIBUS 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.

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

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

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 screws (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.



a0003782

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 Connection compartment cover
e Cable gland
f Terminal connector
g Ground terminal

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

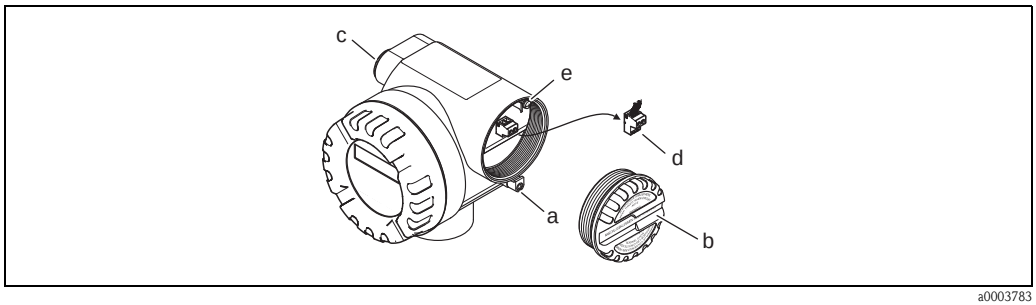
1. Release the securing clamp (a) of the connection compartment cover.
2. Screw the connection compartment cover (b) off the transmitter housing.
3. Push the power supply/PROFIBUS cable through the cable gland (c).
4. Tighten the cable glands (c) (see also Page 28).
5. Pull the terminal connector (d)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

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

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.

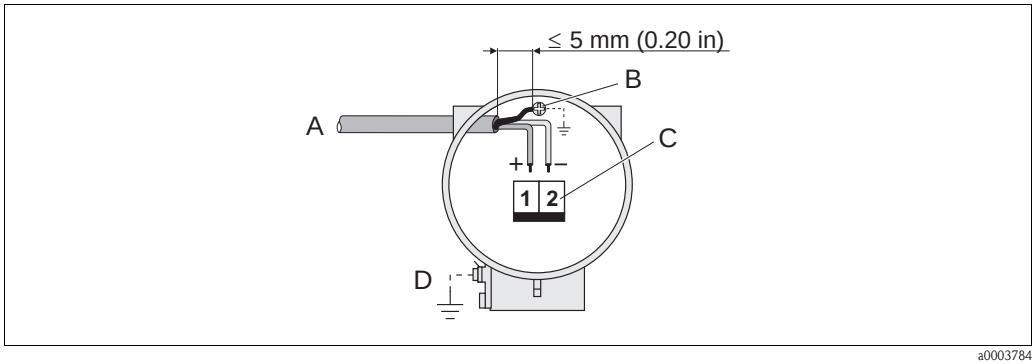


a0003783

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



a0003784

Fig. 18: Connecting the transmitter

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

4.3.2 Terminal assignment

	Terminal No.	
Order version	**1**	**2**
73***-**********H	PA +	PA –

4.3.3 Fieldbus connector

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

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

The 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 76).

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 equalization.

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

Ideally, cable glands with Iris springs should be used for the shielding connection. The shielding is 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 PROFIBUS PA 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).

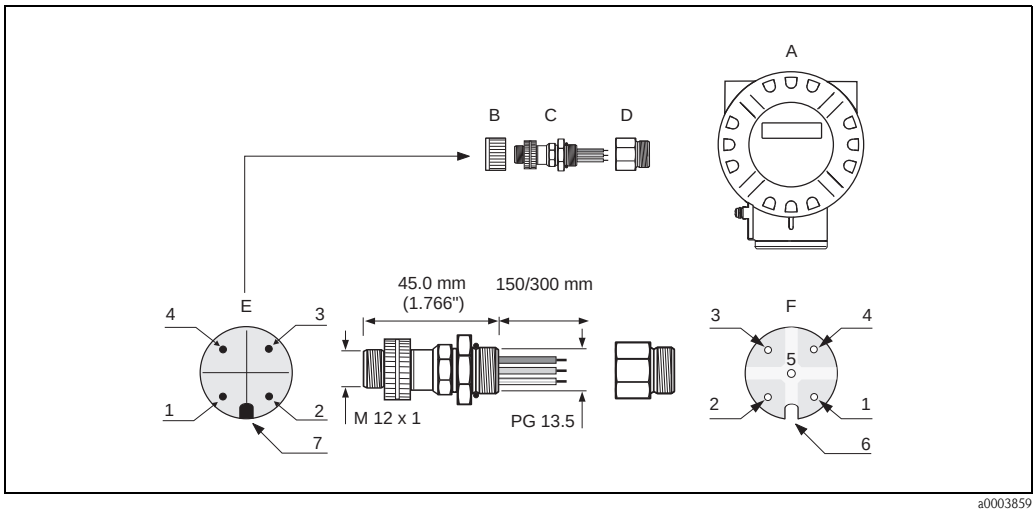


Fig. 19: Connectors for connecting to the PROFIBUS PA

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

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

Technical data (connector):

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

4.4 Degree of protection

The measuring device meets all the requirements for IP 67 (NEMA 4X).

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

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 → Page 84, cable entries.
- The cable entries must be firmly tightened (point **a** ∅ Fig. 20).
- The cable must loop down before it enters the cable entry ("water trap") (point **b** ∅ Fig. 20). This arrangement prevents moisture penetrating the entry.
  The cable entries should not point upwards.
- Replace all unused cable entries with dummy plugs.
- Do not remove the grommet from the cable entry.

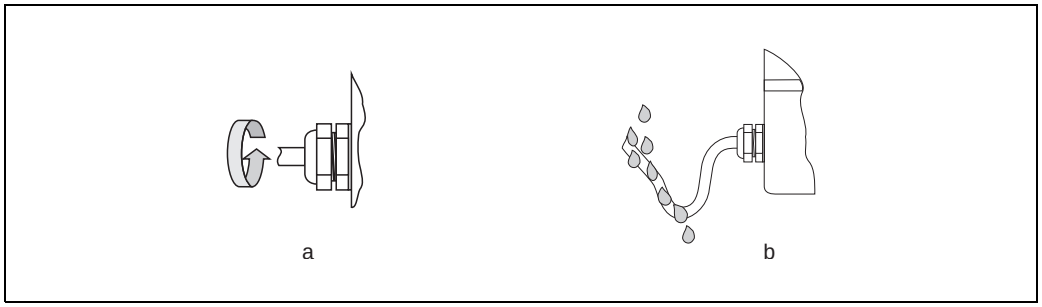


Fig. 20: Installation instructions for cable entries

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 18 ■ Signal cable see Page 21
Do the cables have adequate strain relief?	–
Are the power supply and signal 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 - PROFIBUS PA	Notes
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	–
Has each fieldbus segment been terminated at both ends with a bus terminator?	–
Has the max. length of the fieldbus cable been observed in accordance with the PROFIBUS specifications?	see Page 18
Has the max. length of the spurs been observed in accordance with the PROFIBUS specifications?	see Page 19
Is the fieldbus cable fully shielded and correctly grounded?	see Page 20

5 Operation

5.1 Quick operation guide

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

1. Configuration programs → Page 35
The configuration of profile and device-specific parameters is done via the PROFIBUS PA interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.

2. Jumpers/miniature switches (for hardware settings)
You can make the following hardware settings for the PROFIBUS PA interface using miniature switches on the I/O board:
- Configuring the device bus address → Page 47
- Switching the hardware write protection on/off → Page 46

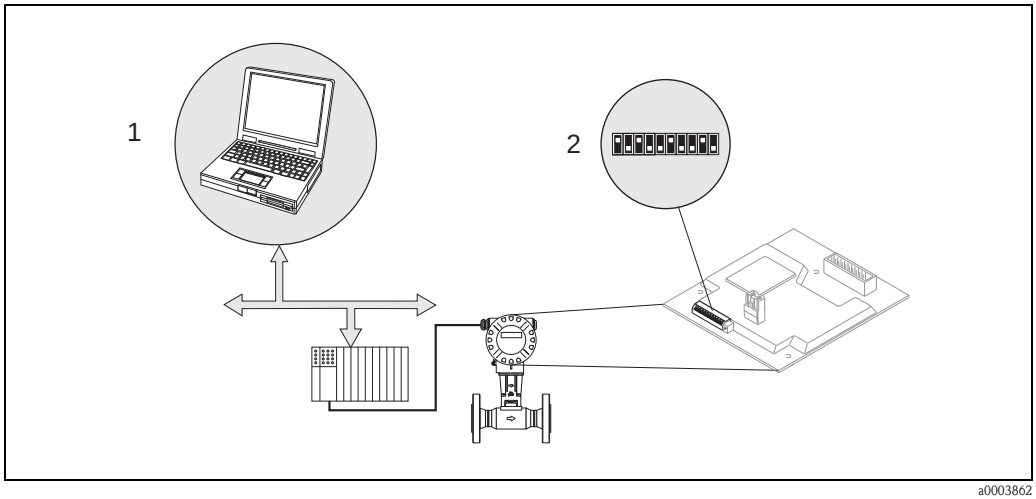


Fig. 21: Device operating options via the PROFIBUS PA interface

1 Configuration/operating programs for operation via PROFIBUS PA
2 Miniature switches for hardware settings (write protection, device address)

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 107 ff.).

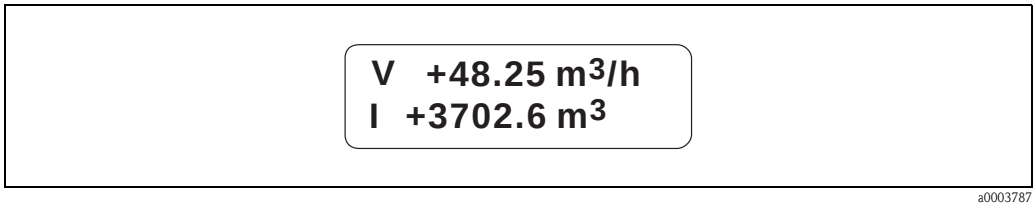


Fig. 22: Liquid crystal display

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 [m³/h] or in [%].
– Bottom line: shows additional measured variables and status variables, e.g. totalizer reading in [m³], bar graph, tag name

5.2.2 Display symbols

The symbols shown in the left display field flash if the device is not involved in cyclic data exchange with the automation system.

Display symbol	Meaning
S	System error
P	Process error
$	Fault message
!	Notice message
1 to 4	Analog Input function block 1 to 4, output value OUT
I to II	Totalizer function block 1 to 2, output value OUT
p	Operating pressure (external process variable), Pressure Value
D	Display value (external process variable), Display Value
1 to 4 ←	Cyclic communication of the Analog Input function block (AI 1 to 4) from the measuring device to the automation system is active
I to II ←	Cyclic communication of the Totalizer function block (1 or 2) from the measuring device to the automation system is active
p →	Cyclic communication of the external operating pressure (Pressure Value) from the automation system to the measuring device is active
D →	Cyclic communication of the Display Value from the automation system to the measuring device is active
T	Temperature
V	Volume flow
s	Corrected volume flow
m	Mass flow
H	Calculated heat flow
N	Tag name
i	Actual system condition

Note!
If the cyclic measured value "AI1"," AI2", "AI3", "AI4", "TOT1", "TOT2" or "D" is shown on the local display, the display alternates between one of the following status messages and the measured value if a notice message or error message is active.

Display:	Meaning:
BAD (0x00)	BAD
BAD (0x08)	BAD NOT CONNECTED
BAD (0x0C)	BAD DEVICE FAILURE
BAD (0x11)	BAD SENSOR LOW LIM
BAD (0x12)	BAD SENSOR HIG LIM
BAD (0x1C)	BAD OUT OF SERVICE
UNCERTAIN (0x40)	UNCERTAIN
UNCERTAIN (0x44)	UNCERTAIN LAST USABLE
UNCERTAIN (0x48)	UNCERTAIN SUBS SET
UNCERTAIN (0x4C)	UNCERTAIN INIT VALUE
UNCERTAIN (0x4C)	UNCERTAIN SENSOR NOK
UNCERTAIN (0x60)	UNCERTAIN SIM VALUE

5.3 Error message display

5.3.1 Type of error

Errors which occur during commissioning or measuring operation are displayed immediately. If two or more errors occur, the error with the highest priority is always 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. → Page 69.
- *Process error:* this group includes all application errors e.g. device being operated outside the resonance frequency etc. → Page 74.

5.3.2 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.

The measuring system distinguishes between two types of error messages:
- "Fault message" error message type (ϟ):
  - If this message occurs, operation is immediately interrupted or stopped.
  - Display on the PROFIBUS → Fault messages are relayed to downstream function blocks or higher-level process control systems with the status "BAD" of the corresponding process variable.
- "Notice message" error message type (!):
  - Normal operation continues despite this message.
  - Display on the PROFIBUS → Notice messages are relayed to downstream function blocks or higher-level process control systems with the status "UNCERTAIN" of the corresponding process variable.

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 and positive zero return as "notice messages".

How the display reacts when an error message occurs
The way in which the display reacts when an error message occurs depends on the option selected in the ASSIGN LINE 1 (Page 107) and ASSIGN LINE 2 parameters (Page 109).

For example, if only process variables have been selected to be shown on the display (e.g. volume flow, mass flow, temperature, etc.), the display alternates between the selected process variables and the information on the error message present if an error message occurs.

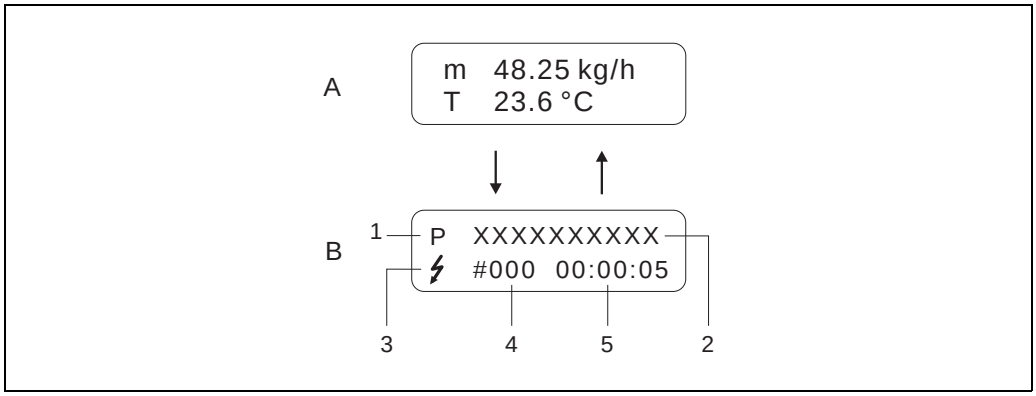


Fig. 23: A = Process variable display; B = information on the error message

1 Type of error: P = Process error, S = System error
2 Error designation: e.g. DCS SENS LIMIT = Device being operated near application limits
3 Error message type: ϟ = Fault message, ! = Notice message
4 Error number: e.g. #395
5 Duration of last error message occurrence (in hours, minutes and seconds), display format - see OPERATING HOURS function.

If one or two bus-related output variables have been selected to be shown on the display (e.g. Analog Input 1, Analog Input 2, Totalizer 1, etc.), first the selected output variable, then the related status message and then the information on the error message present is displayed if an error message occurs.

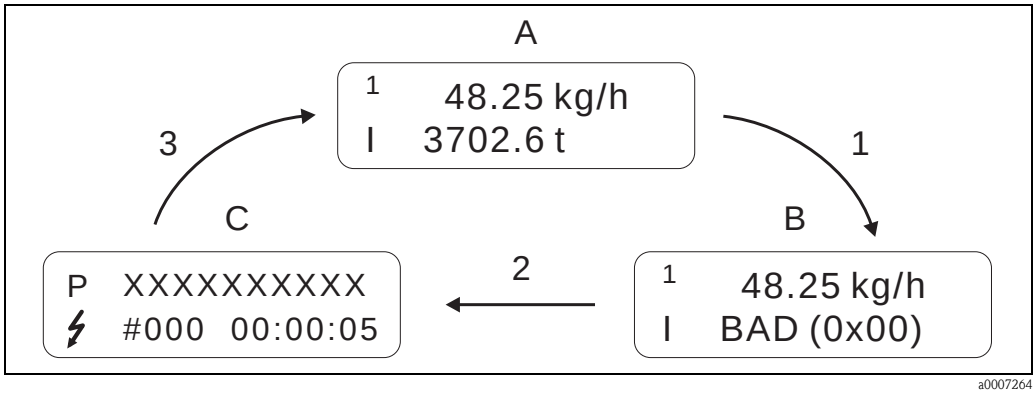


Fig. 24: A = Process variable display; B = status message; C = information on the error message

5.4 Operating options

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 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
- Access to the verification data and updating the software of the "Fieldcheck" flow simulator

Program download: www.ToF-Fieldtool.endress.com

5.4.2 Operating program "FieldCare"

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple and effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or the FXA 193 service interface.

For further information, visit www.endress.com

5.4.3 Operating program "SIMATIC PDM" (Siemens)

SIMATIC PDM is a vendor-independent tool for operating, configuring, maintaining and diagnosing intelligent field devices.

For further information, visit www.endress.com

5.4.4 Commuwin II operating program

Commuwin II is a program for remote operation of field and control-room equipment. Commuwin II can be used irrespective of the device type and the mode of communication (HART or PROFIBUS).

Note!
You can find more information on the Commuwin II operating program in the following Endress+Hauser documents:

- System Information: SI018F/00/en "Commuwin II"
- Operating Instructions: BA124F/00/en "Commuwin II"- operating program
- An exact description of the data types can be found in the slot/index lists on Page 149 ff.

All of the device's device functions are clearly arranged in a matrix for programming with the Commuwin II - operating program.
You can call up various parts of the matrix using the MATRIX SELECTION function in the device matrix (VAH5, see Page 37):

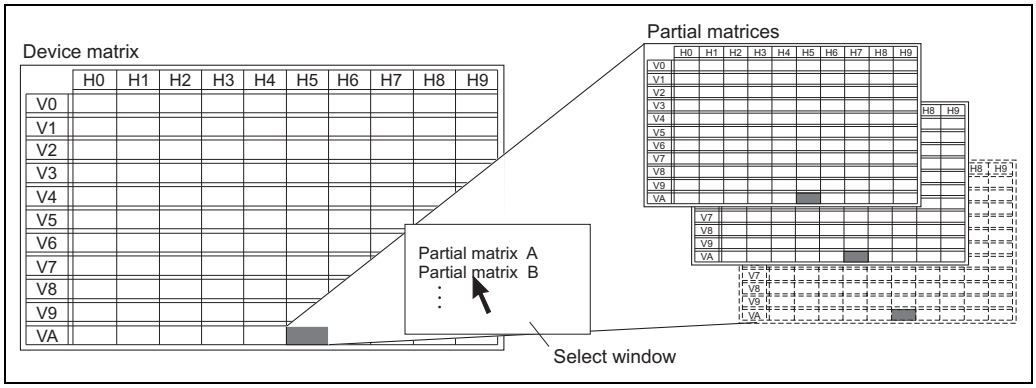


Fig. 25: Selecting parts of the matrix

The following matrixes are available for programming with the Commuwin II operating program (you can switch matrix via VAH5):

- 1 x Device matrix → Page 37
- 1 x Diagnosis/Simulation/Version Info (partial matrix) → Page 38
- 1 x Flow computer → Page 39
- 1 x Advanced diagnostics → Page 40
- 1 x Physical Block (operation via profile) → Page 41
- 1 x Transducer Block Flow (operation via profile) → Page 42
- 4 x Analog Input Block (operation via profile) → Page 43
- 2 x Totalizer Block (operation via profile) → Page 44

Device matrix

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURING VALUES	VOL.FLOW (display)	TEMPERATURE (display)	MASS FLOW (display)	CORR VOLUME FLOW (display)	HEAT FLOW (display)	DENSITY (display)	SPEC. ENTHALPY (display)	CALC. SAT. STEAM P. (display)	Z-FACTOR (display)	VORTEX FREQUENCY (display)
V1 SYSTEM UNITS	UNIT VOL. FLOW (selection)	UNIT TEMPERATURE (selection)	UNIT MASS FLOW (selection)	UNIT CORR. VOL. FL (selection)	UNIT HEAT FLOW (selection)	UNIT DENSITY (selection)	UNIT SPEC. ENTH. (selection)	UNIT PRESSURE (selection)	UNIT LENGTH (selection)	UNIT FREQUENCY (selection)
V2 OPERATION	LANGUAGE (selection)	ACCESS CODE (input)	DEFINE PRIVATE CODE (input)	STATUS ACCESS (display)	ACCESS CODE C. (input)	ACTIV. CODE NX-19 (input)	CODE. ADV.DIAG (input)			
V3 USER INTERFACE	ASSIGN LINE 1 (selection)	0% VALUE LINE 1 (input)	100% VALUE LINE 1 (input)	ASSIGN LINE 2 (input)	0% VALUE LINE 2 (input)	100% VALUE LINE 2 (input)	FORMAT (input)	DISPLAY DAMPING (input)	CONTRAST LCD (input)	TEST DISPLAY (selection)
V4 PROCESS PARAMETER	SELECT FLUID (selection)				MATING PIPE DIAM. (input)					
V5 SYSTEM PARAMETER	POS. ZERO RETURN (selection)	FLOW DAMPING (input)								
V6 PROFIBUS-DP/-PA	WRITE PROTECT (display)	SELECTION GSD (selection)	SET UNIT TO BUS (selection)	CHECK CONFIG. (display)	BUS ADDRESS (selection)	PROFILE VERSION (selection)	DEVICE ID (display)			
V7 PROFIBUS BLOCKS	AI BLOCK SELECT (selection)	CHANNEL AI (selection)	OUT VALUE (display)	OUT STATUS (display)	TOT BLOCK SELECT (selection)	CHANNEL TOT (selection)	OUT VALUE (display)	OUT STATUS (display)		
V8 LOW FLOW CUT OFF	ASSIGN LF CUT OFF (selection)	ON VAL. LF CUT OFF (input)	OFF VAL. LF CUT OFF (input)							
V9 SENSOR DATA	K-FACTOR (display)	K-FACTOR COMPENS (display)	NOMINAL DIAMETER (display)	METER BODY MB (input)	T-COEFF. SENSOR (input)	AMPLIFICATION (input)	OFFSET T-SENSOR (input)		CABLE LENGTH (input)	
VA MEASURING POINT	TAG NAME (input)					MATRIX SELECTION (selection)	DEVICE NAME (display)			

Diagnosis/Simulation/Version Info (partial matrix)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 SUPERVISION	ACTUAL.SYS.COND (display)	PRESENT ERROR (display)	PREV. SYS. CON. (display)	LAST ERROR NO. (display)	CLEAR LAST ERR. (selection)	ALARM DELAY (input)	SYSTEM RESET (selection)	OPERATION HOURS (selection)		
V1										
V2 OPERATION	LANGUAGE (selection)	ACCESS CODE (input)	DEFINE PRIVATE CODE (input)	STATUS ACCESS (display)	ACCESS CODE C. (display)	ACTIV. CODE NX-19 (input)	ACTIV. C. ADV. DIAG (input)			
V3										
V4 SIMULATION	SIM. MEASURAND (selection)	VALUE SIM. MEAS (input)	SIM. FAILSAFE (selection)							
V5										
V6 SENSOR INFO	SERIAL NUMBER (display)	SENSOR TYPE (display)	SN DSC SENSOR (display)							
V7 AMPLIFIER INFO	HW REV. AMP. (display)		SW REV. AMP. (display)							
V8 I/O MODULE INFO	HW REV. I/O (display)		SW REV. I/O (display)							
V9										
VA MEASURING POINT	TAG NAME (input)					MATRIX SELECTION (selection)	DEVICE NAME (display)			

Flow computer

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURING VALUES	VOLUME FLOW (display)	TEMPERATURE (display)	MASS FLOW (display)	CORRECTED VOLUME FLOW (display)	HEAT FLOW (display)	DENSITY (display)	SPEC. ENTHALPY (display)	CALC. SAT. STEAM P. (display)	Z-FACTOR (display)	VORTEX FREQUENCY (display)
V1 SYSTEM UNITS	UNIT VOL. FLOW (selection)	UNIT TEMPERATURE (selection)	UNIT MASS FLOW (selection)	UNIT CORR. VOL. FL (selection)	UNIT HEAT FLOW (selection)	UNIT DENSITY (selection)	UNIT SPEC. ENTH. (selection)	UNIT PRESSURE (selection)	UNIT LENGTH (selection)	UNIT FREQUENCY (selection)
V2 OPERATION	LANGUAGE (selection)	ACCESS CODE (input)	DEFINE PRIVATE CODE (input)	STATUS ACCESS (display)	ACCESS CODE C. (input)	ACTIV. CODE NX-19 (input)	ACTIV. C. ADV. DIAG (input)			
V3										
V4 PROCESS PARAMETER	SELECT FLUID (selection)	TEMPERATURE VALUE (input)	DENSITY VALUE (input)	EXPANSION COEFF. (input)	SPEC. DENSITY (input)	MOL-% N2 (input)	MOL-% CO2 (input)			
V5 REFERENCE PARAMETER		REFERENCE TEMP. (selection)	REFERENCE DENSITY (input)	REF. Z-FACTOR (input)	REFERENCE PRESSURE (input)					
V6 CONTROL PARAMETER		ERROR => TEMP. (display)		OPERATING Z-FACTOR (selection)	OPERATING PRESSURE (selection)					
V7										
V8										
V9										
VA MEASURING POINT	TAG NAME (input)					MATRIX SELECTION (selection)	DEVICE NAME (display)			

Advanced diagnostics

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURING VALUES	FLUID TEMP. (display)	ELECTRONICS TEMP. (display)	REYNOLDS NUMBER (display)	VELOCITY (display)						
V1 SYSTEM UNITS	UNIT TEMPERATURE (selection)									
V2 OPERATION	LANGUAGE (selection)	ACCESS CODE (input)	DEFINE PRIVATE CODE (input)	STATUS ACCESS (display)	ACCESS CODE C. (display)	ACTIV. CODE NX-19 (input)	ACTIV. C. ADV. DIAG (input)			
V3 DIAGNOSIS FLUID TEMP.	FLUID TEMP. STATUS (display)	MIN T FLUID (input)	MAX T FLUID (input)	RESET T FLUID (selection)	WARN T MEAS. LO (input)	WARN T MEAS. HI (input)				
V4 DIAGNOSIS ELECTRONIC TEMP.	ELECTRONIC TEMP. STATUS (display)	MIN T ELECTRONICS (input)	MAX T ELECTRONICS (input)	RESET T ELECTR. (selection)	WARN T ELECTR. LO (input)	WARN T ELECTR. HI (input)				
V5 DIAGNOSIS REYNOLDS NUMBER	REYNOLDS NUMBER STATUS (display)	REYNOLDS N. WARNING (input)								
V6 DIAGNOSIS VELOCITY	VELOCITY STATUS (display)	VELOC. WARNING (input)								
V7 ADVANCED SENSOR DIAGNOSTICS	SENSOR STATUS (display)	SENSOR DIAGNOSIS (input)								
V8										
V9										
VA MEASURING POINT	TAG NAME (input)					MATRIX SELECTION (selection)	DEVICE NAME (display)			

Physical Block (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 DEVICE DATA	DEVICE ID (display)	SERIAL NUMBER (display)	SOFTWARE VERSION (display)	HARDWARE VERSION (display)	MANUFACTURER ID (display)					
V1 DESCRIPTION	DESCRIPTOR (input)	INSTALLATION DATE (display)	MESSAGE (input)	DEVICE CERTIFICATE (display)						
V2 SOFTWARE RESET	SOFTWARE RESET (input)									
V3 SECURITY LOCKING	WRITE LOCKING (input)	HW WRITE PROTECT (selection)	LOCAL OPERATION (input)							
V4 DEVICE DATA	IDENT NUMBER (selection)									
V5 DIAGNOSIS MASK	MASK (display)	MASK 1 (display)	MASK 2 (display)	DIAG MASK EXTENS. (display)						
V6 DIAGNOSIS	DIAGNOSIS (display)	DIAGNOSIS 1 (display)	DIAGNOSIS 2 (display)	DIAGNOSIS EXTENS. (display)						
V7										
V8 BLOCK MODE	TARGET MODE (input)	ACTUAL (display)	NORMAL (display)	PERMITTED (display)						
V9 ALARM CONFIG	CURRENT (display)	DISABLE (display)				ST REVISION (display)				
VA BLOCK PARAMETER	TAG (input)	STRATEGY (input)	ALERT KEY (input)	PROFILE VERSION (display)						

Transducer Block Flow (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 VOLUME FLOW	VOLUME FLOW (display)	STATUS (display)	UNIT (selection)	LOWER RANGE VAL. (input)	UPPER RANGE VAL. (input)					
V1 MASS FLOW	MASS FLOW (display)	STATUS (display)	UNIT (selection)	LOWER RANGE VAL. (input)	UPPER RANGE VAL. (input)					
V2 DENSITY	DENSITY (display)	STATUS (display)	UNIT (selection)	LOWER RANGE VAL. (input)	UPPER RANGE VAL. (input)					
V3 TEMPERATURE	TEMPERATURE (display)	STATUS (display)	UNIT (selection)	LOWER RANGE VAL. (input)	UPPER RANGE VAL. (input)					
V4										
V5 VORTEX	VORTEX FREQ (display)	STATUS (display)	UNIT (selection)	LOWER RANGE VAL. (input)	UPPER RANGE VAL. (input)					
V6										
V7 SYSTEM PARAMETER			LOW FLOW CUTOFF (input)				CALIBR FACTOR (input)	NOMINAL SIZE (input)	UNIT (input)	
V8 BLOCK MODE	TARGET MODE (input)	ACTUAL (display)	NORMAL (display)	PERMITTED (display)				UNIT MODE (selection)		
V9 ALARM CONFIG	CURRENT (display)	DISABLE (display)	UNACKNOWLEDGED (display)	UNREPORTED (display)		ST REVISION (display)				
VA BLOCK PARAMETER	TAG (input)	STRATEGY (input)	ALERT KEY (input)	PROFILE VERSION (display)						

Analog Input Block (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 OUT	OUT VALUE (display)	OUT STATUS (display)	OUT STATUS (display)	OUT SUB STATUS (display)	OUT LIMIT (display)		FAILSAFE ACTION (selection)	FAILSAFE VALUE (input)		
V1 SCALING	PV SCALE MIN (input)	PV SCALE MAX (input)	TYPE OF LIN (selection)	OUT SCALE MIN (input)	OUT SCALE MAX (input)	OUT UNIT (input)	USER UNIT (input)	DEC POINT OUT (input)	RISING TIME (input)	
V2 ALARM LIMITS	ALARM HYSTERESIS (input)									
V3 HI HI ALARM	HI HI LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V4 HI ALARM	HI LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V5 LO ALARM	LO LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V6 LO LO ALARM	LO LO LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V7 SIMULATION	SIMULATION VALUE (input)	SIMULATION STATUS (selection)	SIMULATION MODE (selection)							
V8 BLOCK MODE	TARGET MODE (input)	ACTUAL (display)	NORMAL (display)	PERMITTED (display)		CHANNEL (selection)		UNIT MODE (selection)		
V9 ALARM CONFIG	CURRENT (display)	DISABLE (display)	UNACKNOWLEDGED (display)	UNREPORTED (display)		ST REVISION (display)				
VA BLOCK PARAMETER	TAG (input)	STRATEGY (input)	ALERT KEY (input)	PROFILE VERSION (display)	BATCH ID (input)	BATCH RUP (input)	BATCH PHASE (input)	BATCH OPERATION (selection)		

Totalizer Block (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 TOTAL	TOTAL. VALUE (display)	TOTAL. STATUS (display)	TOTAL. STATUS (display)	TOTAL. SUBSTATUS (display)	TOTAL. LIMIT (display)		FAILSAFE MODE (input)			
V1 CONFIGURATION	TOTAL. UNIT (display)	SET TOTALIZER (selection)	PRESET TOTALIZER (input)	TOTALIZER MODE (selection)						
V2 ALARM LIMITS	ALARM HYSTERESIS (input)									
V3 HI HI ALARM	HI HI LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V4 HI ALARM	HI LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V5 LO ALARM	LO LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V6 LO LO ALARM	LO LO LIM (input)	VALUE (display)	ALARM STATE (display)	SWITCH-ON POINT (input)	SWITCH-OFF POINT (input)					
V7										
V8 BLOCK MODE	TARGET MODE (input)	ACTUAL (display)	NORMAL (display)	PERMITTED (display)		CHANNEL (input)		UNIT MODE (selection)		
V9 ALARM CONFIG	CURRENT (display)	DISABLE (display)	UNACKNOWLEDGED (display)	UNREPORTED (display)		ST REVISION (display)				
VA BLOCK PARAMETER	TAG (input)	STRATEGY (input)	ALERT KEY (input)	PROFILE VERSION (display)	BATCH ID (input)	BATCH RUP (input)	BATCH PHASE (input)	BATCH OPERATION (selection)		

5.4.5 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.

PROFIBUS PA protocol (IEC 61158-2 (MBP)):

Valid for software:	1.03.XX	→ DEVICE SOFTWARE function
PROFIBUS PA device data		
Profile Version:	3.0	→ PROFILE VERSION function
Prowirl 73 device ID:	$153C_{hex}$	→ DEVICE ID function
Profile ID:	9742_{hex}	
GSD information:		
Prowirl 73 GSD:	Extended Standard	eh3x153C.gsd eh3_153C.gsd
Profile GSD:	PA139742.gsd	
Bitmaps:	EH_153C_d.bmp/.dib EH_153C_n.bmp/.dib EH_153C_s.bmp/.dib	
Software release:	01.2007	

Operating program/device driver:	**Sources for obtaining device descriptions/program updates:**
GSD	■ www.endress.com (→ Download → Software → Drivers) ■ www.profibus.com ■ CD-ROM
Fieldcare / DTM	■ www.endress.com (→ Download → Software → Drivers) ■ CD-ROM
SIMATIC PDM	■ www.endress.com (→ Download → Software → Drivers) ■ www.feldgeraete.de

Tester and simulator:	**Sources for obtaining device descriptions:**
Fieldcheck	■ Update via FieldCare with the flow device FXA193/291 DTM in the Fieldflash module

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

5.5 Hardware configuration

5.5.1 Switching write protection on/off

A DIP switch on the I/O amplifier board provides the means of activating or deactivating the write protection. When write protection is active, parameters cannot be modified. The current write protection status is displayed in the HW WRITE PROTECT parameter (Physical Block).

1. Switch off power supply.
2. Unscrew the cover of the electronics compartment from the transmitter housing.
3. 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).
4. Fold up the plastic cover (c).
5. Set the DIP switch (f) to the desired position.
   Position **A**, DIP switch at front = Write protection disabled
   Position **B**, DIP switch at rear = Write protection enabled
6. Installation is the reverse of the removal procedure.

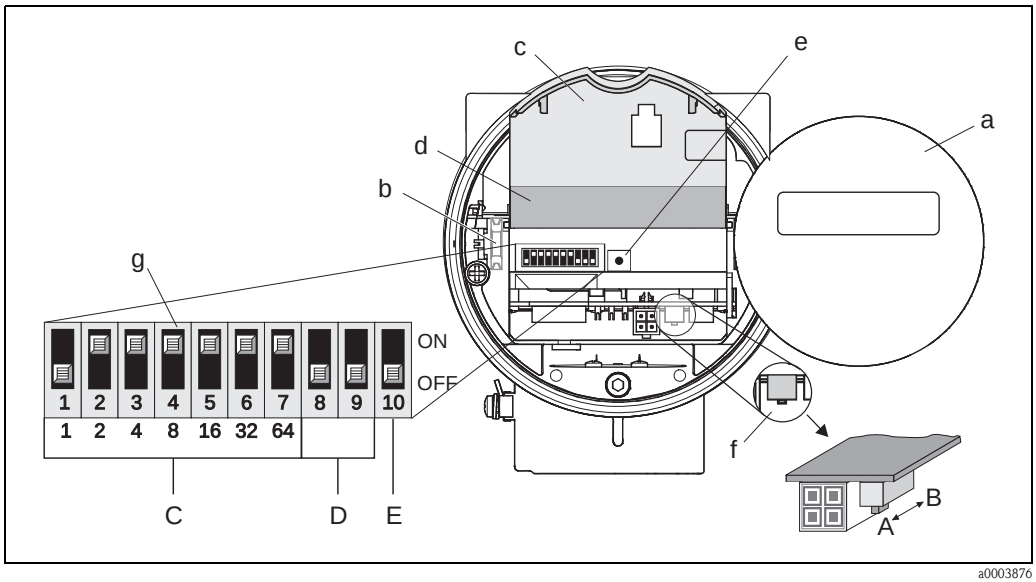


Fig. 26: DIP switch for write protection, configuring device address, LED

a Local display module
b Retaining rails of the 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 → Page 69 ff.
f DIP switch for write protection
– A = write protection disabled (DIP switch at front = factory setting)
– B = write protection enabled (DIP switch at rear)
g DIP switch for device address
– C = DIP switches 1 to 7 = device address configuration (factory setting = 126)
– D = DIP switches 8 to 9 = not assigned
– E = DIP switch 10 = addressing selection
(ON = hardware addressing / OFF = software addressing = factory setting)

5.5.2 Configuring the device address

Note the following points:
- In the case of a PROFIBUS PA device, the address must always be configured.
  Valid device addresses are in the range 1 to 126. In a PROFIBUS PA network,
  each address may only be given once. If an address is not configured correctly, the device is not recognized by the master.
  The address 126 can be used for initial commissioning and for service purposes.
- All devices have the address 126 and software addressing on leaving the factory.

Procedure for configuring the device address (see Fig. 26 on Page 46):

1. Switch off power supply.
2. Unscrew the cover of the electronics compartment from the transmitter housing.
3. Remove the display module (a) from the retaining rails (b) and refit onto right retaining rail with the left side (this secures the display module).
4. Fold up the plastic cover (c).
5. Fold up the cover (d) of the I/O board (COM module).
6. Configure the device address using DIP switches 1 to 7.
7. Activate hardware addressing using DIP switch 10 (=ON).
8. Installation is the reverse of the removal procedure.

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 → Page 17
- "Post-connection check" checklist → Page 29

Note!
- The PROFIBUS PA 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 Fig. 26 on Page 46) it is possible to carry out a simple function check in the non-hazardous area.

6.1.1 Switching on the measuring device

Once the final checks have been completed, 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 **START-UP RUNNING**	Start-up message
▼	
DEVICE SOFTWARE **V XX.XX.XX**	Current software version
▼	
FIELDBUS ADDRESS	The PROFIBUS address is displayed

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 the PROFIBUS interface

6.2.1 Commissioning via the Class 2 master (Commuwin II)

Operation with Commuwin II is described in the Endress+Hauser document BA124F/00/a2. The configuration parameters are found in the following places in the Commuwin II operation matrix:
- In the Physical Block → Page 41
- In the manufacturer-specific device matrix, rows V6 and V7 → Page 37
- In the Analog Input Block → Page 43
- In the Totalizer Block, row V1 → Page 44

Procedure:

1. Configuring the "Physical Block":
   – Open the Physical Block.
   – Software and hardware write protection is disabled in Prowirl 73 so that you can access the write parameters. Check this status via the WRITE LOCKING (V3H0, software write protection) and HW WRITE PROTECT. (V3H1, hardware write protection) parameters.
   – Enter the tag name in the TAG (VAH0) parameter.
2. Configuring the manufacturer-specific device parameters in the Transducer Block:
   – Open the manufacturer-specific Transducer Block "PROWIRL 73 PBUS".
   – Enter the desired name for the block (tag name).
   Factory setting: no block name (tag name).
   – Configure the device-specific parameters (e.g. SELECT FLUID, see Page 112) for flow measurement.
   – Execute the SET UNIT TO BUS parameter (see Page 118).

   ✎ Note!
   Other matrixes can be selected in the matrix cell VAH5 if you wish to configure other manufacturer-specific parameters.
   Please note that alterations made to device parameters will only be activated once a valid release code has been entered. The release code can be entered in the matrix cell V2H0 (factory setting: 73).

3. Configuring the "Analog Input function block":
   Prowirl 73 has four Analog Input function blocks to which various process variables can be assigned as required (see Table).
   These are selected by means of the connection clearance list. The explanation that follows is an example for Analog Input function block 1.
   – Enter the required block name for Analog Input function block 1 (factory setting: ANALOG INPUT 1 BLOCK).
   – Open the Analog Input function block.
   – Use the CHANNEL parameter (V8H5) to select the process variable which should be used as the input variable for the function block algorithm (scaling and limit value monitoring functions).

The following settings are possible:

CHANNEL = 273	→ Volume flow
CHANNEL = 277	→ Mass flow
CHANNEL = 398	→ Corrected volume flow
CHANNEL = 285	→ Temperature
CHANNEL = 116	→ Calculated heat flow
CHANNEL = 281	→ Density
CHANNEL = 118	→ Specific enthalpy
CHANNEL = 120	→ Calculated saturated steam pressure
CHANNEL = 186	→ Z factor
CHANNEL = 289	→ Vortex frequency
CHANNEL = 89	→ Electronics temperature*
CHANNEL = 96	→ Reynolds number*
CHANNEL = 99	→ Flow velocity

*Only available with the "Advanced diagnostics" software option.

– In the Analog Input function block, the input value or the input range can be scaled in accordance with the requirements of the automation system (see Page 144).
– If necessary, set the limit values (see Page 145).

4. Configuring the "Totalizer Block":
Prowirl 73 has two Totalizer function blocks to which various process variables can be assigned as required (see Table).
These are selected by means of the connection clearance list. The explanation that follows is an example for Totalizer function block 1.
– Enter the required block name for Totalizer function block 1 (factory setting: TOTALIZER 1 BLOCK).
– Open the Totalizer function block.
– Select the desired process variable by means of the CHANNEL parameter (V8H5).

The following settings are possible:

CHANNEL = 273	→ Volume flow
CHANNEL = 277	→ Mass flow
CHANNEL = 398	→ Corrected volume flow
CHANNEL = 116	→ Calculated heat flow

– Select the required units for the totalizer (UNIT TOTALIZER, V1H0).
– Configure the totalizer status (SET TOTALIZER, V1H1), e.g. for totalizing.
– Configure the totalizer mode (TOTALIZER MODE, V1H3), e.g. for balancing.

5. Configuring cyclic data traffic:
– All the relevant data are described in the "System integration" (see Page 51) section.
– We recommend that the "Coupling Documentation" be used for step-by-step configuration. This can be obtained from Endress+Hauser Process Solutions for various automation systems and programmable logic controllers.
– The files required for commissioning and network configuration can be obtained as described on Page 51 ff.

6.3 System integration

The device is ready for system integration once commissioning has been effected via the Class 2 master (Commuwin II). The PROFIBUS PA system requires a description of the device parameters, e.g. output data, input data, data format, data volume and supported transmission rate so that it can integrate the field devices into the bus system.
These data are contained in a Device Master File (GSD file) which is placed at the disposal of the PROFIBUS PA master while the communication system is being commissioned. Device bitmaps, which appear as icons in the network tree, can also be integrated.

The Profile 3.0 Device Master File (GSD) allows field devices from various manufacturers to be exchanged without having to reconfigure. Generally, the Profile 3.0 distinguishes between three different versions of GSD (factory setting: manufacturer-specific GSD):

Manufacturer-specific GSD: This GSD guarantees the unlimited functionality of the field device. Device-specific process parameters and functions are therefore available.

Profile GSD: This GSD is different in terms of the number of Analog Input Blocks (AI) and the measuring principles. If a system is configured with profile GSDs, it is possible to exchange devices that are supplied by various manufacturers. It is, however, essential that the cyclic process values follow the same sequence.

Example:
The Proline Prowirl 73 PROFIBUS PA supports the Profile PA139742.gsd (IEC 61158-2 (MBP)). This GSD contains one Analog Input Block and one Totalizer Block. The following measured variable is always assigned to the Analog Input Block: AI 1 = Volume flow. This guarantees that the first measured variable agrees with the field devices of other manufacturers.

Profile GSD (multivariable) with the ID number 9760_{Hex}: This GSD contains all function blocks such as AI, DO, DI etc. This GSD is not supported by Prowirl 73.

Note!
- A decision should be made with respect to which GSD is to be used before configuration takes place.
- The setting can be changed using a Class 2 master.

Prowirl 73 supports the following GSD files:

Name of device	Manufacturer-spec. ID No.	Profile 3.0 ID No.	Manufacturer-spec. GSD
Prowirl 73 PA PROFIBUS PA (IEC 61158-2 (MBP))	153C (Hex)	9742 (Hex)	EH3_153C.gsd EH3X153C.gsd
	Profile 3.0 GSD	**Type file**	**Bitmaps**
	PA139742.gsd	EH_153C.200	EH153C_d.bmp/.dib EH153C_n.bmp/.dib EH153C_s.bmp/.dib

Each device receives an identification number from the Profibus User Organization (PNO). The name of the Device Master File (GSD) is derived from this.
For Endress+Hauser, this ID No. starts with the manufacturer ID 15xx.

How to acquire GSD files
The GSD files for all Endress+Hauser devices can be acquired in the following manner:
- Internet (Endress+Hauser) → http://www.endress.com (Products → Process Solutions → PROFIBUS → GSD files)
- Internet (PNO) → http://www.profibus.com (GSD library)
- On CD ROM from Endress+Hauser

Compatibility of Profile 2.0 and 3.0 devices
It is possible to operate Profile 2.0 and 3.0 devices with different GSD files in one system using one DP master as the cyclic data for the automation system in both profile versions are compatible.

6.3.1 Compatibility with other Endress+Hauser measuring devices

The Prowirl 73 PROFIBUS PA ensures compatibility in cyclic data exchange with the automation system (Class 1 master) for the following measuring devices:
- Prowirl 72 PROFIBUS PA (Profile version 3.0, ID No. 153B)
- Prowirl 77 PROFIBUS PA (Profile version 2.0, ID No. 1510)

It is possible to replace these measuring devices with a Prowirl 73 PROFIBUS PA without adjusting the planning of the PROFIBUS DP/PA network in the automation device even though the devices differ with regard to their name and their ID number. Once replaced, the device is recognized either automatically (factory setting) or this can be set manually.

Automatic recognition (factory setting)
The Prowirl 73 PROFIBUS PA automatically recognizes the measuring device (Prowirl 72 PROFIBUS PA or Prowirl 77 PROFIBUS PA) planned in the automation system and makes the same input and output data and measured value status information available for cyclic data exchange.

Manual setting
The manual setting is made in the manufacturer-specific device matrix in the SELECTION GSD (V6H1) parameter, see Page 118.
- When replacing instead of a Prowirl 72 PROFIBUS PA, "Prowirl 72" must be selected in the SELECTION GSD parameter.
- When replacing instead of a Prowirl 77 PROFIBUS PA, "Prowirl 77" must be selected in the SELECTION GSD parameter.

Then the Prowirl 73 PROFIBUS PA makes the same input and output data and measured value status information available for cyclic data exchange.

Note!
- At 16 mA, the current consumption of the Prowirl 73 PROFIBUS PA is slightly higher than that of the Prowirl 77 PROFIBUS PA (12 mA). After replacing the devices, make sure that the sum of the base currents of all the PROFIBUS PA bus users does not exceed the maximum permitted feed current of the bus feed device.
- When acyclically configuring the Prowirl 73 PROFIBUS PA by means of an operating program (Class 2 master), access takes place directly via the block structure or the parameters of the measuring device.
- If parameters in the device to be replaced (Prowirl 72 PROFIBUS PA or Prowirl 77 PROFIBUS PA) have been changed (parameter setting no longer corresponds to the original factory setting), these parameters have to be adjusted accordingly in the new Prowirl 73 PROFIBUS PA in use by means of an operating program (Class 2 master).

  Example:
  The assignment of low flow cut off was changed from volume flow (factory setting) to corrected volume flow in a Prowirl 72 PROFIBUS PA which is in use. This measuring device is now replaced by a Prowirl 73 PROFIBUS PA. Once the device has been replaced, the low flow cut off assignment in the Prowirl 73 PROFIBUS also has to be adjusted manually, i.e. changed to corrected volume flow to ensure that the device behaves identically.

Procedure when replacing the measuring devices

Replacing a Prowirl 77 PROFIBUS PA with a Prowirl 73 PROFIBUS PA	Replacing a Prowirl 72 PROFIBUS PA with a Prowirl 73 PROFIBUS PA
■ Remove the Prowirl 77 PROFIBUS PA ■ Configure the device address (see Page 47). The same device address as that configured for the Prowirl 77 PROFIBUS PA must be used. ■ Check that the maximum permitted feed current of the bus feed device is not exceeded. This could be caused by the higher current consumption of the Prowirl 73 PROFIBUS PA. ■ Connect the Prowirl 73 PROFIBUS PA ■ If necessary, the following settings must be adjusted (if the factory setting had been altered): – Configuration of the application-specific parameters – Configuration of the units for the process variables	■ Remove the Prowirl 72 PROFIBUS PA ■ Configure the device address (see Page 47). The same device address as that configured for the Prowirl 72 PROFIBUS PA must be used. ■ Connect the Prowirl 73 PROFIBUS PA ■ If necessary, the following settings must be adjusted (if the factory setting had been altered): – Configuration of the application-specific parameters – Option selected for the process variables to be transmitted by means of the CHANNEL parameter in the Analog Input or Totalizer function block – Configuration of the units for the process variables

6.4 Cyclic data exchange

6.4.1 Block model

The block model illustrated shows which input and output data are provided for cyclic data exchange.

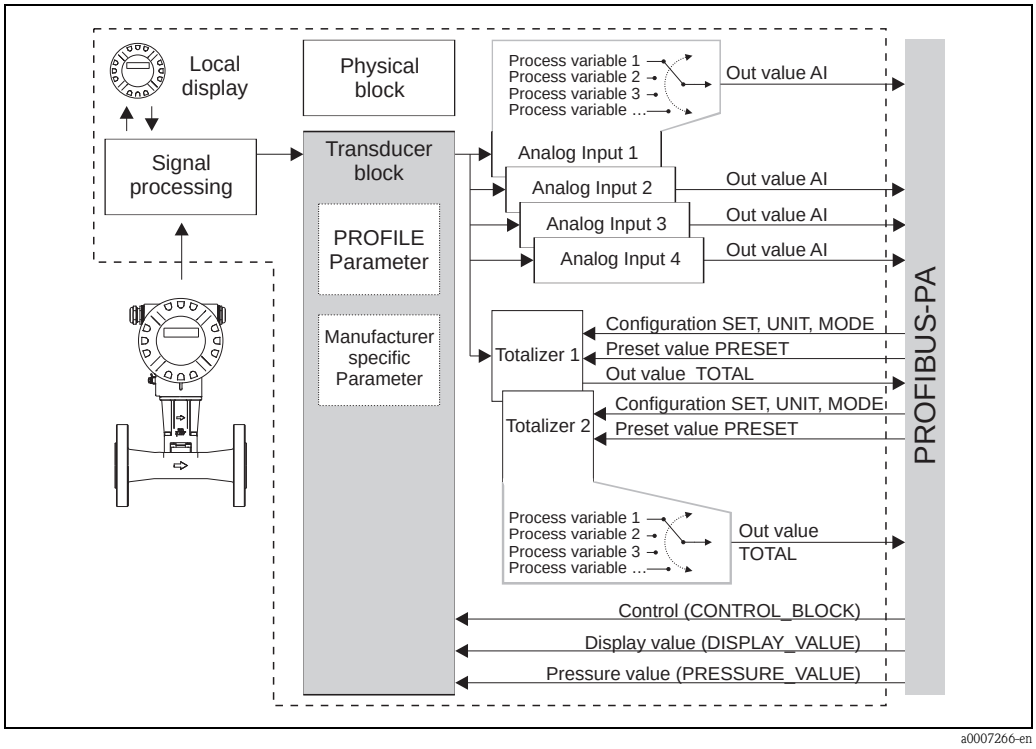


Fig. 27: Block model for Prowirl 73 PROFIBUS PA Profile 3.0

6.5 Input data (measuring device – PLC)

6.5.1 Cyclic transmission of the process variables: AI (Analog Input), TOTAL (totalizer value)

In the case of PROFIBUS DP/PA, the cyclic transmission of process variables to the automation system is effected in data blocks of 5 bytes each. The process variable is portrayed in the first four bytes in the form of floating point numbers in accordance with IEEE 754 standard.. The fifth byte contains status information pertaining to the measured value which is implemented in accordance with the PROFIBUS PA Profile Specification, Version 3.0.

Data structure of the data blocks (AI and TOTAL)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Process variable				Status

An overview of the process variables which are transmitted to the automation system by means of the Analog Input or Totalizer function block can be found on Page 55.

Assignment of the process variables to the AI data block

The process variables are assigned to the AI data block with the aid of a Class 2 master (operating program) in the CHANNEL parameter of the Analog Input function block.

Block	Process variable	Unit	CHANNEL parameter
AI – Analog Input Function block 1 to 4	Volume flow / + status	m^3/h	273 (factory setting AI 1)
	Mass flow / + status	kg/s	277 (factory setting AI 2)
	Corrected volume flow / + status	Nm^3/h	398 (factory setting AI 3)
	Temperature / + status	K	285 (factory setting AI 4)
	Calculated heat flow / + status	kJ/h	116
	Density / + status	kg/l	281
	Specific enthalpy / + status	kJ/kg	118
	Calc. saturated steam pressure / + status	bar	120
	Z factor / + status	–	186
	Vortex frequency / + status	Hz	289
	* Electronics temperature / + status	K	89
	* Reynolds number / + status	–	96
	Flow velocity / + status	m/s	99
	* Only available with the "Advanced diagnostics" software option. If the "Advanced diagnostics" software option is not available and if one of the two assignments is made, NaN (not-a-number) is transmitted as the value for the process variable.		

✎ Note!
The system units in the table correspond to the preset scales which are transferred during cyclic data exchange. In the case of customized settings, the units can deviate from the factory setting, however.

Assignment of the process variables to the TOTAL data block

The process variables are assigned to the TOTAL data block with the aid of a Class 2 master (operating program) in the CHANNEL parameter of the Totalizer function block.

Block	Process variable	Unit	CHANNEL parameter
TOTAL – totalizer function block 1 to 2	Volume flow / + status	m^3	273
	Mass flow / + status	kg	277
	Corrected volume flow / + status	Nm^3/h	398
	Calculated heat flow / + status	kJ/h	116

✎ Note!
The system units in the table correspond to the preset scales which are transferred during cyclic data exchange. In the case of customized settings, the units can deviate from the factory setting, however.

Factory setting, totalizer 1 and 2:

Selected fluid (SELECT FLUID parameter, see Page 112):	Assignment Totalizer 1:	Assignment Totalizer 2:
Saturated steam	→ Mass flow	→ Calculated heat flow
Superheated steam	→ Mass flow	→ Calculated heat flow
Water	→ Volume flow	→ Calculated heat flow
User-defined liquid	→ Mass flow	→ Volume flow
Compressed air	→ Corrected volume flow	→ Volume flow
Natural gas NX-19	→ Corrected volume flow	→ Volume flow
Real gas	→ Mass flow	→ Volume flow
Gas volume	→ Volume flow	→ Volume flow
Liquid volume	→ Volume flow	→ Volume flow

6.6 Output data (PLC – measuring device)

6.6.1 Cyclic configuration of totalizers 1 to 2, SET_TOT, MODE_TOT, UNIT_TOT, PRESET_TOT

The totalizers 1 to 2 can be configured and controlled by means of the automation system (Class 1 master) using the following data blocks.

Data block	Byte length	GSD block name	Control variables for totalizer 1 to 2
SET_TOT	1	SET	Control of totalizer. 0 = Totalize (factory setting) 1 = Reset totalizer 2 = Preset totalizer
MODE_TOT	1	MODE	How the totalizer totalizes. 0 = Balance (factory setting) 1 = Only positive flow detection 2 = Only negative flow detection 3 = Totalizing is stopped
UNIT_TOT	2	UNIT	Totalizer unit. Enter the unit code as per the PROFIBUS PA Profile Specification, Version 3.0. ✎ Note! The unit must suit the process variable selected in the CHANNEL parameter.
PRESET_ TOT	4	PRESET	Specifies a totalizer value (32-bit floating point number, IEEE 754) ✎ Note! The preset value is not taken until SET_TOT is activated (2 = preset totalizer).

Example for SET_TOT and MODE_TOT
If the SET_TOT parameter is set to 1 (= reset the totalizer), the value for the aggregated totals of the totalizer is reset to 0. If the aggregated totals of the totalizer should constantly retain the value 0, the MODE_TOT parameter must first be set to 3 (= totalizing is stopped) and then the SET_TOT parameter must be set to 1 (= reset the totalizer).

Data structure of the block combinations supported
The data blocks shown in the table can be integrated in the automation system in conjunction with the TOTAL data block (input data) by means of the following block combinations:

SET_TOT_TOTAL

Byte 1	2	3	4	5	6
SET_TOT	Output variable TOTAL				Status

SET_TOT_MODE_TOT_TOTAL

Byte 1	2	3	4	5	6	7
SET_TOT	MODE_TOT	Output variable TOTAL				Status

SET_TOT_PRESET_TOT_UNIT_TOT_TOTAL

Byte 1	2	3	4	5	6	7	8	9	10	11	12
SET_TOT	PRESET_TOT				UNIT_TOT		Output variable TOTAL				Status

SET_TOT_MODE_TOT_PRESET_TOT_UNIT_TOT_TOTAL

Byte 1	2	3	4	5	6	7	8	9	10	11	12	13
SET_TOT	MODE_TOT	PRESET_TOT				UNIT_TOT		Output variable TOTAL				Status

6.6.2 Cyclic control of device functions, CONTROL_BLOCK

By means of the CONTROL_BLOCK data block, the measuring device is able to process device-specific control variables in cyclic data exchange (e.g. switching on measured value suppression).

Data structure of the CONTROL_BLOCK data block

Byte 1
Control

The table below shows the possible control variables which can be transmitted to the device:

Data block	Byte length	Control variables
CONTROL_ BLOCK	1	0 → 1 Reserved 0 → 2 Positive zero return **ON** 0 → 3 Positive zero return **OFF** 0 → 24 Run "SET UNIT TO BUS" function 0 → 25 System/process error messages* are **not** displayed and evaluated (used for rinsing the pipe for example) 0 → 26 System/process error messages* are displayed and evaluated
* Affects the following system/process error messages: ■ System error message: # 381, 382, 396, 515, 516, 517, 601 (see Page 69 ff.) ■ Process error message: # 412, 421, 494 (see Page 73)		

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

Example: when the output byte switches:

From	→	To	Result
0	→	2	positive zero return is switched on.
2	→	0	this does not have any effect.
0	→	3	positive zero return is switched off.
3	→	2	this does not have any effect.

6.6.3 Cyclic transmission of the display value to the local display, DISPLAY_VALUE

Any value (32-bit floating-point number) incl. unit and status can be cyclically transmitted directly to the local display via the automation system using the DISPLAY_VALUE data block. Provided cyclic data exchange is active, the value is automatically displayed on the second line of the local display. However, it is possible to assign the value to line 1 of the local display by means of an operating program (Class 2 master).

Data structure of the DISPLAY_VALUE data block:

Byte 1	2	3	4	5	6	7	8	9	10	11
Display value				Status	Unit					

Status
In accordance with the PROFIBUS PA Profile Specification, Version 3.0, if a display value is transmitted with the status UNCERTAIN or BAD, the display alternates between this message and the display value. If the display value does not have a GOOD status, the display alternates between the display value and the status message BAD (0x00).

Unit
ASCII text, character set as per ISO 646-IRV (International Reference Version).
If no unit text is available, no text is displayed on the local display.

6.6.4 Cyclic transmission of the operating pressure value, PRESSURE_VALUE

A value for the operating pressure (32-bit floating-point number) incl. unit and status can be cyclically transmitted from the automation system to the measuring device by means of the PRESSURE_VALUE data block. The value for the operating pressure is used for continuous density calculation (see OPERATING PRESSURE parameter, Page 135).

Data structure of the PRESSURE_VALUE data block:

Byte 1	2	3	4	5	6	7
Pressure measured value				Status	Unit	

Status

General information
Implementation as per the PROFIBUS PA Profile Specification, Version 3.0.

Behavior when status is GOOD
If an operating pressure value is transmitted with the status GOOD, this value is converted to the current system unit and processed further in the measuring device.

Behavior when status is BAD or UNCERTAIN
If an operating pressure with the status BAD or UNCERTAIN is transmitted, the process variables dependent on the operating pressure (e.g. density) assume the status BAD and NaN (not-a-number) is the value transmitted for these process variables. If the operating pressure is assigned to the local display, the display alternates between showing five dashes "_ _ _ _ _" and showing the system error "PT-No Data".
If a process variable which depends on the operating pressure is assigned to the local display, the status "BAD (0x00)" is displayed in addition to "[1] _ _ _ _ _" and the system error "PT-No Data".

Units
In accordance with the PROFIBUS PA Profile Specification, Version 3.0.

Supported units:

Units code (dec)	Unit
1130	Pa
1131	GPa
1132	MPa
1133	kPa
1134	mPa
1135	µPa
1137	bar
1138	mbar
1139	torr
1142	psia

Note!
- The operating pressure data always refer to the absolute pressure.
- If no unit is transmitted or if a unit is transmitted that is not in the table, the unit selected in the measuring device is used.

6.6.5 Planning notes for integrating data blocks

It is essential to adhere to the following sequence when integrating data blocks into the automation system:

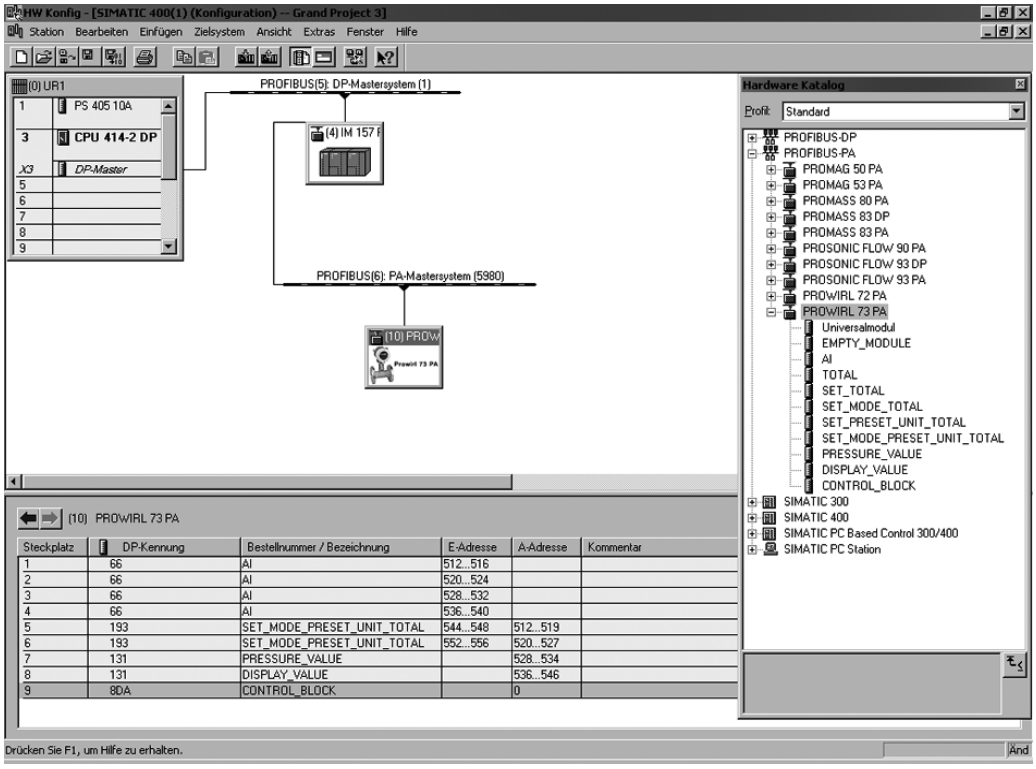
Sequence (Slot)	Data block/ GSD block name	Description
1	AI	Analog Input function block 1 Output variable = volume flow (factory setting)
2	AI	Analog Input function block 2 Output variable = mass flow (factory setting)
3	AI	Analog Input function block 3 Output variable = corrected volume flow (factory setting)
4	AI	Analog Input function block 4 Output variable = temperature (factory setting)
5	TOTAL or SET_TOTAL or SET_MODE_TOTAL or SET_PRESET_UNIT_TOTAL or SET_MODE_PRESET_UNIT_TOTAL	Totalizer function block 1 TOTAL output variable Configuration → Page 56
6		Totalizer function block 2 TOTAL output variable Configuration → Page 56
7	PRESSURE_VALUE	Operating pressure value
8	DISPLAY_VALUE	Display value
9	CONTROL_BLOCK	Control of device functions

Note!

- The assignment of the process variables for the Analog Input function blocks (1 to 4) and the Totalizer function blocks (1 to 2) can be changed by means of the CHANNEL parameter in question.
- The device has to be reset once a new measured variable configuration has been loaded to the automation system. This can be effected in either of two ways:
  – By means of a Class 2 master (e.g. Commuwin II, SYSTEM RESET parameter V0H6, diagnosis partial matrix)
  – Switching supply voltage OFF and then ON again.
- If not all the measured variables are required, individual data blocks can be deactivated using the "EMPTY_MODULE" placeholder.
- Only activate the data blocks which are processed in the automation system. This improves the data throughput rate of a PROFIBUS DP/PA network.

6.6.6 Configuration examples with Simatic S7 HW-Konfig

Example 1:
Full configuration using the manufacturer-specific GSD file.

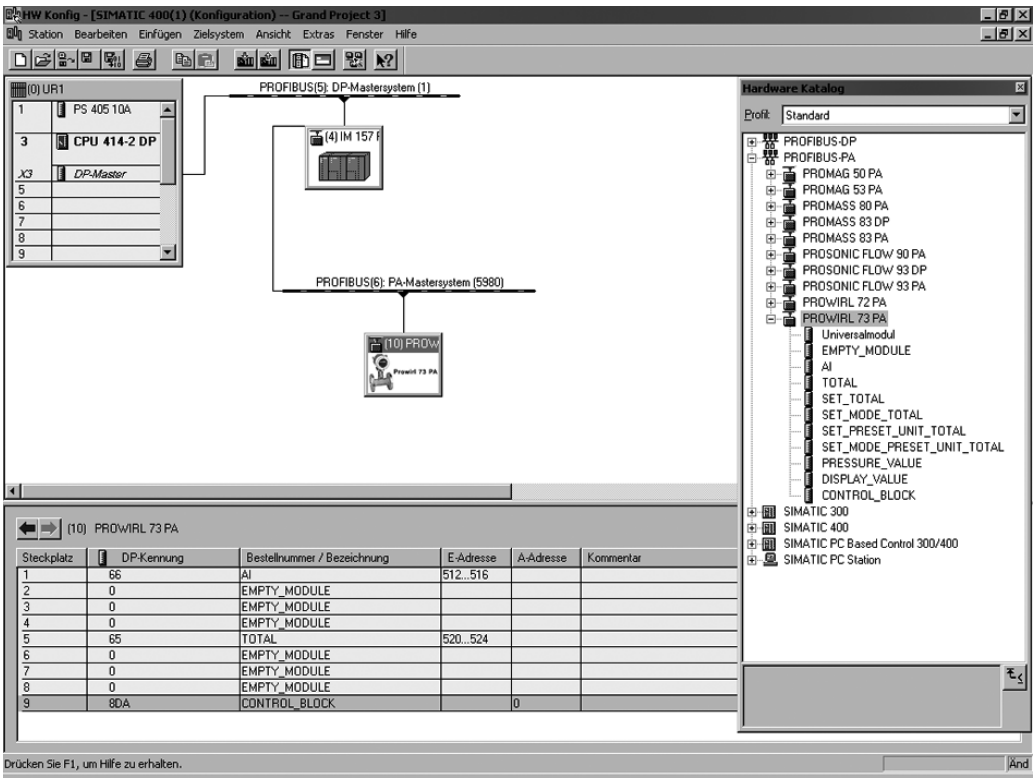


a0007267

In this form of configuration, all the data blocks which are supported by the measuring device are activated.

Sequence (Slot)	Data block/ GSD block name	Byte length, input data	Byte length, output data	Description
1	AI	5	–	Analog Input function block 1 Output variable = volume flow (factory setting) Data structure → Page 54
2	AI	5	–	Analog Input function block 2 Output variable = mass flow (factory setting) Data structure → Page 54
3	AI	5	–	Analog Input function block 3 Output variable = corrected volume flow (factory setting) Data structure → Page 54
4	AI	5	–	Analog Input function block 4 Output variable = temperature (factory setting) Data structure → Page 54
5	SET_MODE_PRESET_UNIT_TOTAL	5	8	Totalizer function block 1 (slot 5) Totalizer function block 2 (slot 6) *Totalizer configuration → Page 56* SET → set totalizer MODE → totalizing PRESET → totalizer default value UNIT → totalizer unit *Totalizer output variable* TOTAL Data structure → Page 54
6	SET_MODE_PRESET_UNIT_TOTAL	5	8	
7	PRESSURE_VALUE	–	7	Operating pressure value
8	DISPLAY_VALUE	–	11	Display value
9	CONTROL_BLOCK	–	1	Control of device functions

Example 2:
Replacing measured variables with placeholders (EMPTY_MODULE) using the manufacturer-specific GSD file:

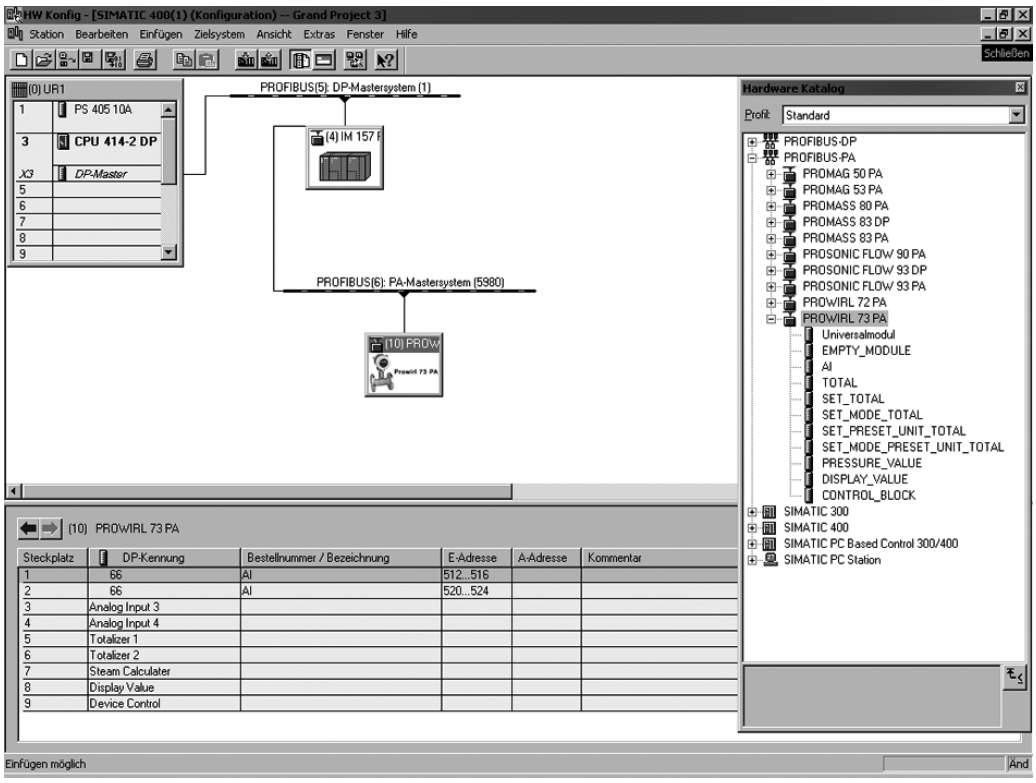


a0007268

With this configuration, the Analog Input function block, the totalizer value TOTAL and the cyclic control of device functions CONTROL_BLOCK are activated. The totalizer is configured "without configuration". In this example, it only returns the totalizer value and cannot be controlled. It is not possible to reset or stop the totalizer.

Sequence (Slot)	Data block/ GSD block name	Byte length, input data	Byte length, output data	Description
1	AI	5	–	Analog Input function block 1 Output variable = volume flow (factory setting) Data structure → Page 54
2	EMPTY_MODULE	–	–	Placeholder
3	EMPTY_MODULE	–	–	Placeholder
4	EMPTY_MODULE	–	–	Placeholder
5	TOTAL	5	–	Totalizer function block 1 Totalizer output variable TOTAL Data structure → Page 54
6	EMPTY_MODULE	–	–	Placeholder
7	EMPTY_MODULE	–	–	Placeholder
8	EMPTY_MODULE	–	–	Placeholder
9	CONTROL_BLOCK	–	1	Control of device functions

Example 3:
Configuration of the measured variables without placeholders (EMPTY_MODULE) using the manufacturer-specific GSD file.



a0007269

Analog Input function block 1 and 2 are transmitted with this configuration.
If no further measured variables are required, the placeholders do not need to be used.

Sequence (Slot)	Data block/ GSD block name	Byte length, input data	Byte length, output data	Description
1	AI	5	–	Analog Input function block 1 Output variable = volume flow (factory setting) Data structure → Page 54
2	AI	5	–	Analog Input function block 2 Output variable = mass flow (factory setting) Data structure → Page 54

Status code

The status codes which are supported by the AI (Analog Input) and TOT (Totalizer) Blocks are listed in the following table.
The coding of the status corresponds to the PROFIBUS Profiles 3.0 "PROFIBUS PA Profile for Process Control Devices – General Requirements" V 3.0:

Status code	Meaning	Device status	Limits
0x1C 0x1D 0x1E 0x1F	Out of service	Bad	OK LOW_LIM HIG_LIM CONST
0x10 0x11 0x12	Sensor error Sensor limit undershot Sensor limit exceeded	Bad	NO_LIMIT LOW_LIM HIG_LIM
0x0C 0x0D 0x0E 0x0F	Device error	Bad	OK LOW_LIM HIG_LIM CONST
0x18	No communication	Bad	NO_LIMIT
0x08 0x09 0x0A 0x0B	Function block not available	Bad	OK LOW_LIM HIG_LIM CONST
0x40 0x41 0x42 0x43	Uncertain status	Uncertain	OK LOW_LIM HIG_LIM CONST
0x44 0x45 0x46 0x47	Last useable value	Uncertain	OK LOW_LIM HIG_LIM CONST
0x48 0x49 0x4A 0x4B	Substitute set of failsafe status	Uncertain	OK LOW_LIM HIG_LIM CONST
0x4C 0x4D 0x4E 0x4F	Values which are not saved after the device or parameters have been reset	Uncertain	OK LOW_LIM HIG_LIM CONST
0x50 0x51 0x52 0x53	Measured value of sensor inaccurate	Uncertain	OK LOW_LIM HIG_LIM CONST
0x60 0x61 0x62 0x63	Manually specified value	Uncertain	OK LOW_LIM HIG_LIM CONST
0x80 0x81 0x82 0x83	Measuring system OK	Good	OK LOW_LIM HIG_LIM CONST
0x84 0x85 0x86 0x87	Change of parameters	Good	OK LOW_LIM HIG_LIM CONST
0x8C 0x8D 0x8E 0x8F	Critical alarm: Alarm limits exceeded	Good	OK LOW_LIM HIG_LIM CONST
0x88 0x89 0x8A 0x8B	Warning: Early warning limit exceeded	Good	OK LOW_LIM HIG_LIM CONST

6.7 Acyclic data exchange

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

When observing acyclic communication, a distinction must be made between two types:

6.7.1 Class 2 master acyclic (MS2AC)

MS2AC deals with acyclic communication between a field device and a Class 2 master (e.g. FieldCare, Commuwin, PDM etc., see Page 35). Here, the master opens a communication channel by means of an SAP (service access point) to access the device.

A Class 2 master must be made aware of all the parameters which should be exchanged with a device by means of PROFIBUS. This assignment is made to each individual parameter either in a device description (DD), a DTM (Device Type Manager) or within a software component in the master via slot and index addressing.

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

6.7.2 Class 1 master acyclic (MS1AC)

In the case of MS1AC, a cyclic master, which is already reading the cyclic data from the device or writing the data to the device, opens the communication channel via the SAP 0x33 (special service access point for MS1AC) and can then, like a Class 2 master, acyclically read or write a parameter by means of the slot and the index (if supported).

The following should be noted with MS1AC communication:
- At present, there are very few PROFIBUS masters on the market that support this kind of communication.
- Not all PROFIBUS devices support MS1AC.
- In the user program, you must be aware that constant parameter writing (e.g. with every program cycle) can drastically reduce the operating life of a device. Parameters written acyclically are written to memory modules (EEPROM, Flash, etc.). These are resistant to voltage. These memory modules are only designed for a limited number of writes. This number of writes is not even nearly reached in normal operation without MS1AC (during configuration). This maximum figure can be quickly reached as a result of incorrect programming and thus the operating time of a device can be drastically reduced.

The measuring device supports MS2AC communication with 2 available SAPs.
MS1AC communication is supported by the device.
The memory module is designed for 10^6 writes.

7 Maintenance

The flowmeter 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) → Page 66.
  Only Endress+Hauser sensor seals may 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 Endress+Hauser service organization can provide detailed information on the order codes 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 * * * * * *
Mounting kit for Prowirl 73 W	Mounting kit for wafer version consisting of: – Threaded studs – Nuts incl. washers – Flange seals	DKW** – ***
Mounting kit for transmitter	Mounting kit for remote version, suitable for pipe and wall mounting.	DK5WM – B
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, 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 PROFIBUS PA, only Cerabar S sensors are suitable for absolute pressure.	PMC71 – ********* PMP71 – *********
PROFIBUS PA display RID 261	Displays process values and limit value overshoot on PROFIBUS PA, can be used in the Ex area (ATEX).	RID261 – * * *
Surge arrester HAW562Z	Surge arrester for limiting overvoltage in signal lines and components.	51003575

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 4 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 the display	
No display visible and no output signals present	1. Check supply voltage → Terminal 1, 2 2. Electronics defective → Order spare part → Page 76
No display visible but output signals are present	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → Page 77 2. Display module defective → Order spare part → Page 76 3. Electronics defective → Order spare part → Page 76

▼

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 and seconds), for display format see OPERATION HOURS parameter on Page 126. – **#395** = Error number Caution! Please refer also to the information on Page 33 ff.!	
Error message present	System error (device error) → Page 69 Process error (application error) → Page 73

▼

Faulty connection to control system	
No connection can be made between the control system and the device. Check the following points:	
Fieldbus connection	Check data lines
Fieldbus connector	– Check pin assignment / wiring → Page 23 ff. – Check connection between connector / fieldbus port. Is the coupling ring tightened correctly?
Fieldbus voltage	Check that a min. bus voltage of 9 V DC is present at terminals 1/2. Permissible range: 9 to 32 V DC
Network structure	Check permissible fieldbus length and number of spurs. → Page 19
Basic current	Is there a basic current of min. 16 mA?

Continued on next page

Faulty connection to control system (contd.)	
Fieldbus address	Check bus address: make sure there are no double assignments!
Terminating resistors	Has the PROFIBUS network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise they 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.

▼

System or process error messages
System or process errors which occur during commissioning or operation can also be displayed in the manufacturer-specific device controls using the Commuwin II operating program → Page 69 ff.

▼

Other errors (without error message)	
Some other error has occurred.	Diagnosis and remedial measures → Page 74

9.2 System error messages

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 4 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.

Error messages on the local display, in the configuration program and the automation system

Type	Device status message display / error number	Cause / remedy	Device status / diagnosis message (control system)	Analog Input / Totalizer output status	Status / alarm limit	Process variables affected
Serious system errors are **always** recognized by the device as "fault messages" and are indicated with a lightning flash (ϟ) on the display! Fault messages have a direct effect on the PROFIBUS PA process variables. Simulations and positive zero return, on the other hand, are only classed and displayed as "notice messages". Please refer also to the information on → Page 33! S = System error ϟ = Fault message (with an effect on the inputs and outputs) ! = Notice message (without an effect on the inputs and outputs)						
S ϟ	CRITICAL FAIL. # 001	Serious device error. Replace the amplifier board: Spare parts → Page 76.	ROM / RAM failure	Device failure	BAD 0x0F / constant	All
S ϟ	AMP HW EEPROM # 011	Amplifier: faulty EEPROM. Replace the amplifier board: Spare parts → Page 76.	Amplifier HW EEPROM failure	Device failure	BAD 0x0F / constant	All
S ϟ	AMP SW EEPROM # 012	Amplifier: error when accessing data of the EEPROM. Contact your Endress+Hauser service organization.	Amplifier SW-EEPROM failure	Device failure	BAD 0x0F / constant	All
S ϟ	COM HW EEPROM # 021	COM module: faulty EEPROM. Replace COM module: Spare parts → Page 76.	COM-HW-EEPROM	Device failure	BAD 0x0F / constant	All
S ϟ	COM SW EEPROM # 022	COM module: error when accessing data of the EEPROM Contact your Endress+Hauser service organization.	COM-SW-EEPROM	Device failure	BAD 0x0F / constant	All
S ϟ	CHECKSUM TOT. # 111	Totalizer checksum error. Contact your Endress+Hauser service organization.	Totalizer checksum error	Device failure	BAD 0x0F / constant	Only totalizers 1 to 2
S ϟ	COMMUNIC. I/O # 261	Communication error: no data reception between amplifier and I/O board or faulty transfer. Check whether the electronics board is correctly inserted in its holder → Page 77.	Communication failure	No communication	BAD 0x18 / No limits	All
S !	PT DSC BROKEN # 310	The temperature sensor is faulty. Temperature measurement becomes inaccurate and total failure of the temperature sensor (#316) must be reckoned with. ✎ Note! Where applicable, this error message indicates that the max. permitted flow velocity has been greatly exceeded. Contact your Endress+Hauser service organization.	DSC Temperature sensor defect	Out of service	BAD 0x1F / constant	All except: – Volume flow – Temperature – Vortex frequency – Electronics temperature
S !	SHORT C. PT DSC # 311					
S !	PT DSC BROKEN # 312					
S !	SHORT C. PT DSC # 313					

Type	Device status message display / error number	Cause / remedy	Device status / diagnosis message (control system)	Analog Input / Totalizer output status	Status / alarm limit	Process variables affected
S !	PT ELECT BROKEN # 314	The temperature sensor is defective and temperature measurement is no longer possible. The device uses the value specified in the ERROR => TEMP. parameter (see Page 134). Replace amplifier board: Spare parts → Page 76.	Temperature electronics defect	Sensor conversion not accurate (measured value from sensor not accurate)	UNC 0x53 / constant	All except: – Volume flow – Temperature – Vortex frequency
S !	SHORT C. PT EL # 315					
S ϟ	NO T SENSOR # 316	The temperature sensor has failed and no temperature sensor is present. The device uses the value specified in the ERROR => TEMP. parameter (see Page 134). Contact your Endress+Hauser service organization. ✎ Note! – If the device is intentionally operated with a Prowirl 72 DSC sensor (without temperature sensor), this message must be changed from a fault message to a notice message. – Where applicable, this error message indicates that the max. permitted flow velocity has been greatly exceeded.	No T Sensor	Sensor conversion not accurate (measured value from sensor not accurate)	UNC 0x53 / constant	All except: – Volume flow – Temperature – Vortex frequency – Electronics temperature
S ϟ	T-SENSOR CHECK # 317	The measuring device self-monitoring system has discovered an error in the DSC sensor which can affect the temperature measurement. ✎ Note! The mass flow is calculated with the value entered for the temperature in the ERROR => TEMP. function (Page 134).	DSC Temperature sensor defect	Sensor conversion not accurate (measured value from sensor not accurate)	UNC 0x53 / constant	All except: – Volume flow – Velocity – Vortex frequency – Electronics temperature
S ϟ	SENSOR CHECK # 318	The measuring device self-monitoring system has discovered an error in the DSC sensor which can affect the flow and temperature measurement. ✎ Note! The mass flow is calculated with the value entered for the temperature in the ERROR => TEMP. function (Page 134).	Sensor check	Sensor failure	BAD 0x13/ constant	All except: – Temperature – Electronics temperature
S ϟ	RESONANCE DSC # 379	Device being operated in the resonance frequency. Reduce the flow. ☝ Caution! If the device is operated in the resonance frequency, this can result in damage which can lead to complete device failure.	Resonance DSC	Sensor failure	BAD 0x13/ constant	All except: – Temperature – Electronics temperature
S ϟ	FLUIDTEMP. MIN # 381	The limit value for the minimum permissible fluid temperature is undershot. Increase the fluid temperature.	DSC Sensor Temp Limit	Out of service	BAD 0x1F / constant	All except: – Volume flow – Velocity – Vortex frequency – Electronics temperature
S ϟ	FLUIDTEMP. MAX # 382	The limit value for the maximum permissible fluid temperature is overshot. Reduce the fluid temperature.				
S ϟ	DSC SENS DEFCT # 394	The DSC sensor is defective, measurement no longer takes place. Contact your Endress+Hauser service organization.	DSC Sensor defect	Sensor failure	BAD 0x13 / Constant	All except: – Temperature – Electronics temperature

Type	Device status message display / error number	Cause / remedy	Device status / diagnosis message (control system)	Analog Input / Totalizer output status	Status / alarm limit	Process variables affected
S !	DSC SENS LIMIT # 395	The DSC sensor is being operated near application limits, device failure is probable soon. If the message persists, please contact your local Endress+Hauser service organization.	DSC Sensor limit	Sensor conversion not accurate (measured value from sensor not accurate)	UNC 0x53 / Constant	All except: – Temperature – Electronics temperature
S ϟ	SIGNAL>LOW PASS # 396	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 direction of flow. ■ Verify that the correct option was selected in the SELECT FLUID parameter (see P. 112). ■ Check whether the operating conditions are within the specifications of the measuring device (e.g. flow is above measuring range, i.e. the flow may have to be reduced) If the checks do not solve the problem, please contact your local E+H service organization.	Signal error	Sensor conversion not accurate (measured value from sensor not accurate)	BAD 0x13 / Constant	All except: – Temperature – Electronics temperature
S ϟ	T ELECTR. MIN. # 397	The limit value for the minimum permissible ambient temperature is undershot: ■ Check whether the device has been correctly insulated (see Page 10). ■ Check whether the transmitter is pointing downwards or to the side (see Page 9). ■ Increase the ambient temperature.	T Electr. Min	Sensor failure	BAD 0x13 / Constant	Electronics temperature
S ϟ	T ELECTR. MAX. # 398	The limit value for the maximum permissible ambient temperature is overshot: ■ Check whether the device has been correctly insulated (see Page 10). ■ Check whether the transmitter is pointing downwards or to the side (see Page 9). ■ Reduce the ambient temperature.	T Electr. Max	Sensor failure		
S ϟ	PREAMP. DISCONN. # 399	Pre-amplifier disconnected. Check the connection between the preamplifier and amplifier board and establish connection if necessary.	Pre-amplifier disconnected	Out of service	BAD 0x1F / constant	Electronics temperature
S !	SW. UPDATE ACT. # 501	New amplifier software version or data being loaded into the measuring device. No other commands can be executed. Wait until the procedure is complete. The device is restarted automatically.	Software update active	Non specific (uncertain status)	UNC 0x43 / constant	All
S !	UP./DOWNLOAD ACT. # 502	Device data are being uploaded. No other commands can be executed. Wait until the procedure is complete.	Upload/download active	Initial value (Values which are not saved after the device or parameters have been reset)	UNC 0x43 / constant	All

Type	Device status message display / error number	Cause / remedy	Device status / diagnosis message (control system)	Analog Input / Totalizer output status	Status / alarm limit	Process variables affected
S !	NO DATA - ϟ ->DISP. # 515	The display is not receiving any valid data. Check the option selected in the ASSIGN LINE 1, Page 107 and ASSIGN LINE 2, Page 109 parameters.	No Data Display	–	–	Only affects the display
S !	NO DATA - ϟ - >TOT.1 # 516	Totalizer 1 is not receiving any valid data. Check the option selected in the ASSIGN TOTALIZER 1 function.	No Data Totalizer 1	Non specific (uncertain status)	UNC 0x43 / constant	Only affects totalizer 1.
S !	NO DATA - ϟ - >TOT.2 # 517	Totalizer 2 is not receiving any valid data. Check the option selected in the ASSIGN TOTALIZER 2 function.	No Data Totalizer 2	Non specific (uncertain status)	UNC 0x43 / constant	Only affects totalizer 2.
S !	POS. ZERO-RET. # 601	Positive zero return active. Switch off positive zero return. ✎ Note! This message has the highest display priority.	Positive zero return active	Sensor conversion not accurate (measured value from sensor not accurate)	UNC 0x53 / Constant	All except: – Temperature – Vortex frequency – Electronics temperature
S !	SIM. FAILSAFE # 691	Simulation of failsafe mode (outputs) active. Switch off simulation.	Simulation failsafe active	Substitute set (substitute value of failsafe status)	UNC 0x4B/ Constant	All
S !	SIM. MEASURAND # 692	Simulation of a measured variable active (e.g. mass flow). Switch off simulation.	Simulation measurand	Simulated value (manually specified value)	UNC 0x60 to 0x63 / Low/high Constant	All
S !	DEVICE TEST ACT. # 698	The device is tested on site by the "Fieldcheck" tester and simulator.	Tool Active (e.g. Fieldcheck)	Sensor conversion not accurate (measured value from sensor not accurate)	UNC 0x53 / Constant	All

9.3 Process error messages

Process errors can be defined as either fault messages or notice messages and are thus weighted differently.
This is specified by means of the function matrix
(see Operation via PROFIBUS PA as of Page 97).

✎ Note!
- The types of error listed below correspond to the factory settings.
- Please refer also to the information on Page 33 ff.

Type	Device status message display / error number	Cause / remedy	Device status / diagnosis message (control system)	Analog Input / Totalizer output status	Status / alarm limit	Process variables affected
P = Process error ϟ = Fault message (with an effect on the inputs and outputs) ! = Notice message (without an effect on the inputs and outputs)						
P !	P, T -> DATA - ϟ # 412	No data are stored in the device for the combination of current values for medium pressure and fluid temperature. Check the following: ■ Whether the correct fluid was selected in the SELECT FLUID parameter (see P. 112). ■ Whether the correct pressure was entered in the OPERATING PRESSURE parameter (see Page 135).	P, T -> No Data/Wet Steam Alarm	Out of service	BAD (0x1F) / constant	All except: – Volume flow – Temperature – Vortex frequency – Electronics temperature
P !	FLOW RANGE # 421	The current flow velocity exceeds the value permitted for the measuring device. Flow monitoring is active in the VELOC. WARNING function (see P. 140). Reduce the flow.	Flow Range	Sensor failure	BAD (0x13) / constant	All except: – Temperature – Vortex frequency – Electronics temperature
P !	REYNOLDS < 20000 # 494	The Reynolds number of 20000 is undershot. The accuracy is reduced when the Reynolds number < 20000. Increase the flow.	Reynolds < 20000	Sensor failure	BAD (0x13) / constant	All except: – Temperature – Vortex frequency – Electronics temperature
P !	WET STEAM- ϟ # 525	The steam status for superheated steam, which is calculated from the temperature and steam, is near (2 °C / 36 °F) the saturated steam curve. ■ Check whether steam is actually present. ■ If you do not need the wet steam alarm, you can switch this off in the WET STEAM ALARM function.	P, T -> No Data/Wet Steam Alarm	Out of service	BAD (0x1F) / constant	All except: – Volume flow – Temperature – Vortex frequency – Electronics temperature

9.4 Process errors without messages

Symptoms	Remedial measures
Remark: You may have to change or correct settings in certain parameters in order to rectify the fault. The parameters listed below, such as AMPLIFICATION etc. are described in detail in the Section »Operation via PROFIBUS PA« on Page 97 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 subject to 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° (pay attention to the installation conditions, see Page 9 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. ■ The amplification can be altered using the AMPLIFICATION parameter (see Page 124). 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 12). ■ 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 correct fluid was selected in the SELECT FLUID parameter (see Page 112). The setting in this parameter determines the filter settings and can thus have an effect on the measuring range. ■ Check whether the data for the K-factor on the nameplate match the data in the K-FACTOR parameter (see Page 123). Continued on next page

Symptoms	Remedial measures
Faulty or highly fluctuating flow signal (contd.)	■ Check whether the device is installed correctly in the direction of flow. ■ Check whether the nominal diameter of the mating pipe and the device match (see Page 116). ■ The flow must be in the measuring range of the device (see Page 82). 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 5 ff.): order code and serial number. **Return devices to Endress+Hauser** The procedures on Page 4 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 76
"– – – –" appears on the display	"– – – –" appears on the display if an option which cannot be assigned was selected in the ASSIGN LINE 1 or ASSIGN LINE 2 parameter for the fluid selected (e.g. the 'corrected volume flow' option was selected for the fluid 'saturated steam'). In the ASSIGN LINE 1 or ASSIGN LINE 2 parameter, select an option that suits the fluid.

9.5 Spare parts

Section 9.1 contains detailed troubleshooting instructions (see Page 67).
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 5).

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

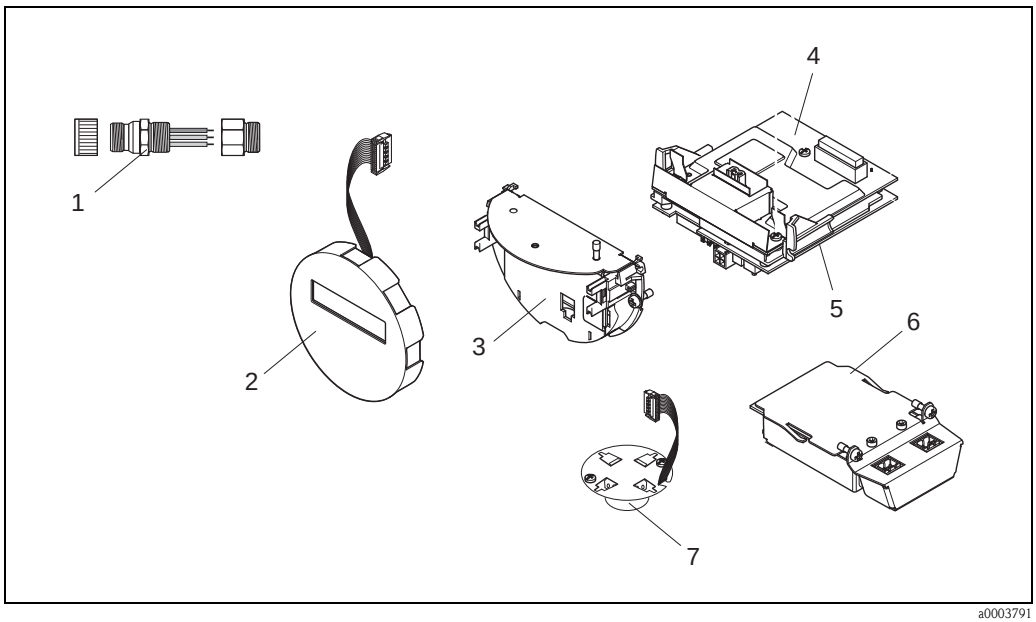


Fig. 28: Spare parts for transmitter Proline Prowirl 73 PROFIBUS PA (field and wall-mount housing)

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

9.6 Installing and removing electronics boards

9.6.1 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. 29)

1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.
2. Remove the local display module (b) from the retaining rails (c).
3. Attach the left side of the local display module (b) to the right retaining rail (c) (this secures the local display module).
4. Loosen the set screw (d) of the cover of the connection compartment (e) and fold down the cover.
5. Disconnect the terminal connector (f) from 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 retainer (i).
8. Remove the ribbon-cable connector (j) from the amplifier board (s) and release from the cable retainer (k).
9. Detach the local display module (b) from the right retaining rail (c).
10. Fold down the plastic cover (g) again.
11. Release both 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).
    – Fix the new I/O board (COM module) onto the board body.
15. Replace the amplifier board (s):
    – Loosen fixing screws (r) on the amplifier board.
    – Remove the amplifier board (s) from the board body (o).
    – Fix the new amplifier board onto the board body.
16. Installation is the reverse of the removal procedure.

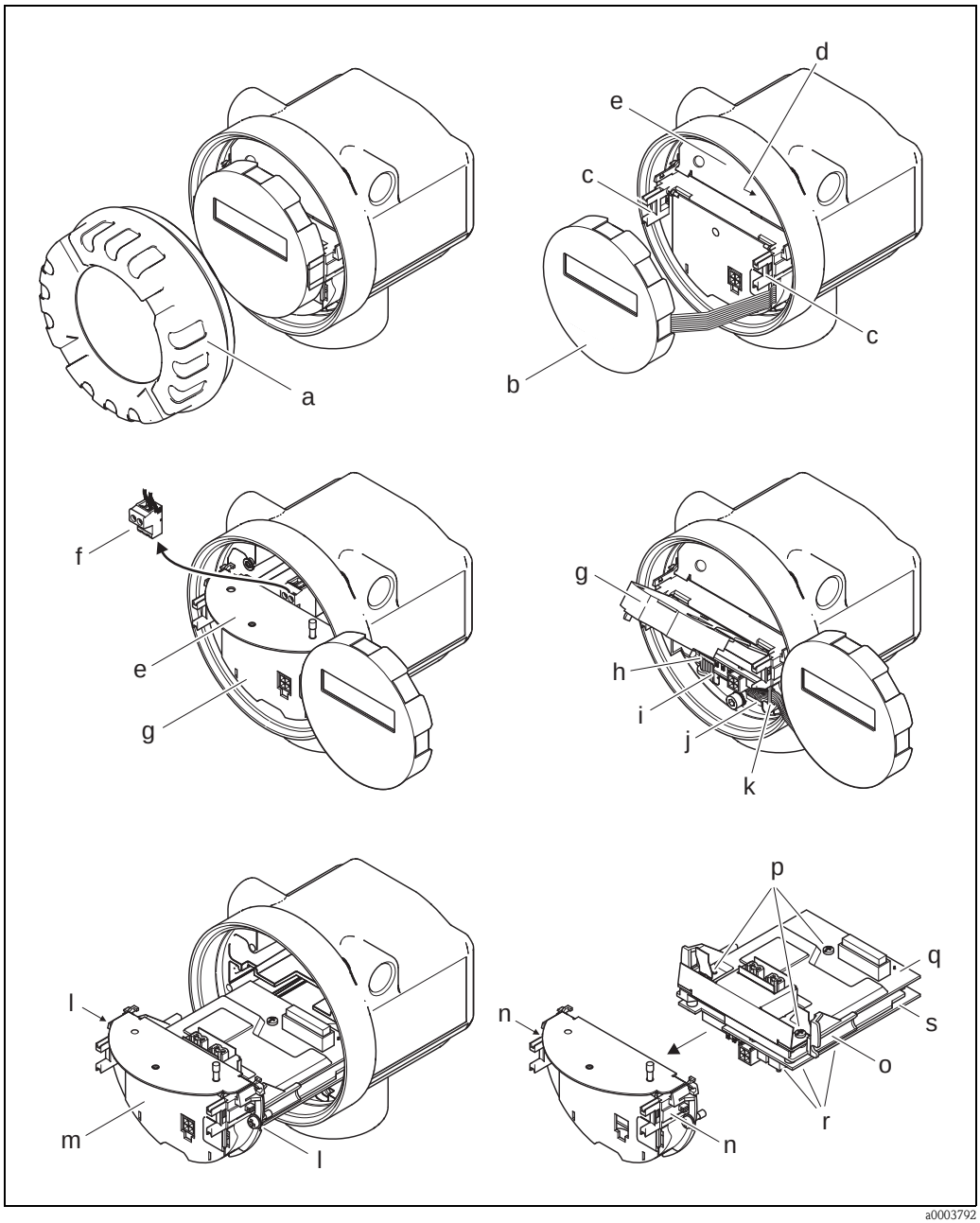


Fig. 29: Installing and removing electronics boards, non-Ex, Ex i/IS and Ex n version

a Cover of electronics compartment
b Local display module
c Retaining rails of local display module
d Fixing screws of connection compartment cover
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 Board holder threaded joint
m Board holder
n Board holder latches
o Board body
p I/O board threaded joint (COM module)
q I/O board (COM module)
r Amplifier board threaded joint
s Amplifier board

9.6.2 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.

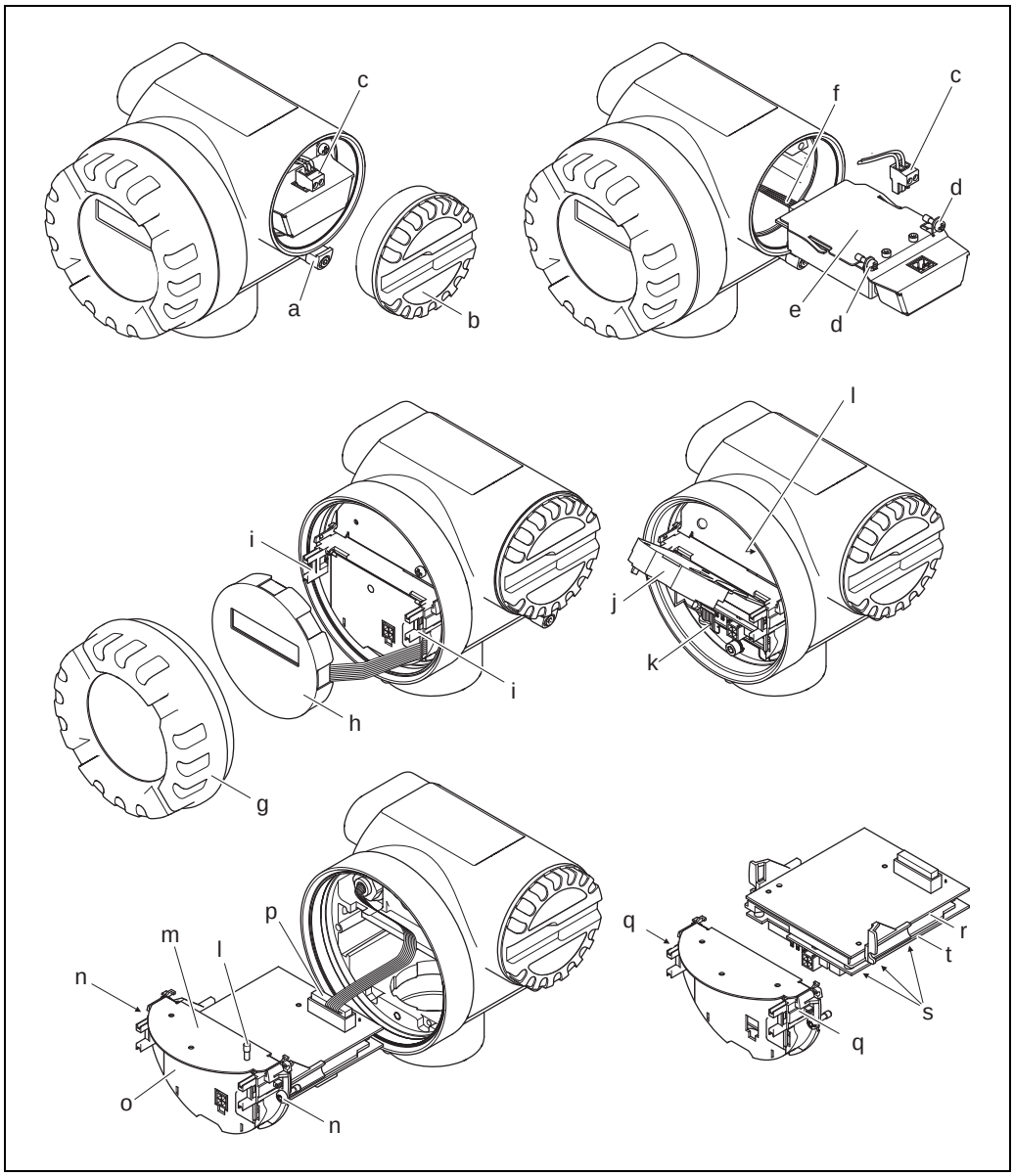
Procedure when installing/removing electronics boards (see Fig. 30)

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. Disconnect the terminal connector (c) from the I/O board (COM module) (e).
4. Slacken threaded joint (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 local 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 retainer.
5. Remove the signal cable connector (k) from the amplifier board (t) and release from the cable retainer.
6. Release the set screw (l) and fold down the cover (m).
7. Release both 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) on the amplifier board.
    – Remove the amplifier board (t) from the board body (r).
    – Fix the new amplifier board onto the board body.
12. Installation is the reverse of the removal procedure.



a0003793

Fig. 30: Installing and removing electronics boards, Ex d/XP version

a Securing clamp for connection compartment cover
b Connection compartment cover
c Terminal connector
d I/O board threaded joint (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 screws of connection compartment cover
m Connection compartment cover
n Board holder threaded joint
o Board holder
p Connecting cable plug
q Board holder latches
r Board body
s Amplifier board threaded joint
t Amplifier board

9.7 Software history

Date	Software version	Software modifications	Documentation
01.2007	V 1.03.00	Software extension: – For flange devices with a reduced internal diameter (R-type, S-type) New function: – Device software displayed (NAMUR Recommendation NE 53) – Maximum fluid velocity monitored (incl. warning message) – Modified fault handling for superheated steam	BA093D/06/en/01.07 71041141
11.2004	Amplifier: V 1.02.XX	New function: ■ Operation in Polish and Czech, V 1.02.01 and higher Welded flanges	
03.2004	Communication module: V 1.01.00	Communication module (inputs/outputs) Original software Compatible with: Commuwin II version 2.08-1 and higher (update E)	BA093D/06/en/03.04 50106808
	Amplifier: V 1.00.00	Original software Compatible with service protocol: ToF Tool-Fieldtool Package (version 1.04.00 and higher)	

Note!
Uploading/downloading between different software versions is normally only possible with special service software.

10 Technical data

10.1 Technical data at a glance

10.1.1 Application

The measuring system is used to measure the flow of saturated steam, superheated steam, gases and liquids. The measured variables volume flow and temperature are measured primarily.

From these values, the device can use stored data on the density and enthalpy to calculate and output the mass flow and heat flow for example.

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 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.
- Temperature → can be output directly and is used to calculate the mass flow for example.

The measured process variables volume flow, temperature or the calculated process variables mass flow, heat flow or corrected volume flow can be output as output variables.

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} = 20000). The Reynolds number is dimensionless and represents the ratio of the inertia force of a fluid to its viscous force. It is used to characterize the flow. The Reynolds number is calculated as follows:

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

a0003794

Re = Reynolds number, Q = flow, di = internal diameter, μ = dynamic viscosity, ρ = density

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

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

a0003239

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 helps you orientate yourself. 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 PROFIBUS PA output

Output signal	PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), in accordance with PROFIBUS PA Profile Version 3.0, galvanically isolated
Signal on alarm	Status and alarm messages in accordance with PROFIBUS PA Profile Version 3.0
Current consumption	16 mA
Permissible feed voltage	9 to 32 V, not intrinsically safe
FDE (Fault Disconnection Electronic)	0 mA

Data transmission rate	Supported baud rate = 31.25 kBaud
Signal coding	Manchester II
Acyclic communication	■ Supports Class 2 master acyclic (MS2AC) communication with 2 available service access points. ■ Supports Class 1 master acyclic (MS1AC) communication with approx. 10^6 writes.
Low flow cut off	Switch points for low flow cut off can be selected as required.
Galvanic isolation	All electric connections are galvanically isolated from one another.

10.1.5 Power supply

Electrical connection	see Page 18 ff.
Supply voltage	9 to 32 V DC
Cable entry	Power supply cable / signal cable (outputs): ■ Cable entry: M20 ×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 → Page 21
Power supply failure	■ Totalizer stops at the last value determined (can be configured). ■ 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 standard in question.

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 velocities 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 velocities 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 function (→ Page 135).
  Individual error observation has to be performed.
  o.r. = of reading, 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 reading)

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:

- FLOW DAMPING → Page 117
- DISPLAY DAMPING → Page 111
- RISING TIME → Page 111

	Installation
Installation instructions	see Page 9 ff.
Inlet and outlet run	see Page 12 ff.

10.1.7 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 (with factory setting for amplification), 10 to 500 Hz, following IEC 60068-2-6
Electromagnetic compatibility (EMC)	To IEC/EN 61326 and NAMUR Recommendation NE 21

10.1.8 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

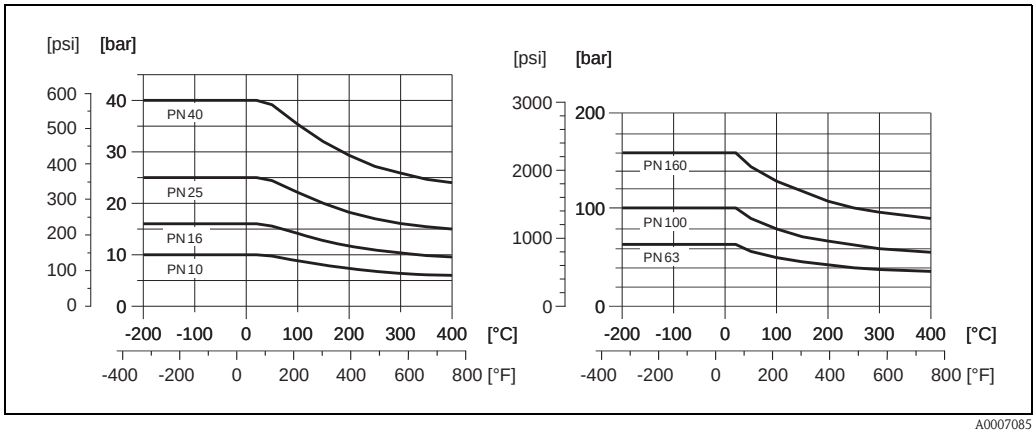
Graphite	–200 to +400 °C (–328 to +752 °F)
Viton	–15 to +175 °C (+5 to +347 °F)
Kalrez	–20 to +275 °C (–4 to +527 °F)
Gylon (PTFE)	–200 to +260 °C (–328 to +500 °F)

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

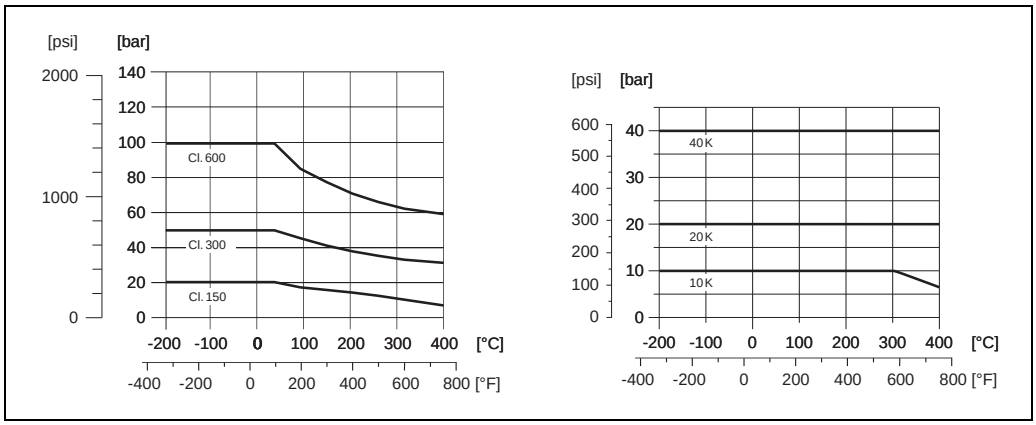
Pressure-temperature curve to EN (DIN) (stainless steel)
PN 10 to 40 → Prowirl 73W and 73F
PN 63 to 160 → Prowirl 73F (under development)



A0007085

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)



a0001923

Limiting flow

See data on Page 82 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.

10.1.9 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/dm^3]
	$\dot{V}_{min}$	$\dot{V}_{max}$	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 [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	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/dm^3]
	$\dot{V}_{min}$	$\dot{V}_{max}$	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

10.1.10 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")

10.1.11 Human interface

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

10.1.12 Certificates and approvals

CE approval	see Page 7
C-tick mark	see Page 7
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.
Functional safety	SIL 1 An overview of all the Endress+Hauser devices for SIL applications, including parameters like SFF, MTBF and PFD_{avg} can be found under **http://www.endress.com/sil**.

Certification PROFIBUS PA

The Prowirl 73 flowmeter has successfully passed all the test procedures implemented and has been certified and registered by the PNO (PROFIBUS User Organization). The flowmeter thus meets all the requirements of the specifications listed below:
- Certified to PROFIBUS PA Profile Version 3.0, device certification number: available upon request
- The device may also be operated using certified devices from other manufacturers (interoperability).

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
- NAMUR NE 53: Software of field devices and signal-processing devices with digital electronics.
- 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 volume 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.
- 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).
- American Gas Association (1962): A.G.A. Manual for the Determination of Supercompressibility Factors for Natural Gas – PAR Research Project NX-19.

Ordering information

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

10.1.13 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor (see Page 66). Your Endress+Hauser service organization can provide detailed information on the order codes of your choice.

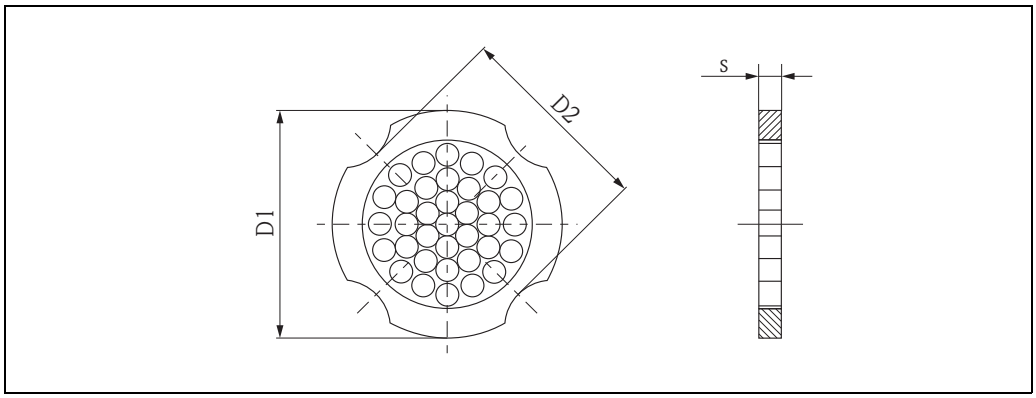
10.1.14 Documentation

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

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



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 PROFIBUS PA

11.1 Block model

In the PROFIBUS PA 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 PROFIBUS PA device has the following block types:

- A Physical Block (device block)
  The Physical Block contains all the device-specific features of the device.
- One or more Transducer Blocks.
  The Transducer Block contains all the measuring and device-specific parameters of the device. The measurement principles (e.g. flow) are depicted in the Transducer Blocks in accordance with the PROFIBUS PA Profile 3.0 Specification.
- One or more function blocks.
  Function blocks contain the automation functions of the device.
  We distinguish between different function blocks, e.g. Analog Input function block, Analog Output function block, Totalizer Block, etc. Each of these function blocks is used to process different application functions.

A number of automation-related tasks can be implemented with these blocks. In addition to these blocks, a field device may have any number of other blocks, e.g. several Analog Input function blocks if more than one process variable is available from the field device.

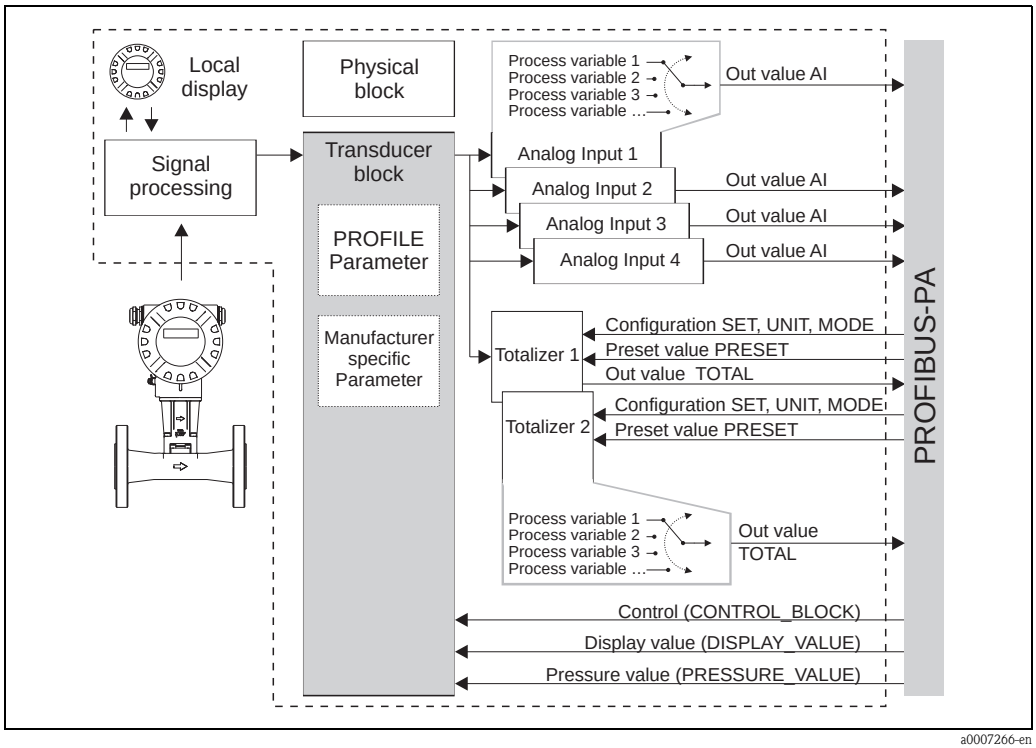


Fig. 31: Block model Proline Prowirl 73 PROFIBUS PA Profile 3.0

The sensor signal is first prepared specifically for the flow in the measuring block (the Transducer Block). The process variable is then passed to the Analog Input and Totalizer function block for technical processing (e.g. scaling, limit value processing). The process variable goes through the entire function block algorithm and is available to the process control system as an output variable.

11.2 Physical Block (device block)

A Physical 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 Physical Block include the device type, device name, manufacturer ID, serial number, etc.

A further task of the Physical 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 Physical 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.

11.2.1 Write protection

Hardware write protection for the device parameters is enabled and disabled by means of a DIP switch on the amplifier board (see Page 46).

The HW WRITE PROTECT parameter shows the status of the hardware write protection. The following statuses are possible:
1 → Hardware write protection enabled, it is not possible to write to the device
0 → Hardware write protection disabled, device data can be overwritten

It is also possible to set software write protection to prevent all parameters from being acyclically overwritten. This lock is set by an entry in the WRITE LOCKING parameter. The following entries are permitted:
2457 → Device data can be overwritten (factory setting)
0 → Device data cannot be overwritten

11.3 Transducer Block

The Transducer Block contains all the measuring and device-specific parameters of the flowmeter. All the settings directly connected with the application/flow measurement are made here. It forms the interface between sensor-specific measured value preprocessing 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.

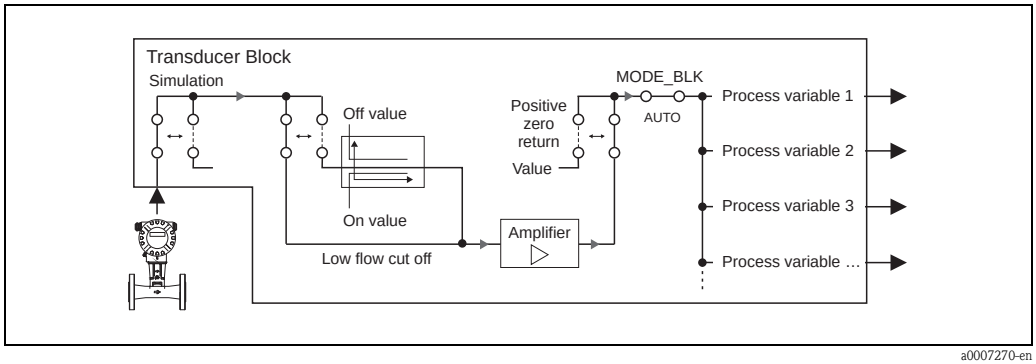


Fig. 32: Schematic illustration of the internal structure of the Transducer Block.

List of process variables available → see Page 99

11.3.1 Signal processing

The Transducer Block receives two signal variables from the sensor (volume flow and temperature) as the input variables. Other process variables are derived from these signal variables. The input signals are prepared for measuring via the amplifier.

The VALUE SIM. MEAS parameter allows you to specify a simulation value for the Transducer Block in order to test assigned parameters in the device and downstream function blocks.

A low flow cut off allows you to hide measurement inaccuracies in the low flow range. You can define a limit value via the ON VAL. LF CUT OFF parameter (see Page 121). If the measured flow value undershoots this limit value, the output value of 0 is output.

You also have the option of setting the measured value to "zero flow" by means of the POS. ZERO RETURN parameter (see Page 116). This is necessary when the piping system is being cleaned, for example.

The process variables of the Transducer Block are output via the following parameters:

VOL FLOW	→ Page 100
MASS FLOW	→ Page 100
CORR VOLUME FLOW	→ Page 100
HEAT FLOW	→ Page 100
TEMPERATURE	→ Page 100
DENSITY	→ Page 101
SPEC. ENTHALPY	→ Page 101
CALC. SAT. STEAM P.	→ Page 100
Z-FACTOR	→ Page 100
VORTEX FREQUENCY	→ Page 100
* ELECTRONICS TEMP.	→ Page 100
* REYNOLDS NUMBER	→ Page 100
VELOCITY	→ Page 101

* Only available with the "Advanced diagnostics" software option.

The process variables are made available to the downstream function blocks for further processing.

11.3.2 Alarm detection and processing

The Transducer Block does not generate any process alarms. The status of the process variable of the Transducer Block is evaluated in the downstream Analog Input function block. If the Analog Input function block does not receive an input value that can be evaluated from the Transducer Block, then a process alarm is generated.

This process alarm is displayed via the OUT STATUS, OUT SUB STATUS and OUT LIMIT parameters of the Analog Input function block. More detailed information on the current device status is provided in the manufacturer-specific ACTUAL.SYS.COND parameter (see Page 125). This parameter also displays a device error that produced an input value that could not be evaluated and thus triggered the process alarm in the Analog Input function block.

More information on eliminating errors can be found on Page 67.

11.3.3 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 98).
2. The correct code must be entered in the DEFINE PRIVATE CODE parameter (see Page 106).

11.3.4 Transducer Block parameters (device matrix)

The following table shows all the parameters available for the Transducer Block. The parameters can be changed by means of a Class 2 master, such as Commuwin II or PDM (Process Device Management). Apart from the parameters in the "Using the profile parameters" parameter group (Page 134 onwards), no parameter of the Transducer Block can be changed unless the private code has first been entered.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
MEASURING VALUES (V0…)	
VOL FLOW (V0H0)	The volume flow currently measured (input variable for the Analog Input function block) appears on the display. **Display:** 5-digit floating point number, incl. unit (e.g. 5.5445 dm^3/min; 1.4359 m^3/h; etc.)
TEMPERATURE (V0H1)	The temperature currently measured (input variable for the Analog Input function block) appears on the display. **Display:** Max. 4-digit fixed-point number, incl. unit and sign (e.g. –23.4 °C, 160.0 °F, etc.)
MASS FLOW (V0H2)	✎ Note! The 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 function (V4H0). If another option was selected, "– – – –" appears on the local display and the display in the software operating tool is no longer refreshed. The mass flow (input variable for the Analog Input function block) appears on the display. **Display:** 5-digit floating-point number, incl. unit (e.g. 462.87 kg/h; 731.63 lb/min; etc.) ✎ Note! Is calculated using the measured volume flow and the measured temperature.
CORR VOLUME FLOW (V0H3)	✎ Note! This value is not available unless the WATER, USER-DEFINED LIQUID, COMPRESSED AIR, REAL GAS or NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter (V4H0). If another option was selected, "– – – –" appears on the local display and the display in the software operating tool is no longer refreshed. The corrected volume flow (input variable for the Analog Input function block) appears on the display. **Display:** 5-digit floating point number, incl. unit (e.g. 5.5445 Nm^3/min; 1.4359 Sm^3/h; etc.) ✎ Note! Is calculated using the measured volume flow and the measured temperature.
HEAT FLOW (V0H4)	✎ Note! This value is not available unless the SATURATED STEAM, SUPERHEATED STEAM or WATER option was selected in the SELECT FLUID (V4H0) parameter. If another option was selected, "– – – –" appears on the local display and the display in the software operating tool is no longer refreshed. The heat flow (input variable for the Analog Input function block) appears on the display. **Display:** 5-digit floating point number, incl. unit, corresponds to 0.100000 to 6.00000 MJ/h (e.g. 1.2345 MJ/h) ✎ Note! Is calculated using the measured volume flow and the measured temperature.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
DENSITY (V0H5)	✎ Note! This parameter is not available unless the GAS VOLUME or LIQUID VOLUME option was selected in the SELECT FLUID parameter (V4H0). The density (input variable for the Analog Input function block) 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) ✎ Note! Is calculated using the measured volume flow and the measured temperature.
SPEC. ENTHALPY (V0H6)	✎ Note! This parameter is not available unless the SATURATED STEAM, WATER or SUPERHEATED STEAM option was selected in the SELECT FLUID parameter (V4H0). The specific enthalpy (input variable for the Analog Input function block) appears on the display. **Display:** 5-digit floating point number (e.g. 5.1467 kJ/kg, etc.) ✎ Note! ■ The specific enthalpy of the saturated steam is calculated using the fluid selected in the SELECT FLUID parameter (V4H0) and the temperature. ■ The appropriate unit is taken from the UNIT DENSITY parameter (V1H5).
CALC. SAT. STEAM P. (V0H7)	✎ Note! This parameter is not available unless the SATURATED STEAM option was selected in the SELECT FLUID parameter (V4H0). The calculated saturated steam pressure (input variable for the Analog Input function block) 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 calculated using the fluid selected in the parameter SELECT FLUID (V4H0) and the temperature. ■ The appropriate unit is taken from the UNIT SPEC. ENTH. parameter (V1H6).
VORTEX FREQUENCY (V0H9)	The measured vortex frequency (current measured value) appears on the display. This process variable is made available to the Analog Input function block as an input variable. **Display:** 3-digit floating point number, incl. unit (e.g. 105.23 Hz) ✎ Note! This parameter is only used for a plausibility check.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
Z-FACTOR (V0H8)	✎ Note! This parameter is not available unless the NATURAL GAS NX-19 or COMPRESSED AIR option was selected in the SELECT FLUID parameter (V4H0). ■ 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. The process variable is made available to the Analog Input function block as an input variable. **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.
VELOCITY (Not available in Commuwin II)	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, including unit ✎ Note! The unit displayed in this function depends on the option selected in the UNIT LENGTH function (see Page 105): ■ UNIT LENGTH option = mm → Unit in this function = m/s ■ UNIT LENGTH option = inch → Unit in this function = ft/s

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
SYSTEM UNITS (V1…)	
UNIT VOL. FLOW (V1H0)	For selecting the unit required and displayed for the volume flow. The unit selected here is also valid for: Flow display, Low flow cut off on-value and Simulation measurand. ✎ Note! The following units of time 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 – Million 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, see Page 156 ff.
UNIT TEMPERATURE (V1H1)	Use this parameter to select the unit displayed for the temperature. **Options:** °C (CELSIUS) K (KELVIN) °F (FAHRENHEIT) R (RANKINE) **Factory setting:** Depends on country, see Page 156 ff.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
UNIT MASS FLOW (V1H2)	For selecting the unit required and displayed for the calculated mass flow. The unit selected here is also valid for: Flow display, Low flow cut off on-value and Simulation measurand. ✎ 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 – pound → lb/time unit – ton → ton/time unit **Factory setting:** In accordance with order, otherwise depends on country, see Page 156 ff.
UNIT CORR. VOL. FL (V1H3)	For selecting the unit required and displayed for the corrected volume flow. The unit selected here is also valid for: Flow display, Low flow cut off on-value and Simulation measurand. ✎ 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, see Page 156 ff.
UNIT HEAT FLOW (V1H4)	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:* kW; MW; kJ/time unit; MJ/time unit; GJ/time unit; kcal/time unit; Mcal/time unit; Gcal/time unit US: tons; kBtu/time unit; MBtu/time unit ; GBtu/time unit **Factory setting:** Depends on country, see Page 156 ff.
UNIT DENSITY (V1H5)	For selecting the unit required and displayed for the density. **Options:** *Metric:* g/cm^3; g/cc; kg/dm^3; kg/l; kg/m^3; SD 4 °C, SD 15 °C, SD 20 °C; SG 4 °C, SG 15 °C, SG 20 °C *US:* lb/ft^3; 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); lb/imp. bbl PETR. (petrochemicals) **Factory setting:** Depends on country, see Page 156 ff. SD = Specific Density, SG = Specific Gravity. The specific density is the ratio of fluid density to water density (at water temperature = 4, 15, 20 °C).

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
UNIT SPEC. ENTH. (V1H6)	For selecting the unit required and displayed for the specific enthalpy of saturated steam. **Options:** *Metric:* kWh/kg; kJ/kg; MJ/kg; kcal/kg *US:* Btu/lb **Factory setting:** Depends on country, see Page 156 ff.
UNIT PRESSURE (V1H7)	For selecting the unit required and displayed for the pressure and the relative pressure unit. **Options:** bara (bar absolute) psia (pounds per square inch absolute) *Other units (not available in Commuwin II):* kPa a (kilopascal absolute) MPa a (megapascal absolute) kg/cm2 a (kilogram per square centimeter absolute) mmH20(4°C) a (millimeter water absolute) inH20(39.2°F) a (inch water absolute) mmHg(0°C) a (millimeter mercury absolute) inHg(39.2°F) a (inch mercury absolute) **Factory setting:** See parameter printout supplied (the parameter printout is an integral part of these Operating Instructions)
UNIT LENGTH (V1H8)	For selecting the unit required and displayed for the length unit of the nominal diameter in the NOMINAL DIAMETER parameter (see Page 123) and NOMINAL SIZE. The unit you select here also affects: ■ The unit in which the cable length is entered (see Page 124) ■ The unit of velocity on the local display (see Page 137) **Options:** MILLIMETER METER INCH **Factory setting:** Depends on country, see Page 156 ff. ✎ Note! If a setting is changed in this parameter, the setting in the UNIT parameter is changed simultaneously.
UNIT FREQUENCY **(V1H9)**	For selecting the unit required and displayed for the frequency. **Options:** Hz KHz MHz **Factory setting:** Hz

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
OPERATION (V2…)	
LANGUAGE (V2H0)	Use this function to select the language for all texts, parameters and messages shown on the local display. **Options (with standard display):** ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS NORSK SVENSKA SUOMI PORTUGUES POLSKI CESKY **Factory setting:** Depends on country (→ Page 156 ff.)
ACCESS CODE (V2H1)	All data of the measuring system are protected against inadvertent change. Programming is disabled and the device settings cannot be changed until a code is entered in this parameter. You can enable programming by entering the private code (**factory setting = 73**, see DEFINE PRIVATE CODE parameter). **User input:** Max. 4-digit number: 0 to 9999 ✎ Note! ■ You can also disable programming by entering any number in this parameter (other than the private code). ■ The Endress+Hauser service organization can be of assistance if you mislay your private code.
DEFINE PRIVATE CODE (V2H2)	Use this function to specify the private code for enabling programming. **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. This parameter cannot be edited when programming is disabled. This precaution prevents others from accessing your personal code.
STATUS ACCESS (V2H3)	The access status for the parameter matrix appears on the display. **Display:** ACCESS CUSTOMER (parameters can be modified) LOCKED (parameters cannot be modified)
ACCESS CODE C. (V2H4)	The number of times the private and service code was entered to access the device appears on the display. **Display:** Integer (delivery status: 0)

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
ACTIV. CODE NX-19 (V2H5)	For entering the activation code for the "Natural gas NX-19" software option (only relevant when replacing the amplifier board). **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.
CODE. ADV.DIAG (V2H6)	For entering the activation code for the "Advanced diagnostics" software option (only relevant when replacing the amplifier board). **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.
USER INTERFACE (V3…)	
ASSIGN LINE 1 (V3H0)	For selecting the display value for the main line (top line of the local display) to be displayed during normal operation. **Options:** OFF VOLUME FLOW MASS FLOW CORRECTED VOLUME FLOW TEMPERATURE HEAT FLOW TAG NAME AI 1 OUT VALUE AI 2 OUT VALUE AI 3 OUT VALUE AI 4 OUT VALUE TOT. OUT VALUE 1 TOT. OUT VALUE 2 VOLUME FLOW IN % MASS FLOW IN % CORRECTED VOLUME FLOW IN % HEAT FLOW IN % AI 1 OUT IN % AI 2 OUT IN % AI 3 OUT IN % AI 4 OUT IN % VOLUME FLOW BARGRAPH IN % MASS FLOW BARGRAPH IN % CORRECTED VOLUME FLOW BARGRAPH IN % HEAT FLOW BARGRAPH IN % AI 1 OUT BARGRAPH IN % AI 2 OUT BARGRAPH IN % AI 3 OUT BARGRAPH IN % AI 4 OUT BARGRAPH IN % DISPLAY_VALUE OPERATING/SYSTEM CONDITIONS **Factory setting:** VOLUME FLOW (if no data specified or LIQUID VOLUME or GAS VOLUME specified as fluid when ordering), otherwise MASS FLOW ✎ Note! The appropriate unit is selected in the SYSTEM UNITS parameter group (see Page 103).

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
0% VALUE LINE 1 (V3H1)	✎ Note! This parameter is not available unless one of the following options was selected in the ASSIGN LINE 1 (V3H0) parameter: ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ CORRECTED VOLUME FLOW IN % ■ HEAT FLOW IN % ■ AI 1 OUT IN % ■ AI 2 OUT IN % ■ AI 3 OUT IN % ■ AI 4 OUT IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % ■ CORRECTED VOLUME FLOW BARGRAPH IN % ■ HEAT FLOW BARGRAPH IN % ■ AI 1 OUT BARGRAPH IN % ■ AI 2 OUT BARGRAPH IN % ■ AI 3 OUT BARGRAPH IN % ■ AI 4 OUT BARGRAPH IN % For entering the flow value which should be shown on the display as the 0% value. **User input:** 5-digit floating-point number **Factory setting:** 0 l/s (with volume flow) 0 kg/s (with mass flow) 0 Nm²/s (with corrected volume flow) 0 kW (with heat flow)
100% VALUE LINE 1 (V3H2)	✎ Note! This parameter is not available unless one of the following options was selected in the ASSIGN LINE 1 (V3H0) parameter: ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ CORRECTED VOLUME FLOW IN % ■ HEAT FLOW IN % ■ AI 1 OUT IN % ■ AI 2 OUT IN % ■ AI 3 OUT IN % ■ AI 4 OUT IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % ■ CORRECTED VOLUME FLOW BARGRAPH IN % ■ HEAT FLOW BARGRAPH IN % ■ AI 1 OUT BARGRAPH IN % ■ AI 2 OUT BARGRAPH IN % ■ AI 3 OUT BARGRAPH IN % ■ AI 4 OUT BARGRAPH 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/s (with mass flow) 10 Nm²/s (with corrected volume flow) 10 kW (with heat flow)

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
ASSIGN LINE 2 (V3H3)	For selecting the display value for the additional line (bottom line of the local display) to be displayed during normal operation. **Options:** OFF VOLUME FLOW MASS FLOW CORRECTED VOLUME FLOW TEMPERATURE HEAT FLOW TAG NAME AI 1 OUT VALUE AI 2 OUT VALUE AI 3 OUT VALUE AI 4 OUT VALUE TOT1 OUT VALUE TOT2 OUT VALUE VOLUME FLOW IN % MASS FLOW IN % CORRECTED VOLUME FLOW IN % HEAT FLOW IN % AI 1 OUT IN % AI 2 OUT IN % AI 3 OUT IN % AI 4 OUT IN % VOLUME FLOW BARGRAPH IN % MASS FLOW BARGRAPH IN % CORRECTED VOLUME FLOW BARGRAPH IN % HEAT FLOW BARGRAPH IN % AI 1 OUT BARGRAPH IN % AI 2 OUT BARGRAPH IN % AI 3 OUT BARGRAPH IN % AI 4 OUT BARGRAPH IN % DISPLAY_VALUE OPERATING/SYSTEM CONDITIONS **Factory setting:** TEMPERATURE ✎ Note! ■ The appropriate unit is selected in the SYSTEM UNITS parameter group (see Page 103). ■ On the local display, totalizer 1 is displayed with I and totalizer 2 with II.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
0% VALUE LINE 2 (V3H4)	✎ Note! This parameter is not available unless one of the following options was selected in the ASSIGN LINE 1 (V3H0) parameter: ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ CORRECTED VOLUME FLOW IN % ■ HEAT FLOW IN % ■ AI 1 OUT IN % ■ AI 2 OUT IN % ■ AI 3 OUT IN % ■ AI 4 OUT IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % ■ CORRECTED VOLUME FLOW BARGRAPH IN % ■ HEAT FLOW BARGRAPH IN % ■ AI 1 OUT BARGRAPH IN % ■ AI 2 OUT BARGRAPH IN % ■ AI 3 OUT BARGRAPH IN % ■ AI 4 OUT BARGRAPH IN % For entering the flow value which should be shown on the display as the 0% value. **User input:** 5-digit floating-point number **Factory setting:** 0 l/s (with volume flow) 0 kg/s (with mass flow) 0 Nm²/s (with corrected volume flow) 0 kW (with heat flow)
100% VALUE LINE 2 (V3H6)	✎ Note! This parameter is not available unless one of the following options was selected in the ASSIGN LINE 2 (V3H3) parameter: ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ CORRECTED VOLUME FLOW IN % ■ HEAT FLOW IN % ■ AI 1 OUT IN % ■ AI 2 OUT IN % ■ AI 3 OUT IN % ■ AI 4 OUT IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % ■ CORRECTED VOLUME FLOW BARGRAPH IN % ■ HEAT FLOW BARGRAPH IN % ■ AI 1 OUT BARGRAPH IN % ■ AI 2 OUT BARGRAPH IN % ■ AI 3 OUT BARGRAPH IN % ■ AI 4 OUT BARGRAPH 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/s (with mass flow) 10 Nm²/s (with corrected volume flow) 10 kW (with heat flow)

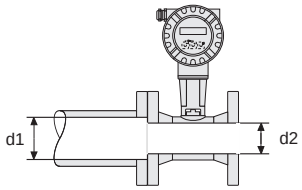
Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
FORMAT (V3H6)	For selecting the maximum number of places displayed after the decimal point for the value displayed in the main line. **Options:** XXXXX. - XXXX.X - XXX.XX - XX.XXX -X.XXXX **Factory setting:** XX.XXX ✎ Note! ■ 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 (V3H7)	For entering 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 reaction time of the parameter depends on the time specified in the FLOW DAMPING parameter (see Page 117).
CONTRAST LCD (V3H8)	For setting the display contrast to suit local operating conditions. **User input:** 10 to 100% **Factory setting:** 50%
TEST DISPLAY (V3H9)	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. Pixels of the main line and additional line are darkened for minimum 0.75 seconds. 3. The main line and additional line show an "8" in each field for minimum 0.75 seconds. 4. The main line and additional line show a "0" in each field for minimum 0.75 seconds. 5. The main line and additional line show nothing (blank display) for minimum 0.75 seconds. 6. When the test is completed, the local display returns to its initial state and the displays the option OFF.

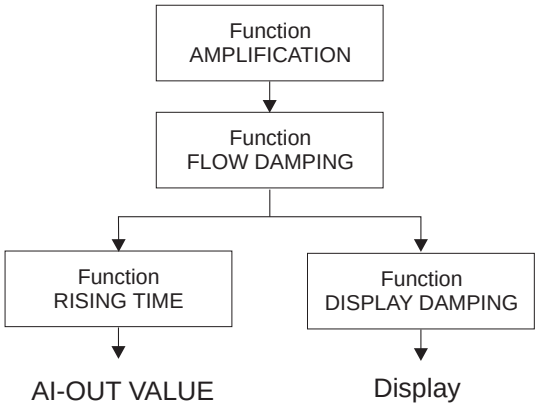
Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
PROCESS PARAMETER (V4…)	
SELECT FLUID (V4H0)	**Options:** SATURATED STEAM SUPERHEATED STEAM WATER REAL GAS (for all gases not given here, pay attention to Note) NATURAL GAS NX-19 (only available as option, see P. 107; please observe Note) USER-DEFINED LIQUID GAS VOLUME (only volume and temperature measurement possible) LIQUID VOLUME (only volume and temperature measurement possible) COMPRESSED AIR **Factory setting:** See parameter printout supplied (the parameter printout is an integral part of these Operating Instructions) **Information on the fluids which can be selected** **Selected 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 IAPWS-IF97 (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 enthalpy* *T* *Operating temperature (measured)* ρ *Density** ** from saturated steam curve in accordance with IAPWS-IF97 (ASME), for the measured temperature.* **Selected fluid → GAS VOLUME or LIQUID VOLUME** *Applications:* The measured volume flow and the measured temperature are made available for further external processing. *Calculated variables:* None in the device; calculation takes place externally. Continued on next page

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
Contd. **SELECT FLUID** **(V4H0)**	**Selected fluid → 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 average operating pressure is either available as an input signal (PROFIBUS data block PRESSURE_VALUE, see Page 58) or has to be entered in the OPERATING PRESSURE function (see Page 135). Calculations are made in view of the following factors: – Assuming superheated steam, the device calculates until the saturation point is reached. (At 2 °C /36 °F above saturation, the notice message "#525 WET STEAM ALARM" is triggered. This alarm can be switched off using the WET STEAM ALARM function, Page 132). – If the temperature is lowered even further, assuming the saturated steam, the device continues calculating until a temperature of 0 °C (32 °F). (If the pressure is preferred as a measured variable here, it can be selected in the SATURATED STEAM PARAMETER function Page 132). – Below a temperature of 0 °C (32 °F), the device continues calculating with saturated steam at 0 °C (32 °F) *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 steam data to the international standard IAPWS-IF97 (ASME steam data). *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 enthalpy* T *Operating temperature (measured)* p *Operating pressure (see Page 135)* ρ *Density** ** from steam data in accordance with IAPWS-IF97 (ASME), for the measured temperature and the specified pressure* **Selected 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 water line is needed for calculating the process variable. The average operating pressure is either available as an input signal (PROFIBUS data block PRESSURE_VALUE, see Page 58) or has to be entered in the OPERATING PRESSURE function (see Page 135). *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 water data to the international standard IAPWS-IF97 (ASME water data). Continued on next page

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
Contd. **SELECT FLUID** **(V4H0)**	*Formulae for calculation:* ■ Mass flow → $m = q \cdot \rho$ *(T, p)* ■ Enthalpy→ $E = q \cdot \rho$ (T, p) · h (T) ■ Corrected volume flow → $q_{ref} = q \cdot (\rho$ (T, p) ÷ $\rho_{ref})$ *m* *Mass flow* *E* *Enthalpy* *q* *Volume flow (measured)* q_{ref} *Corrected volume flow* *h* *Specific enthalpy of water* *T* *Operating temperature (measured)* *p* *Operating pressure (see Page 135)* ρ *Density** ρ_{ref} *Reference density (see Page 133)* ** from water data in accordance with IAPWS-IF97 (ASME), for the measured temperature and the specified pressure.* **Selected fluid → USER-DEFINED 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. *Formulae for calculation:* ■ Mass flow → $m = q \cdot \rho$ (T) ■ Density → $\rho = \rho_1 (T_1) \div (1 + \beta_p \cdot [T - T_1])$ ■ Corrected volume flow → $q_{ref} = q \cdot (\rho$ (T) ÷ $\rho_{ref})$ *m* *Mass flow* *q* *Volume flow (measured)* q_{ref} *Corrected volume flow* *T* *Operating temperature (measured)* T_1 *Temperature at which the value for* ρ_1 *applies (see Page 130)** ρ *Density* ρ_{ref} *Reference density (see Page 133)* ρ_1 *Density at which the value for* T_1 *applies (see Page 130)** β_p *Expansion coefficient of the liquid at* T_1 *(see Page 131)** ** For possible combinations of these values, see the table on Page 136.* **Option selected for fluid → REAL GAS (e.g. nitrogen, CO_2, etc.), COMPRESSED AIR or NATURAL GAS NX-19** *Applications:* Calculation of the mass flow and the corrected volume flow of gases. ✎ Note! The average operating pressure (p) in the gas line is needed for calculating the process variables and the measuring range limit values. The average operating pressure is either available as an input signal (PROFIBUS data block PRESSURE_VALUE, see Page 58) or has to be entered in the OPERATING PRESSURE function (see Page 135). Continued on next page

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
Contd. **SELECT FLUID** **(V4H0)**	*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 at a specific density of 0.554 to 0.75. The specific density describes the ratio of the reference density of the natural gas to the reference density of air (see Page 106). ■ In accordance with the NX-19 equation, the Mol percentage of nitrogen and carbon dioxide can be max. 15%. ■ The NX-19 equation is not defined for certain combinations of parameters (specific density, pressure, temperature, Mol-% nitrogen and Mol-% carbon dioxide) and the measuring device outputs the error message #412. In such instances, while the mass flow can no longer be calculated with the NX-19 equation, the following alternatives can be applied: – Mass flow calculated using the real gas equation and fixed values for the operating Z factor (see Page 135) and reference Z factor (see Page 134). – Mass flow calculated using the AGA-8 equation programmed into the RMC621 flow computer. *Formulae for calculation:* ■ Mass flow $\rightarrow m = q \cdot \rho\,(T, p)$ ■ Density (real gas) $\rightarrow \rho\,(T, p) = \rho_{ref} \cdot (p \div p_{ref}) \cdot (T_{ref} \div T) \cdot (Z_{ref} \div Z)$ ■ Corrected volume flow $\rightarrow q_{ref} = q \cdot (\rho\,(T, p) \div \rho_{ref})$ m *Mass flow* q *Volume flow (measured)* q_{ref} *Corrected volume flow* T *Operating temperature (measured)* T_{ref} *Reference temperature (see Page 130)* p *Operating pressure (see Page 135)* p_{ref} *Reference pressure (see Page 134)* ρ *Density* ρ_{ref} *Reference density (see Page 133)** Z *Operating Z-factor (see Page 135)** Z_{ref} *Reference Z factor (see Page 134)** ** 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.*

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
MATING PIPE DIAM. (V4H4)	The measuring device has diameter jump correction. This can be activated by entering the actual value of the mating pipe in this parameter (see Fig., d1). 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. To correct any resulting shift in the calibration factor, enter the actual value of the mating pipe (d1) in this parameter.  a0001982 *d1 > d2* *d1 = Mating pipe diameter* *d2 = Measuring pipe diameter* **User input:** 5-digit floating-point number **Factory setting:** 0 ✎ Note! ■ Inlet correction is switched off if 0 is entered. ■ The appropriate unit is taken from the UNIT LENGTH function (see P. 105). ■ Only diameter jumps within the same nominal diameter class (e.g. DN 50 / ½") 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.
SYSTEM PARAMETER (V5…)	
POS. ZERO RETURN (V5H0)	Use this parameter to interrupt evaluation of measured variables. This is necessary when a pipe is being cleaned, for example. The setting acts on all parameters and outputs of the measuring device. If positive zero return is active, the notice message #601 "POS. ZERO- RET." is displayed (see Page 72). **Options:** OFF ON (signal output is set to the value for zero flow). **Factory setting:** OFF

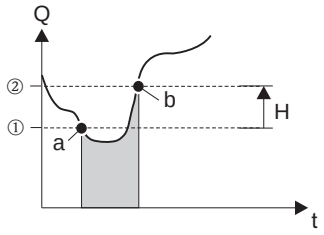
Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
FLOW DAMPING (V5H1)	For setting the filter depth. This reduces the sensitivity of the measuring signal to interference peaks (e.g. in the event of high solids content, gas bubbles in the fluid, etc.). The measuring system reaction time increases with the filter setting. **User input:** 0 to 100 s **Factory setting:** 1 s ✎ Note! The damping acts on the following parameters and outputs of the measuring device:  a0003907-en
PROFIBUS-DP/-PA (V6…)	
WRITE PROTECT (V6H0)	The status of the general write protection appears on the display. **Display:** 0 → Inactive (parameter can be changed) 1 → Active (parameter **cannot** be changed) **Factory setting:** 0 ✎ Note! Write protection is activated and deactivated by means of a DIP switch on the amplifier board (see P. 46).

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
SELECTION GSD (V6H1)	✎ Note! In the configuration phase, each PROFIBUS device must check an ID number allocated by the PNO (PROFIBUS User Organization). Along with this device-specific ID number there are also PROFILE ID numbers that have to be accepted in the configuration phase as well, for the purposes of interchangeability between devices of different make. In this case the device might, under certain circumstances, reduce the functionality for cyclic data to a profile-defined scope. For selecting the configuration response. **Options:** MANUFACT.SPEC PROFILE GSD MANUFACT 2.0 PROWIRL 77 (see Page 52) PROWIRL 72 (see Page 52) PROWIRL 73 PROF STANDARD PROF 1AI TOT PROF 2AI TOT PROF 3AI TOT AUTOMATIC **Factory setting:** AUTOMATIC ✎ Note! The option selected in this parameter can only be changed if the device is **not** in cyclic data exchange.
SET UNIT TO BUS (V6H2)	For transmitting the set system units to the automation system. When transmission takes place, the OUT value in the Analog Input Block is automatically scaled to the set system unit and the OUT unit (output unit) is displayed in the OUT UNIT parameter. **Option** CANCEL YES (SET UNITS) **Factory setting:** CANCEL ☝ Caution! Activating this parameter can cause the OUT output value to change suddenly; this, in turn, can affect subsequent control routines.
CHECK CONFIG. (V6H3)	For checking whether the configuration of a Class 1 master has been accepted for cyclic data exchange in Prowirl 73. **Display:** ACCEPTED (configuration accepted) NOT ACCEPTED (configuration not accepted)
BUS ADDRESS (V6H4)	The set bus address of the device appears on the display. **User input:** 1 to 126 **Factory setting:** 126 ✎ Note! This parameter is only for viewing the bus address. The bus address can be changed using a DDE server (via Commuwin II) for example.
PROFILE VERSION (V6H5)	The profile version appears on the display.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
DEVICE ID (V6H6)	The manufacturer-specific device ID appears on the display. **Display:** 0X153C Hex (Proline Prowirl 73 PROFIBUS PA)
PROFIBUS BLOCKS (V7…)	
AI BLOCK SELECT (V7H0)	For selecting the Analog Input function block (ANALOG INPUT 1 to 4) to which a process variable can be assigned in the CHANNEL AI (V7H1) parameter. or For selecting the data block (DISPLAY VALUE or PRESSURE VALUE) whose value (incl. unit) and status should be displayed in the OUT VALUE (V7H2) and OUT STATUS (V7H3) parameters. **Options:** ANALOG INPUT 1 ANALOG INPUT 2 ANALOG INPUT 3 ANALOG INPUT 4 DISPLAY_VALUE PRESSURE_VALUE **Factory setting:** ANALOG INPUT 1
CHANNEL AI (V7H1)	✎ Note! This parameter is not available unless the ANALOG INPUT 1, ANALOG INPUT 2, ANALOG INPUT 3 or ANALOG INPUT 4 option is selected in the CHANNEL AI (V7H1) parameter. For selecting the process variable which should be assigned to the Analog Input function block (ANALOG INPUT 1 to 4) selected in the AI BLOCK SELECT (V7H0) parameter. **Options:** VOLUME FLOW MASS FLOW CORRECTED VOLUME FLOW HEAT FLOW TEMPERATURE DENSITY SPECIFIC ENTHALPY CALC. SAT. PRESSURE Z-FACTOR VORTEX FREQUENCY ELECTRONICS TEMPERATURE REYNOLDS NUMBER VELOCITY **Factory setting:** VOLUME FLOW ✎ Note! ■ The value and status of the assigned process variable is displayed in the OUT VALUE (V7H2) and OUT STATUS (V7H3) parameters. ■ The option selected in this parameter has an effect on the assignment between the logical hardware channel of the Transducer Block and the input of the Analog Input function block in question. The element assigned in this parameter is also taken over in the CHANNEL parameter of the Analog Input function block.
OUT VALUE (V7H2)	The value displayed in this parameter depends on the option selected in the AI BLOCK SELECT (V7H0) parameter. If the option selected in the AI BLOCK SELECT (V7H0) parameter is: ■ ANALOG INPUT 1 to 4 → The process variable assigned to the Analog Input function block in the CHANNEL AI (V7H1) parameter appears on the display. ■ DISPLAY VALUE or PRESSURE VALUE → The value cyclically transmitted from the automation system to the measuring device via PROFIBUS appears on the display.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
OUT STATUS (V7H3)	Displays the OUT (output) status in hexadecimal values of the value displayed in the OUT VALUE (V7H2) parameter (status values → Page 63).
TOT BLOCK SELECT (V7H4)	For selecting the Totalizer function block to which a process variable can be assigned in the CHANNEL TOT (V7H5) parameter. **Options:** TOTALIZER 1 TOTALIZER 2 **Factory setting:** TOTALIZER 1 ✎ Note! The value and status of the assigned process variable is displayed in the OUT VALUE (V7H6) and OUT STATUS (V7H7) parameters.
CHANNEL TOT (V7H5)	For selecting the process variable which should be assigned to the Totalizer function block selected in the TOT BLOCK SELECT (V7H4) parameter. **Options:** VOLUME FLOW MASS FLOW CORRECTED VOLUME FLOW HEAT FLOW **Factory setting:** VOLUME FLOW ✎ Note! ■ The value and status of the assigned process variable is displayed in the OUT VALUE (V7H6) and OUT STATUS (V7H7) parameters. ■ The option selected in this parameter has an effect on the assignment between the logical hardware channel of the Transducer Block and the input of the Totalizer function block in question. The element assigned in this parameter is also taken over in the CHANNEL parameter of the Totalizer function block.
OUT VALUE (V7H6)	For displaying the process variable of the totalizer totalized since measuring began and the total overflow, if present. If overflow is present, the display alternates between the totalized process variable and the overflow. The CHANNEL TOT (V7H5) parameter is used to select which process variable is displayed. **Display (totalized process variable):** Max. 7-digit floating-point number **Display (overflows):** Integer with exponent, including sign and unit, e.g. 2 E7 kg ✎ Note! The totalized process variable is represented by a floating-point number consisting of max. 7 digits. You can use this parameter to view higher numerical values (>9999999) as overflows. The effective quantity is thus the total of this parameter plus the value displayed in the OUT VALUE parameter. **Example** Display: – totalized process variable = 196845.7 kg – for 2 overflows: 2 E7 kg (= 20000000 kg). → Effective total quantity = 20196845.7 kg
OUT STATUS (V7H7)	Displays the TOT-OUT (output) status in hexadecimal values (status values → Page 63). The CHANNEL TOT (V7H5) parameter is used to select which process variable is displayed. ✎ Note! The parameter **cannot** be viewed on the local display.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
LOW FLOW CUT OFF (V8…)	
ASSIGN LF CUT OFF (V8H0)	For selecting the process variable on which low flow cut off should act. **Options:** OFF VOLUME FLOW MASS FLOW CORRECTED VOLUME FLOW HEAT FLOW REYNOLDS NUMBER* **Factory setting:** VOLUME FLOW This option is not available unless the SATURATED STEAM, WATER, COMPRESSED AIR, SUPERHEATED STEAM or NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter. ✎ Note! ■ If the low flow cut off should act on the OUT VALUE of the Analog Input function block, the identical option must be chosen in the CHANNEL parameter . ■ 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).
ON VAL. LF CUT OFF (V8H1)	✎ Note! This parameter is **not** available if the OFF option was selected in the ASSIGN LF CUT OFF parameter. For entering the on-value for low flow cut off. **If VOLUME FLOW, MASS FLOW, CORRECTED VOLUME FLOW or HEAT FLOW is selected in the ASSIGN LF CUT OFF parameter:** Low flow cut off is switched on if the value entered is not equal to 0. An inverted plus sign is shown on the local display of the flow value as soon as the low flow cut off is active. **User input:** 5-digit floating-point number **Factory setting:** Below the standard measuring range ✎ Note! The appropriate unit is taken from the SYSTEM UNITS (Page 103 ff.). **If REYNOLDS NUMBER is selected in the ASSIGN LF CUT OFF parameter:** If the Reynolds number entered here is undershot, low flow cut off becomes active. An inverted plus sign is shown on the local display of the flow value when the low flow cut off is active. **User input:** 4000 to 99999 **Factory setting:** 20000

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
OFF VAL. LF CUT OFF (V8H2)	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...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*
VELOCITY WARNING (Not available in Commuwin II)	Use this function to activate monitoring of the fluid velocity (→ ON). If the fluid velocity exceeds the value entered in the LIMIT VELOCITY function (see Page 122), the measuring device outputs the notice message " # 421 FLOW RANGE". **Options:** OFF (function switched off) ON **Factory setting:** OFF
LIMIT VELOCITY (Not available in Commuwin II)	For entering the maximum fluid velocity permitted (= limit speed). Once the VELOCITY WARNING function (Page 122) has been activated, a warning message is output when the limit velocity is exceeded. **User input:** 5-digit floating-point number **Factory setting:** 75 m/s ✎ Note! The unit displayed in this function depends on the option selected in the UNIT LENGTH function (see Page 105): ■ UNIT LENGTH option = mm → Unit in this function = m/s ■ UNIT LENGTH option = inch → Unit in this function = ft/s

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
SENSOR DATA (V9…)	
K-FACTOR (V9H0)	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 report under "K-fct.". ☞ Caution! Value not changed because a change will inevitably affect the accuracy.
K-FACTOR COMPENS (V9H1)	The current compensated calibration factor of the sensor appears on the display. The temperature-dependent expansion of the sensor (see P. 123) and diameter jumps in the inlet of the device (see P. 116) are compensated. **Display:** e.g. 102 P/l (pulse per liter) ☞ Caution! Value not changed because a change will inevitably affect the accuracy.
NOMINAL DIAMETER (V9H2)	The nominal diameter of the sensor appears on the display. **Display:** e.g. DN 25 ☞ Caution! Value not changed because a change will inevitably affect the accuracy.
METER BODY MB (V9H3)	The type of meter body (MB) of the sensor appears on the display. Use this parameter to specify the nominal diameter and the sensor type. **Display:** e.g. 2 ☞ Caution! Value not changed because a change will inevitably affect the accuracy.
T-COEFF. SENSOR (V9H4)	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:** $4.8800*10^{-5}$ / K (stainless steel); $2.6000*10^{-5}$ / K (Alloy C-22) ☞ Caution! Value not changed because a change will inevitably affect the accuracy.

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
AMPLIFICATION (V9H5)	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. **User input:** 1 to 5 (1 = smallest amplification, 5= largest amplification) **Factory setting:** 3
OFFSET T-SENSOR (V9H6)	Use this function to enter the zero offset value for the temperature sensor. The value entered in this parameter is added to the measured temperature value. **User input:** –10 to +10 °C (–18 to +18°F); (converted to UNIT TEMPERATURE) **Factory setting:** 0.00 °C
CABLE LENGTH (V9H8)	Use this parameter 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 Cable specifications standard connecting cable Section on Page 21). **User input:** 0 to 30 m or 0 to 98 ft **Unit:** The unit depends on the option selected in the UNIT LENGTH parameter (see Page 105): ■ UNIT LENGTH option = mm → Unit in this function = m ■ UNIT LENGTH option = inch → Unit in this function = ft **Factory setting:** ■ For compact version → 0m or 0ft ■ 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
MEASURING POINT (VA…)	
TAG NAME (VAH0)	For entering a tag name for the device. You can edit and read this tag name using a Class 2 master. **User input:** Max. 32-character text, permitted characters are: A-Z, 0-9, +,–, punctuation marks **Factory setting:** "– –" (no text)

Transducer Block (device matrix)	
Matrix text (Commuwin II)	**Description**
MATRIX SELECTION (VAH5)	For switching from one matrix page to another. ✎ Note! This parameter is only relevant for Commuwin II.
DEVICE NAME (VAH6)	The device type appears on the display. ✎ Note! This parameter is only relevant for Commuwin II.

11.3.5 Transducer Block parameters (Diagnosis/Simulation/Version Info)

Transducer Block (Diagnosis/Simulation/Version Info)	
Matrix text (Commuwin II)	**Description**
SUPERVISION (V0…)	
ACTUAL.SYS.COND (V0H0)	The current system status appears on the display. **Display:** "SYSTEM OK" or the fault/notice message with the highest priority.
PRESENT ERROR (V0H1)	The number of the current fault or notice message appears on the display.
PREV. SYS. CON. (V0H2)	The last fault and notice message appears on the display.
LAST ERROR NO. (V0H3)	The number of the last fault or notice message to occur appears on the display.
CLEAR LAST ERR. (V0H4)	Clears the last fault or notice message. **Display:** CANCEL YES
ALARM DELAY (V0H6)	For entering the time span for which the criteria for an error have to be satisfied without interruption before a fault or notice message is generated. Depending on the setting and the type of error, this suppression acts on the display, the AI OUT VALUE and TOT-OUT VALUE. **User input:** 0 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 higher-level controller (PCS, etc.). It is therefore imperative to check in advance whether a delay of this nature could affect the safety requirements of the process. If fault and notice messages may not be suppressed, a value of 0 seconds must be entered here.

Transducer Block (Diagnosis/Simulation/Version Info)	
Matrix text (Commuwin II)	**Description**
SYSTEM RESET (V0H7)	Use this parameter to reset the measuring system. **Options:** – 0 = NO RESET – 1 = RESTART SYSTEM → Restart without disconnecting main power. – 2 = RESET DELIVERY → Restart without disconnecting main power, the saved settings of the delivery status (factory settings) are applied. **Factory setting:** NO
OPERATION HOURS (V7H8)	The hours of operation of the device appear on the display. **Display:** Depends on the number of hours of operation elapsed: – Hours of operation < 10 hours → Display format = 00:00:00 (hr:min:sec) – Hours of operation 10 to 10000 hours → Display format = 0000:00 (hr:min) – Hours of operation <10000 hours → Display format = 000000 (hr)
OPERATION (V2…)	
LANGUAGE (V2H0)	This parameter is described on Page 106.
ACCESS CODE (V2H1)	This parameter is described on Page 106.
DEFINE PRIVATE CODE (V2H2)	This parameter is described on Page 106.
STATUS ACCESS (V2H3)	This parameter is described on Page 106.
ACCESS CODE C. (V2H4)	This parameter is described on Page 106.
ACTIV. CODE NX-19 (V2H5)	This parameter is described on Page 107.
ACTIV. C. ADV. DIAG (V2H6)	This parameter is described on Page 107.

Transducer Block (Diagnosis/Simulation/Version Info)	
Matrix text (Commuwin II)	**Description**
SIMULATION (V4…)	
SIM. MEASURAND (V4H0)	Simulation of the Transducer Block output to check the behavior. During this time, the message "SIMULATION MEASURAND" appears on the local display. Simulation affects the Analog Input and Totalizer function block. **Options:** OFF VOLUME FLOW MASS FLOW CORRECTED VOLUME FLOW TEMPERATURE **Factory setting:** OFF ✎ Note! If the unit of the simulated measured value should also be displayed, the selected system unit can be transmitted to the automation system via the SET UNIT TO BUS parameter (see Page 118). This is also possible in the Totalizer function block via the TOTAL UNIT parameter. In the Analog Input Block, you can use the OUT UNIT parameter to select a unit which, however, does not have any effect on measured value scaling. ☝ Caution! ■ The measuring device can only be used for measuring to some degree while this simulation is in progress. ■ The setting is not saved if the power supply fails.
VALUE SIM. MEAS (V4H1)	✎ Note! This parameter is not displayed unless the SIM. MEASURAND parameter is active. For specifying a freely selectable value (e.g. 12 m^3/s) to check the assigned parameters in the device itself and downstream signal circuits. **User input:** 5-digit floating-point number **Factory setting:** 0 ☝ Caution! The setting is not saved if the power supply fails.
SIM. FAILSAFE (V4H2)	Simulation of the Transducer Block's failsafe mode. **Options:** OFF NO **Factory setting:** OFF ✎ Note! The failsafe mode must be defined in the appropriate Analog Input or Totalizer function block.
SENSOR INFO (V6…)	
SERIAL NUMBER (V6H0)	The serial number of the sensor appears on the display.
SENSOR TYPE (V6H1)	The sensor type appears on the display.

Transducer Block (Diagnosis/Simulation/Version Info)	
Matrix text (Commuwin II)	**Description**
SN DSC SENSOR (V6H2)	The serial number of the DSC sensor appears on the display.
AMPLIFIER INFO (V7…)	
HW REV. AMP. (V7H0)	The hardware revision number of the amplifier appears on the display.
SW REV. AMP. (V7H2)	The software revision number of the amplifier appears on the display. ✎ Note! The number can also be read off from the service plate in the electronics compartment cover.
I/O MODULE INFO (V8…)	
HW REV. I/O (V8H0)	The hardware revision number of the I/O module appears on the display.
SW REV. I/O (V8H2)	The software revision number of the I/O module appears on the display.
MEASURING POINT (VA…)	
TAG NAME (VAH0)	This parameter is described on Page 124.
MATRIX SELECTION (VAH5)	This parameter is described on Page 125.
DEVICE NAME (VAH6)	This parameter is described on Page 125.

11.3.6 Transducer Block parameters (flow computer)

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
MEASURING VALUES (V0…)	
VOLUME FLOW (V0H0)	This parameter is described on Page 100.
TEMPERATURE (V0H1)	This parameter is described on Page 100.
MASS FLOW (V0H2)	This parameter is described on Page 100.
CORRECTED VOLUME FLOW (V0H3)	This parameter is described on Page 100.
HEAT FLOW (V0H4)	This parameter is described on Page 100.
DENSITY (V0H5)	This parameter is described on Page 101.
SPEC. ENTHALPY (V0H6)	This parameter is described on Page 101.
CALC. SAT. STEAM P. (V0H7)	This parameter is described on Page 101.
Z-FACTOR (V0H8)	This parameter is described on Page 102.
VORTEX FREQUENCY (V0H9)	This parameter is described on Page 101.
SYSTEM UNITS (V1…)	
UNIT VOL. FLOW (V1H0)	This parameter is described on Page 103.
UNIT TEMPERATURE (V1H1)	This parameter is described on Page 103.
UNIT MASS FLOW (V1H2)	This parameter is described on Page 104.
UNIT CORR. VOL. FL (V1H3)	This parameter is described on Page 104.
UNIT HEAT FLOW (V1H4)	This parameter is described on Page 104.
UNIT DENSITY (V1H5)	This parameter is described on Page 104.
UNIT SPEC. ENTH. (V1H6)	This parameter is described on Page 105.
UNIT PRESSURE (V1H7)	This parameter is described on Page 105.
UNIT LENGTH (V1H8)	This parameter is described on Page 105.
UNIT FREQUENCY (V1H9)	This parameter is described on Page 105.
OPERATION (V2…)	
LANGUAGE (V2H0)	This parameter is described on Page 106.

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
ACCESS CODE (V2H1)	This parameter is described on Page 106.
DEFINE PRIVATE CODE (V2H2)	This parameter is described on Page 106.
STATUS ACCESS (V2H3)	This parameter is described on Page 106.
ACCESS CODE C. (V2H4)	This parameter is described on Page 106.
ACTIV. CODE NX-19 (V2H5)	This parameter is described on Page 107.
ACTIV. C. ADV. DIAG (V2H6)	This parameter is described on Page 107.
PROCESS PARAMETER (V4…)	
SELECT FLUID (V4H0)	This parameter is described on Page 112.
TEMPERATURE VALUE (V4H1)	✎ Note! This parameter is not available unless the USER-DEFINED LIQUID option was selected in the SELECT FLUID parameter (V4H0). Use this function to enter the fluid temperature for the density specified in the DENSITY VALUE parameter for calculating the operating density of user-defined liquids (formula for calculation, see SELECT FLUID parameter, Page 112). **User input:** 5-digit floating-point number **Factory setting:** 293.15 K (20 °C) ✎ Note! ■ The appropriate unit is taken from the parameter UNIT TEMPERATURE (V1H1). ■ If this parameter is changed, we recommend you reset the totalizers. ■ A table with sample values (for the TEMPERATURE VALUE, DENSITY VALUE and EXPANSION COEFF. parameters) for various fluids can be found on Page 136. ☞ 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 87).
DENSITY VALUE (V4H2)	✎ Note! This parameter is not available unless the USER-DEFINED LIQUID option was selected in the SELECT FLUID parameter (V4H0). Use this function to enter the density at the fluid temperature specified in the TEMPERATURE VALUE(V4H1) parameter, for calculating the operating density of user-defined liquids (formula for calculation, see SELECT FLUID parameter, Page 130). **User input:** 5-digit floating-point number **Factory setting:** 1.0000 kg/dm³ ✎ Note! ■ The appropriate unit is taken from the parameter UNIT DENSITY (V1H5). ■ If this parameter is changed, we recommend you reset the totalizers. ■ A table with sample values (for the TEMPERATURE VALUE, DENSITY VALUE and EXPANSION COEFF. parameters) for various fluids can be found on Page 136.

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
EXPANSION COEFF. (V4H3)	✎ Note! This parameter is not available unless the USER-DEFINED LIQUID option was selected in the SELECT FLUID parameter (V4H0). Use this function to enter the expansion coefficient for calculating the operating density of user-defined liquids (formula for calculation, see SELECT FLUID parameter, Page 112). **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 parameter 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 ρ_1 at temperature T_1 and density ρ_2 at temperature T_2), the expansion coefficient can be calculated as follows: $$\beta_p = \frac{\left(\frac{\rho_1}{\rho_2} - 1\right)}{(T_1 - T_2)}$$ a0007271 ■ A table with sample values (for the TEMPERATURE VALUE, DENSITY VALUE and EXPANSION COEFF. parameters) for various fluids can be found on Page 136. ■ The appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1).
SPEC. DENSITY (V4H4)	✎ Note! This parameter is not available unless the NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter (V4H0). 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). **User input:** 5-digit floating-point number **Factory setting:** 0.6640 ✎ Note! The values entered in the SPEC. DENSITY, 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 (V4H5)	✎ Note! This parameter is not available unless the NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter (V4H0). 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. DENSITY, 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.

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
MOL-% CO2 (V4H6)	✎ Note! This parameter is not available unless the NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter (V4H0). 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. DENSITY, 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.
WET STEAM ALARM (Not available in Commuwin II)	If the temperature comes closer than 2 °C (36 °F) to the saturated steam curve for steam applications, error message #525 WET STEAM ϟ is output. **Options:** OFF ON **Factory setting:** ON ✎ Note! This function is not available unless the SUPERHEATED STEAM option is selected in the SELECT FLUID function.
SATURATED STEAM PARAMETER (Not available in Commuwin II)G50	This function specifies what parameters are used to calculate the density and enthalpy when the saturated steam option is selected for the fluid. **Options:** PRESSURE TEMPERATURE **Factory setting:** TEMPERATURE ✎ Note! This field is not available unless the SATURATED STEAM or SUPERHEATED STEAM option was selected in the SELECT FLUID field (→ Page 112 ff.).

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
REFERENCE PARAMETER (V5…)	
REFERENCE TEMP. (V5H1)	✎ Note! This parameter is not available unless the REAL GAS, COMPRESSED AIR or NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter (V4H0). 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 parameter, Page 130), 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 appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1). ☝ 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 87).
REFERENCE DENSITY (V5H2)	✎ Note! This function is **not** available if the following has been selected in the SELECT FLUID function (Page 112): – GAS VOLUME – LIQUID VOLUME – SATURATED STEAM – SUPERHEATED STEAM The reference density can be displayed or entered in this function for fluids other than those listed above: **User input:** – If REAL GAS, USER-DEFINED LIQUID is selected – Enter the reference density of a gas or liquid → As per order, otherwise 1 **Display:** – If COMPRESSED AIR, WATER, NATURAL GAS NX-19 is selected – The reference density calculated by Prowirl 73 is displayed. This is based on the values entered in the REFERENCE TEMPERATURE (Page 133) and REFERENCE PRESSURE (Page 134) functions. ✎ Note! ■ The appropriate unit is taken from the UNIT DENSITY function (see Page 104). ■ If the value in this function is changed, we recommend you reset the totalizers.

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
REF. Z-FACTOR (V5H3)	✎ Note! This parameter is not available unless the REAL GAS option was selected in the SELECT FLUID parameter (V4H0). Use this function to enter the Z-factor for gas under reference conditions. The values defined in the REFERENCE PRESSURE (V5H4) and REFERENCE TEMP. (V5H1) functions apply as the reference conditions (formula for calculation, see SELECT FLUID parameter, Page 130). 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. **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.
REFERENCE PRESSURE (V5H4)	✎ Note! This parameter is not available unless the REAL GAS, COMPRESSED AIR or NATURAL GAS NX-19 option was selected in the SELECT FLUID parameter (V4H0). 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 parameter, Page 130), as well as for the standard volume calculation of compressed air and natural gas NX-19. **User input:** 5-digit floating-point number (value entered must be > 0) **Factory setting:** 1.0000 ✎ Note! The appropriate unit is taken from the UNIT PRESSURE parameter (V1H7).
CONTROL PARAMETER (V6…)	
ERROR => TEMP. (V6H1)	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; incl. unit **Factory setting:** 20 °C ✎ Note! The appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1).

Transducer Block (flow computer)	
Matrix text (Commuwin II)	**Description**
OPERATING Z-FACTOR (V6H3)	✎ Note! This parameter is not available unless the REAL GAS option was selected in the SELECT FLUID parameter (V4H0). 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 parameter, Page 130). 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. **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.
OPERATING PRESSURE (V6H4)	✎ Note! This parameter is not available unless the WATER, COMPRESSED AIR, SUPERHEATED STEAM, REAL GAS or NATURAL GAS NX-19 option is selected in the SELECT FLUID (V4H0) parameter. For entering the fluid pressure for calculating the operating density (formula for calculation, see SELECT FLUID parameter, Page 130) or displaying the value transmitted by the automation system (PROFIBUS data block PRESSURE_VALUE, see Page 58). **User input:** 5-digit floating-point number **Factory setting:** 1 bara ✎ Note! ■ A value for the operating pressure (32-bit floating-point number) incl. unit and status can be cyclically transmitted from the automation system via PROFIBUS to the measuring device by means of the PRESSURE_VALUE data block. If this transmission is activated, the value transmitted is displayed in this parameter and cannot be modified. ■ If the value is specified by means of this parameter, exact calculation is only possible at a constant operating pressure. ■ The appropriate unit is taken from the UNIT PRESSURE parameter (V1H7).
MEASURING POINT (VA…)	
TAG NAME (VAH0)	This parameter is described on Page 124.
MATRIX SELECTION (VAH5)	This parameter is described on Page 125.
DEVICE NAME (VAH6)	This parameter is described on Page 125.

Sample values for the parameters:
TEMPERATURE VALUE, DENSITY VALUE and EXPANSION COEFFICIENT
The calculation of the density for user-defined liquids (see Page 114) 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 131.

Fluid	Temperature value [K]	Density value [kg/m^3]	Expansion coefficient [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			

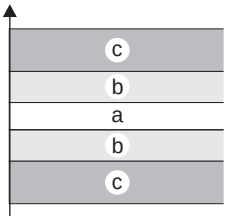
11.3.7 Transducer Block parameters (advanced diagnostics)

Transducer Block (advanced diagnostics)	
Matrix text (Commuwin II)	**Description**
MEASURING VALUES (V0…)	
FLUID TEMP. (V0H0)	This parameter is described on Page 100.
ELECTRONICS TEMP. (V0H1)	The temperature currently measured at the electronics board (input variable for the Analog Input function block) 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.)
REYNOLDS NUMBER (V0H2)	✎ Note! This parameter is not available unless the SATURATED STEAM, SUPERHEATED STEAM, NATURAL GAS NX-19, WATER or COMPRESSED AIR option is selected in the SELECT FLUID (V4H0) parameter. The Reynolds number appears on the display. The Reynolds number is determined using the fluid selected and the measured temperature (input variable for the Analog Input function block). **Display:** 8-digit fixed-point number (e.g. 25800)
VELOCITY (V0H3)	The flow velocity (through the device) appears on the display. This is determined from the current flow through the device and the cross-section area the fluid flows through (input variable for the Analog Input function block). **Display:** 5-digit floating-point number, including unit ✎ Note! The unit displayed in this parameter depends on the option selected in the UNIT LENGTH(V1H8) parameter (see see Page 129): – Selected option UNIT LENGTH = mm → Unit in this function = m/s – Selected option UNIT LENGTH = inch → Unit in this function = ft/s
SYSTEM UNITS (V1…)	
UNIT TEMPERATURE (V1H1)	This parameter is described on Page 103.
OPERATION (V2…)	
LANGUAGE (V2H0)	This parameter is described on Page 106.
ACCESS CODE (V2H1)	This parameter is described on Page 106.
DEFINE PRIVATE CODE (V2H2)	This parameter is described on Page 106.
STATUS ACCESS (V2H3)	This parameter is described on Page 106.
ACCESS CODE C. (V2H4)	This parameter is described on Page 106.
ACTIV. CODE NX-19 (V2H5)	This parameter is described on Page 107.
ACTIV. C. ADV. DIAG (V2H6)	This parameter is described on Page 107.

Transducer Block (advanced diagnostics)	
Matrix text (Commuwin II)	**Description**
DIAGNOSIS FLUID TEMP. (V3…) ✎ Note! This parameter group is not available unless the software option (advanced diagnostics) is activated in the ACTIV. C. ADV. DIAG (V2H6) parameter (see Page 137).	
FLUID TEMP. STATUS (V3H0)	The current status for fluid temperature monitoring appears on the display. **Display:** GOOD BAD LO LIM LO LO LIM HI LIM HI HI LIM
MIN T FLUID (V3H1)	Smallest fluid temperature measured since the last reset (RESET T ELECTR. parameter). **Display:** 5-digit floating-point number, including unit and sign (e.g. 95.3 °C)
MAX T FLUID (V3H2)	Largest fluid temperature measured since the last reset (RESET T ELECTR. parameter). **Display:** 5-digit floating-point number, including unit and sign (e.g. 218.1 °C)
RESET T FLUID (V3H3)	Resets the values in the MIN T ELECTRONICS and MAX T ELECTRONICS parameters. **Options:** NO YES **Factory setting:** NO
WARN T MEAS. LO (V3H4)	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. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** –202 °C ✎ Note! The appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1).
WARN T MEAS. HI (V3H6)	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. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** 402 °C ✎ Note! The appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1).

Transducer Block (advanced diagnostics)	
Matrix text (Commuwin II)	**Description**
DIAGNOSIS ELECTRONIC TEMP. (V4…) ✎ Note! This parameter group is not available unless the software option (advanced diagnostics) is activated in the ACTIV. C. ADV. DIAG (V2H6) parameter (see Page 137).	
ELECTRONIC TEMP. STATUS (V4H0)	The current status for monitoring the temperature on the electronics board appears on the display. **Display:** GOOD BAD LO LIM LO LO LIM HI LIM HI HI LIM
MIN T ELECTRONICS (V4H1)	Smallest electronics board temperature measured since the last reset (RESET T ELECTR. parameter). **Display:** 5-digit floating-point number, including unit and sign (e.g. 20.2 °C)
MAX T ELECTRONICS (V4H2)	Largest electronics board temperature measured since the last reset (RESET T ELECTR. parameter). **Display:** 5-digit floating-point number, including unit and sign (e.g. 65.3 °C)
RESET T ELECTR. (V4H3)	Resets the values in the MIN T ELECTRONICS and MAX T ELECTRONICS parameters. **Options:** NO YES **Factory setting:** NO
WARN T ELECTR. LO (V4H4)	Use this function to enter the lower limit value for monitoring the temperature on the electronics 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. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** –41 °C ✎ Note! The appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1).
WARN T ELECTR. HI (V4H5)	Use this function to enter the upper limit value for monitoring the temperature on the electronics 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. **User input:** 5-digit floating-point number, incl. sign **Factory setting:** 86 °C ✎ Note! The appropriate unit is taken from the UNIT TEMPERATURE parameter (V1H1).

Transducer Block (advanced diagnostics)	
Matrix text (Commuwin II)	**Description**
DIAGNOSIS REYNOLDS NUMBER (V5…) ✎ Note! This parameter group is not available unless the software option (advanced diagnostics) is activated in the ACTIV. C. ADV. DIAG (V2H6) parameter (see Page 137).	
REYNOLDS NUMBER STATUS (V5H0)	The current status for Reynolds number monitoring appears on the display. **Display:** GOOD BAD LO LO LIM
REYNOLDS N. WARNING (V5H1)	✎ Note! This parameter is not available unless the SATURATED STEAM, SUPERHEATED STEAM, NATURAL GAS NX-19, WATER or COMPRESSED AIR option is selected in the SELECT FLUID (V4H0) parameter. Use this function to activate monitoring of the Reynolds number. If a Reynolds number of < 20000 is determined during active monitoring, a notice message #494 RE <20000 is displayed (see Page 73). ✎ Note! ■ With a Reynolds number of <20000, reduced accuracy of the device must be reckoned with. ■ There is no fault message at zero flow. ■ There is no notice message if the REYNOLDS NUMBER option was selected in the ASSIGN LF CUT OFF function. **Options:** OFF (functionality switched off) ON **Factory setting:** OFF
DIAGNOSIS VELOCITY (V6…) ✎ Note! This parameter group is not available unless the software option (advanced diagnostics) is activated in the ACTIV. C. ADV. DIAG (V2H6) parameter (see Page 137).	
VELOCITY STATUS (V6H0)	The current status for velocity monitoring appears on the display. **Display:** GOOD BAD HI HI LIM
VELOC. WARNING (V6H1)	Use this function to activate monitoring of the fluid velocity. If, during active monitoring, the fluid velocity exceeds the value for the limit velocity, a notice message is displayed. **Options:** OFF (function switched off) ON **Factory setting:** OFF

Transducer Block (advanced diagnostics)	
Matrix text (Commuwin II)	**Description**
ADVANCED SENSOR DIAGNOSTICS (V7…) ✎ Note! This parameter group is not available unless the software option (advanced diagnostics) is activated in the ACTIV. C. ADV. DIAG (V2H6) parameter (see Page 137).	
SENSOR STATUS (V7H0)	The current status of the sensor appears on the display. **Display:** GOOD NO T-SENSOR RESONANCE DSC DSC SENS DEFCT DSC SENS LIM
SENSOR DIAGNOSIS (V7H1)	Use this function to activate monitoring of the capacitive signal of the DSC sensor. When monitoring is active, the system 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 – c = Measurement failure → Error message #394 DSC SENS DEFCT  a0001986 **Options:** OFF (function switched off) STANDARD **Factory setting:** STANDARD
MEASURING POINT (VA…)	
TAG NAME (VAH0)	This parameter is described on Page 124.
MATRIX SELECTION (VAH5)	This parameter is described on Page 125.
DEVICE NAME (VAH6)	This parameter is described on Page 125.

11.4 Function blocks, general

The function blocks contain the basic automation functions of the measuring device. We distinguish between different function blocks, e.g. Analog Input function block, Analog Output function block, Totalizer Block, etc.

Each of these function blocks is used to execute different application functions. This means that device errors such as amplifier errors can be reported to the automation system automatically.

The function blocks process the input values in accordance with their specific algorithm and their parameters which are internally available. They generate output values that are then made available to the automation system for further processing.

11.5 Analog Input function block

The device has four Analog Input function blocks. In the Analog Input function block, the device's process variables are prepared for subsequent automation functions (e.g. scaling and limit value processing).

11.5.1 Signal processing

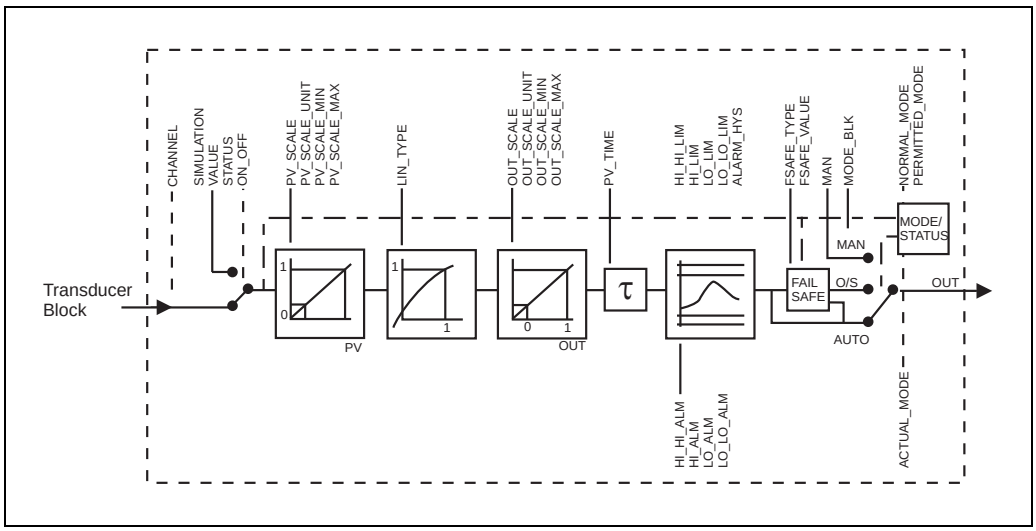


Fig. 33: Schematic illustration of the internal structure of an Analog Input function block

The Analog Input function block receives the process variables as input values from the Transducer Block. The CHANNEL parameter is used to specify which process variable should be used (see Page 145).
The SIMULATION 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 automation system can be tested.
In the RISING_TIME parameter, a filter time can be specified for damping the converted input value (PV). If a time of 0 seconds is specified, the input value is not damped.
The BLOCK_MODE parameter group is used to select the operating mode of the Analog Input function block. If the MAN (manual) operating mode is selected, the OUT output value and the OUT status can be specified directly.

The OUT output value is compared against 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.

11.5.2 Selecting the operating mode

The operating mode is set by means of the BLOCK_MODE parameter group.
The Analog Input function block supports the following operating modes:
- AUTO (automatic mode)
- MAN (manual mode)
- O/S (out of service)

11.5.3 Selecting the units

The system units for the process variables can be changed using Commuwin II in the Transducer Block profile and the manufacturer-specific device block (for factory setting of the system units for the process variables, see Page 156).
Changing the unit does not initially have any effect on the measured value transmitted to the automation system. This ensures that there are no sudden changes in the measured values that could have an effect on the subsequent control routine.
If the change of unit should affect the measured value, the SET UNIT TO BUS parameter (manufacturer-specific, see Page 118) in the Transducer Block (device matrix) can be activated using Commuwin II.
Another way of changing the unit is to use the PV_SCALE and OUT_SCALE parameters (see Page 144 "Rescaling the input value").

11.5.4 Status of the OUT output value

The status of the Analog Input function block and the validity of the OUT output value are relayed to the downstream function blocks by means of the status of the OUT parameter group.

Status:	**The output value:**
GOOD NON CASCADE	→ OUT is valid and can be used for further processing.
UNCERTAIN	→ OUT can only be used for further processing to a limited extent.
BAD	→ OUT is not valid.

✎ Note!
The BAD status value occurs when the Analog Input function block is switched to O/S (out-of-service) or in the event of serious errors (see status code and system/process error messages, see Page 69).

11.5.5 Simulation of input/output

Various parameters of the Analog Input function block allow simulation of the input and output of the function block:

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

Simulating the output of the Analog Input function block:
Set the operating mode in the MODE_BLK parameter group to MAN and directly specify the desired output value in the OUT parameter.

11.5.6 Failsafe mode FAILSAFE TYPE

If an input or simulation value has the status BAD, the Analog Input function block uses the failsafe mode defined in the FAILSAFE_TYPE parameter. The FAILSAFE_TYPE parameter offers the following options:

FAILSAFE TYPE:	Failsafe mode:
FSAFE_VALUE	The value specified in the FAILSAFE_VALUE parameter is used for further processing.
LAST_GOOD_VALUE	The last good value is used for further processing.
WRONG_VALUE	The current value is used for further processing, despite the BAD status.
✎ Note! The factory setting is the default (FSAFE_VALUE) with value "0".	

✎ Note!
Failsafe mode is also activated if the Analog Input function block is set to the "OUT_OF_SERVICE" operating mode.

11.5.7 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 system unit in the Transducer Block is m^3/h. The measuring device has a measuring range of 0 to 30 m^3/h. The output range to the automation system should be 0 to 100%. The measured value from the Transducer Block (input value) is rescaled linearly via the input scaling PV_SCALE to the desired output range OUT_SCALE:

PV_SCALE parameter group		OUT_SCALE parameter group	
PV_SCALE_MIN (V1H0)	→ 0	OUT_SCALE_MIN (V1H3)	→ 0
PV_SCALE_MAX (V1H1)	→ 30	OUT_SCALE_MAX (V1H4)	→100
		OUT_UNIT (V1H5)	→ %

The result is that with an input value of, for example, 15 m^3/h a value of 50% is output via the OUT parameter.

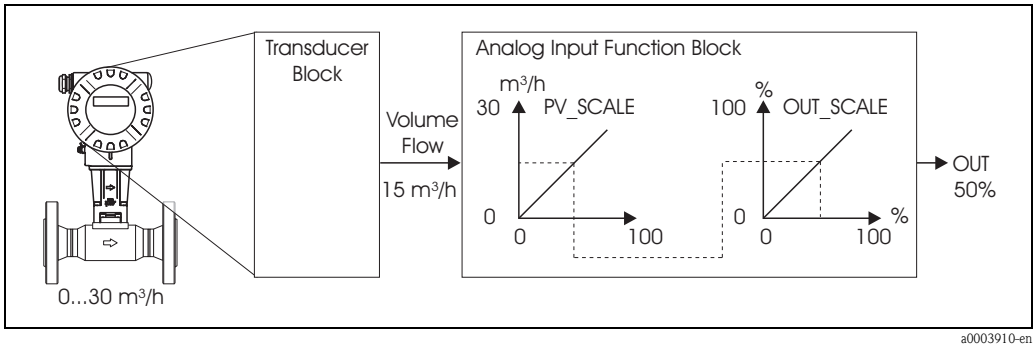


Fig. 34: Rescaling the input value

✎ Note!
The "OUT_UNIT" parameter does not have any effect on the scaling. It should be set nevertheless for the purposes of viewing on the local display, for example.

11.5.8 Limit values

You can set two warning limits and two alarm limits for monitoring your process. The status of the measured value and the parameters of the limit-value alarms are indicative of the measured value's relative situation. You also have the option of defining an alarm hysteresis in order to avoid frequent changes of the limit-value flags and frequent enabling/disabling of alarms.

The limit values are based on the OUT output value. If the output value OUT exceeds or undershoots the defined limit values, an alarm is sent to the automation system via the limit value process alarms.

The limit values "HI_HI_LIM", "HI_LIM", "LO_LO_LIM" and "LO_LIM" can be defined.

11.5.9 Alarm detection and processing

The following process alarms are generated by the Analog Input function block:

Limit value process alarms
The status of the limit value process alarms is made known to the automation system by means of the "HI_HI_ALM", "HI_ALM", "LO_LO_ALM" and "LO_ALM" parameters.

11.5.10 CHANNEL parameter

The CHANNEL parameter is used to specify which process variable should be used by the Analog Input function block. The following process variables are available:

Block	Process variable	CHANNEL parameter
AI - Analog Input Function block 1 to 4	Volume flow	273 (factory setting AI 1)
	Mass flow	277 (factory setting AI 2)
	Corrected volume flow	398 (factory setting AI 3)
	Temperature	285 (factory setting AI 4)
	Calculated heat flow	116
	Density	281
	Specific enthalpy	118
	Calc. saturated steam pressure	120
	Z factor	186
	Vortex frequency	289
	* Electronics temperature	89
	* Reynolds number	96
	Flow velocity	99
	* Only available with the "Advanced diagnostics" software option. If the "Advanced diagnostics" software option is not available and if one of the two assignments is made, NaN (not-a-number) is transmitted as the value for the process variable.	

11.6 Totalizer function block

The Totalizer function block is used whenever a physical measured variable, generally flow, has to be totaled over a certain period of time.
Like the Analog Input function block, the totalizer also receives its input value from a Transducer Block.

11.6.1 Signal processing

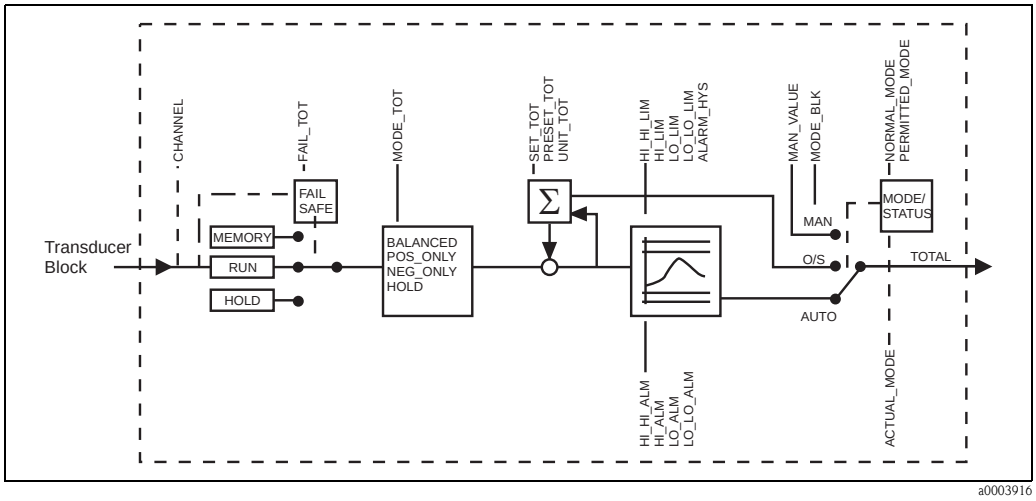


Fig. 35: Schematic illustration of the internal structure of a Totalizer function block

The Totalizer function block receives four process variables as input values from the Transducer Block. The CHANNEL parameter is used to specify which process variable should be used (see Page 148).

The MODE_BLK parameter group is used to select the operating mode of the Totalizer function block. If the MAN (manual) operating mode is selected, the TOTAL output value and the TOTAL_STATUS can be specified directly.

Note!
The block algorithm is not run through in the MAN (manual) operating mode. This, in turn, means that limit values are not calculated or displayed.

The TOTAL output value is compared against 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.

11.6.2 Selecting the operating mode

The operating mode is set by means of the BLOCK_MODE parameter group.
The Totalizer function block supports the following operating modes:
- AUTO (automatic mode)
- MAN (manual mode)
- O/S (out of service)

11.6.3 Unit of the totaled measured value UNIT_TOT

Unit change has a direct effect on the measured value.
There is no scaling similar to that in the Analog Input function block.
The manufacturer-specific SET UNIT TO BUS function is also not necessary.

11.6.4 Status of the TOTAL output value

The status of the Totalizer function block and the validity of the TOTAL output value are relayed to the downstream function blocks by means of the status of the TOTAL parameter group.

TOTAL:	The output value:
GOOD NON CASCADE	→ OUT is valid and can be used for further processing.
UNCERTAIN	→ OUT can only be used for further processing to a limited extent.
BAD	→ OUT is not valid.

✎ Note!
The BAD status value occurs when the Totalizer function block is switched to O/S (out-of-service) or in the event of serious errors (see status code and system/process error messages, Page 69).

11.6.5 Failsafe mode FAIL_TOT

If an input value has the status BAD, the Totalizer function block uses the failsafe mode defined in the FAILSAFE_MODE parameter. The FAILSAFE_MODE parameter offers the following options:

FAILSAFE TYPE:	Failsafe mode:
RUN	The totalizer continues to total despite the BAD input value.
HOLD	The totalizer stops; BAD input values are not totaled.
MEMORY	The totalizer continues to total with the last valid input value (not statused BAD).

✎ Note!
RUN is the factory setting for the FAILSAFE_TYPE parameter.

11.6.6 Selecting the totalizing mode MODE_TOT

Use the TOTALIZER_MODE parameter to define the direction in which the totalizer totals. The options are totaling only positive values, only negative values*, or all values (positive and negative*), or stop the totalizer. The totaled integral is formed in the Totalizer function block. For this, the totalizer needs a time reference that is called up equidistantly in time.

* The device cannot measure any negative flow.

MODE TOT:	Behavior:
BALANCED	→ Positive and negative measured values are totaled.
POS ONLY	→ Only positive values are totaled.
NEG ONLY *	→ * Only negative values are totaled.
HOLD	→ Totalizer is stopped

✎ Note!
In the factory setting, BALANCED is used in the MODE_TOT parameter.
* The device cannot measure any negative flow.

You will find information on integration into an automation system in the examples dealing with system integration and configuration on Page 51 ff.

11.6.7 Controlling the totalizer SET_TOT

Use the SET_TOTALIZER parameter to start totaling (TOTALIZE), to reset the totalizer to 0 (RESET) or set it to a preset value (PRESET).

SET TOTALIZER	Behavior:
TOTALIZE	→ Start the totalizer, total the input value.
RESET	→ Reset the totalizer to 0.
PRESET	→ The totalizer is set to the value defined in the PRESET_TOT parameter.

✎ Note!
- Note that selecting RESET or PRESET resets the totalizer to 0 or sets it to the preset value, respectively, but does not stop the totalizer. This means that it immediately recommences totaling from the new setting. If you want to stop the totalizer you must select HOLD in the MODE_TOT parameter.
- In the factory setting, TOTALIZE is used in the SET_TOT parameter.

You will find information on integration into an automation system in the examples dealing with system integration and configuration on Page 51 ff.

11.6.8 Limit values

You can set two warning limits and two alarm limits for monitoring your process. The status of the measured value and the parameters of the limit-value alarms are indicative of the measured value's relative situation. You also have the option of defining an alarm hysteresis in order to avoid frequent changes of the limit-value flags and frequent enabling/disabling of alarms.
The limit values are based on the TOTAL output value. If the TOTAL output value exceeds or undershoots the defined limit values, an alarm is sent to the automation system via the limit value process alarms.

The limit values "HI_HI_LIM", "HI_LIM", "LO_LO_LIM" and "LO_LIM" can be defined.

11.6.9 Alarm detection and processing

Limit value process alarms
The status of the limit value process alarms is made known to the automation system by means of the "HI_HI_ALM", "HI_ALM", "LO_LO_ALM" and "LO_ALM" parameters.

11.6.10 CHANNEL parameter

The CHANNEL parameter is used to specify which process variable should be used by the Analog Input function block. The following process variables are available:

Block	Process variable	CHANNEL parameter
TOTAL - totalizer function block 1 to 2	Volume flow	273
	Mass flow	277
	Corrected volume flow	398
	Calculated heat flow	116

✎ Note!
Assignment of totalizers 1 and 2, see Page 55.

11.7 Slot/Index lists

11.7.1 General explanatory remarks

Abbreviations used in the Slot/Index lists:
- See Page → The number of the page on which you will find the explanation of the parameter.

- Object Type:
  - Record → Contains data structures (DS)
  - Simple → Contains only single data types (e.g. float, integer, etc.)

- Para. (parameter):
  - M → Mandatory parameter
  - O → Optional parameter

- Data Types:
  - Boolean → True = 0xFF, false = 0x00
  - DS → Data structure, contains data types such as Unsigned8, OctetString, etc.
  - Float → IEEE 754 format
  - Integer → 8 (range of values –128 to 127), 16 (–327678 to 327678), 32 (-2^{31} to 2^{31})
  - Octet String → Binary coded
  - Unsigned → 8 (range of values 0 to 255), 16 (0 to 65535), 32 (0 to 4294967295)
  - Visible String → ISO 646, ISO 2375

- Storage Class:
  - Cst → Constant parameter
  - D → Dynamic parameter
  - N → Nonvolatile parameter
  - S → Static parameter

Physical Block, slot 0:

Parameter Physical Block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
Not used	–	0 to 15	–	–	–	–	–	–	–
BLOCK OBJECT	–	16	X	–	Record	M	DS-32	20	Cst
ST REV	–	17	X	–	Simple	M	Unsigned16	2	N
TAG DESC	–	18	X	X	Simple	M	Octet String	32	S
STRATEGY	–	19	X	X	Simple	M	Unsigned 16	2	S
ALERT KEY	–	20	X	X	Simple	M	Unsigned 8	1	S
TARGET MODE	–	21	X	X	Simple	M	Unsigned 8	1	S
MODE BLK	–	22	X	–	Record	M	DS-37	3	D
ALARM SUM	–	23	X	–	Record	M	DS-42	8	D
SOFTWARE REVISION	–	24	X	–	Simple	M	Octet String	16	Cst
HARDWARE REVISION	–	25	X	–	Simple	M	Octet String	16	Cst
DEVICE MAN ID	–	26	X	–	Simple	M	Unsigned 16	2	Cst
DEVICE ID	–	27	X	–	Simple	M	Octet String	16	Cst
DEVICE SER NUM	–	28	X	–	Simple	M	Octet String	16	Cst
DIAGNOSIS	–	29	X	–	Simple	M	Octet String	4	D
DIAGNOSIS EXT	–	30	X	–	Simple	O	Octet String	6	D
DIAGNOSIS MASK	–	31	X	–	Simple	M	Octet String	4	Cst
DIAGNOSIS MASK EXTENS	–	32	X	–	Simple	O	Octet String	6	Cst
DEVICE CERTIFICATION	–	33	X	–	Simple	O	Octet String	32	Cst
WRITE LOCKING	–	34	X	X	Simple	O	Unsigned 16	2	N
FACTORY RESET	–	35	X	X	Simple	O	Unsigned 16	2	S
DESCRIPTOR	–	36	X	X	Simple	O	Octet String	32	S
DEVICE MESSAGE	–	37	X	X	Simple	O	Octet String	32	S

Parameter Physical Block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
DEVICE INSTAL DATE	–	38	X	X	Simple	O	Octet String	16	S
Not used	–	39	–	–	–	–	–	–	–
IDENT NUMBER SELECTOR	–	40	X	X	Simple	O	Unsigned 8	1	S
HW WRITE PROTECTION	–	41	X	–	Simple	O	Unsigned 8	1	D
Not used	–	42 - 48	–	–	–	–	–	–	–
ACTUAL ERROR CODE	–	49	X	–	Simple	O	Unsigned 16	2	D
Not used	–	50	–	–	–	–	–	–	–
UPDOWN FEAT SUPP	–	51	X	–	Simple	M	Octet String	1	Cst
UPDOWN CONT PARA	–	52	X	X	Simple	O	Unsigned 8	1	D
UPDOWN PARA	–	53	X	X	Record	O	UpDowData	20	D
DEV BUS ADDR	–	54	X	–	Simple	O	Unsigned 8	1	D
Not used	–	55	–	–	–	–	–	–	–
SET UNIT TO BUS	–	56	X	X	Simple	O	Unsigned 8	1	N
Not used	–	57 - 64	–	–	–	–	–	–	–
VERSIONINFODEVICEPRODID	–	65	X	–	Simple	O	OctetString	16	N
VERSIONINFOAMPHWREV	–	66	X	–	Simple	O	OctetString	16	N
VERSIONINFOAMPHWID	–	67	X	–	Simple	O	OctetString	16	N
VERSIONINFOAMPSWREV	–	68	X	–	Simple	O	OctetString	16	N
VERSIONINFOAMPSWID	–	69	X	–	Simple	O	OctetString	16	N
VERSIONINFOAMPPRODID	–	70	X	–	Simple	O	OctetString	16	N
VERSIONINFOINPOUTPHWREV	–	71	X	–	Simple	O	OctetString	16	N
VERSIONINFOINPOUTPHWID	–	72	X	–	Simple	O	OctetString	16	N
VERSIONINFOINPOUTPSWREV		73	X	–	Simple	O	OctetString	16	N
VERSIONINFOINPOUTPSWID	–	74	X	–	Simple	O	OctetString	16	N
VERSIONINFOINPOUTPPRODID	–	75	X	–	Simple	O	OctetString	16	N
Not used	–	76 - 81	–	–	–	–	–	–	–
DEV BUS ADDR CONFIG	–	82	X	X	Simple	O	Unsigned 8	1	D
IDENTNUMBER	–	83	X	–	Simple	O	Unsigned 16	2	D
CHECK CFG	–	84	X	–	Simple	O	Unsigned 8	1	D
DEVICETYPESTORED	–	85	X	–	Simple	O	Unsigned 16	2	D
VIEW PHYSICAL BLOCK	–	86	X	X	Simple	M	Unsigned16,DS-37, DS-42, Octet String [4]	17	D
Not used	–	87 to 92	X	–	–	–	–	–	–
DEVICE SOFTWARE	–	93	X	–	Simple	O	OctetString	16	N
Not used	–	94 to 99	X	–	–	–	–	–	–
MAINTVORTEXMINTEMPFLUID	–	100	X	–	Simple	O	Float	4	D
MAINTVORTEXMAXTEMPFLUID	–	101	X	X	Simple	O	Float	4	D
MAINTVORTEXRESETTEMPFLUID	–	102	X	X	Simple	O	Unsigned 16	2	S
MAINTVORTEXWARNTEMPFLUID-LOW	–	103	X	X	Simple	O	Float	4	S
MAINTVORTEXWARNTEMPFLUID-HIGH	–	104	X	–	Simple	O	Float	4	S
MAINTVORTEXTEMPELECTR	–	105	X	–	Record	O	DS-33	5	D
MAINTVORTEXMINTEMPELECTR	–	106	X	–	Simple	O	Float	4	D
MAINTVORTEXMAXTEMPELECTR	–	107	X	–	Simple	O	Float	4	D
MAINTVORTEXRESETTEMPELECTR	–	108	X	X	Simple	O	Unsigned 16	2	S
MAINTVORTEXWARNTEMPELECTR-LOW	–	109	X	X	Simple	O	Float	4	S
MAINTVORTEXWARNTEMPELECTR-HIGH	–	110	X	X	Simple	O	Float	4	S
MAINTVORTEXSENSDIAG	–	111	X	X	Simple	O	Unsigned 16	2	S
MAINTVORTEXREYNOLDSNO	–	112	X	–	Record	O	DS-33	5	D

Parameter Physical Block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
MAINTVORTEXWARNREYNOLDS	–	113	X	X	Simple	O	Unsigned 16	2	S
MAINTVORTEXWARNVELOCITY	–	114	X	X	Simple	O	Unsigned 16	2	S
MAINTVORTEXVELOCITY	–	115	X	–	Record	O	DS-33	5	D
MAINTVORTEXFLUIDTEMPSTATUS	–	116	X	–	Simple	O	Unsigned 16	2	D
MAINTVORTEXELECTRTEMPSTATUS	–	117	X	–	Simple	O	Unsigned 16	2	D
MAINTVORTEXREYNOLDSSTATUS	–	118	X	–	Simple	O	Unsigned 16	2	D
MAINTVORTEXVELOCITYSTATUS	–	119	X	–	Simple	O	Unsigned 16	2	D
MAINTVORTEXSENSORSTATUS	–	120	X	–	Simple	O	Unsigned 16	2	D
Not used	–	121 to 129	–	–	–	–	–	–	–
PRESSURE	–	130	X	–	Record	O	DS-33	5	D
PRESSURE UNIT	–	131	X	X	Simple	O	Unsigned 16	2	N
HEATFLOW	–	132	X	–	Record	O	DS-33	5	D
HEATFLOW UNIT	–	133	X	X	Simple	O	Unsigned 16	2	N
SPECENTHALPY	–	134	X	–	Record	O	DS-33	5	D
SPECENTHALPY UNIT	–	135	X	X	Simple	O	Unsigned 16	2	N
CALCSATPRESS	–	136	X	–	Record	O	DS-33	5	D
SELECTFLUID	–	137	X	X	Simple	O	Unsigned 16	2	N
DRYNESSFRACTION	–	138	X	X	Simple	O	Float	4	S
EXPCOEFF	–	139	X	X	Simple	O	Float	4	S
OPNZFACTOR	–	140	X	X	Simple	O	Float	4	S
REFDENSITY	–	141	X	X	Simple	O	Float	4	S
REFPRESSURE	–	142	X	X	Simple	O	Float	4	S
REFERENCETEMP	–	143	X	X	Simple	O	Float	4	S
REFZFACTOR	–	144	X	X	Simple	O	Float	4	S
MOL P N2	–	145	X	X	Simple	O	Float	4	S
MOL P CO2	–	146	X	X	Simple	O	Float	4	S
PB_WET_STEAM_ALARM	132	147	X	X	Simple	O	Unsigned 16	2	S
PB_ SAT_STEAM_CALC	132	148	X	X	Simple	O	Unsigned 16	2	S
PB_WARN_VELOCITY	122	149	X	X	Simple	O	Unsigned 16	2	S
PB_SET_MAX_VELOCITY	122	150	X	X	Simple	O	Float	4	S
PB_REFERENCEDENSITY	133	151	X	–	Simple	O	Float	4	N
Not used	–	152 to 199	–	–	–	–	–	–	–
ERROR_TEMP_VALUE	–	200	X	X	Simple	O	Float	4	S
DENSITY VALUE	–	201	X	X	Simple	O	Float	4	S
Z FACTOR	–	202	X	–	Record	O	DS-33	5	D
TEMPERATURE VALUE	–	203	X	X	Simple	O	Float	4	S
SPEC GRAVITY	–	204	X	–	Simple	O	Float	4	S
Not used	–	205 to 219	–	–	–	–	–	–	–

Device Management, slot 1:

Parameter Device Management	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
Directory Header/ Composite Directory Entries	–	0	X	–	Record	M	Unsigned 16	12	Cst
Composite Directory Entry/ Composite Directory Entries	–	1	X	–	Record	M	Unsigned 16	28	Cst
Not used	–	2 to 15	–	–	–	–	–	–	–

Analog Input function block (1 to 4), slot 1/2/3/4:

Parameter Analog Input function block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
BLOCK OBJECT	–	16	X	–	Record	M	DS-32	20	Cst

Parameter Analog Input function block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
ST REV	–	17	X	–	Simple	M	Unsigned16	2	N
TAG DESC	–	18	X	X	Simple	M	Octet String	32	S
STRATEGY	–	19	X	X	Simple	M	Unsigned 16	2	S
ALERT KEY	–	20	X	X	Simple	M	Unsigned 8	1	S
TARGET MODE	–	21	X	X	Simple	M	Unsigned 8	1	S
MODE BLK	–	22	X	–	Record	M	DS-37	3	D
ALARM SUM	–	23	X	–	Record	M	DS-42	8	D
BATCH	–	24	X	X	Record	M	DS-67	10	S
Not used	–	25	–	–	–	–	–	–	–
OUT	–	26	X	–	Record	M	DS-33	5	D
PV SCALE	–	27	X	X	Array	M	Float	8	S
OUT SCALE	–	28	X	X	Record	M	DS-36	11	S
LIN TYPE	–	29	X	X	Simple	M	Unsigned 8	1	S
CHANNEL	–	30	X	X	Simple	M	Unsigned 16	2	S
Not used	–	31	–	–	–	–	–	–	–
PV TIME	–	32	X	X	Simple	M	Float	4	S
FSAFE TYPE	–	33	X	X	Simple	O	Unsigned 8	1	S
FSAVE VALUE	–	34	X	X	Simple	O	Float	4	S
ALARM HSY	–	35	X	X	Simple	M	Float	4	S
Not used	–	36	–	–	–	–	–	–	–
HI HI LIM	–	37	X	X	Simple	M	Float	4	S
Not used	–	38	–	–	–	–	–	–	–
HI LIM	–	39	X	X	Simple	M	Float	4	S
Not used	–	40	–	–	–	–	–	–	–
LO LIM	–	41	X	X	Simple	M	Float	4	S
Not used	–	42	–	–	–	–	–	–	–
LO LO LIM	–	43	X	X	Simple	M	Float	4	S
Not used	–	44 to 45	–	–	–	–	–	–	–
HI HI ALM	–	46	X	–	Record	O	DS-39	16	D
HI ALM	–	47	X	–	Record	O	DS-39	16	D
LO ALM	–	48	X	–	Record	O	DS-39	16	D
LO LO ALM	–	49	X	–	Record	O	DS-39	16	D
SIMULATE	–	50	X	X	Record	O	DS-50	6	S
OUT UNIT TEXT	–	51	X	X	Simple	O	Octet String	16	S
Not used	–	52 to 64	–	–	–	–	–	–	–
VIEW AI1 (2 to 4)	–	65	X	–	Record	M	Unsigned16,DS-37, DS-42, DS-33	18	D
Not used	–	66 to 69	–	–	–	–	–	–	–

Transducer Block, slot 1:

Parameter Transducer Block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
BLOCK OBJECT	–	70	X	–	Record	M	DS-32	20	Cst
ST REV	–	71	X	–	Simple	M	Unsigned16	2	N
TAG DESC	–	72	X	X	Simple	M	Octet String	32	S
STRATEGY	–	73	X	X	Simple	M	Unsigned 16	2	S
ALERT KEY	–	74	X	X	Simple	M	Unsigned 8	1	S
TARGET MODE	–	75	X	X	Simple	M	Unsigned 8	1	S
MODE BLK	–	76	X	–	Record	M	DS-37	3	D
ALARM SUM	–	77	X	–	Record	M	DS-42	8	D
CALIBR FACTOR	–	78	X	X	Simple	M	Float	4	S

Parameter Transducer Block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
LOW FLOW CUTOFF	121	79	X	X	Simple	M	Float	4	S
MEASUREMENT MODE	–	80	X	X	Simple	M	Unsigned 8	1	S
FLOW DIRECTION	–	81	X	X	Simple	M	Unsigned 8	1	S
ZERO POINT	–	82	X	X	Simple	M	Float	4	S
ZERO POINT ADJUST	–	83	X	X	Simple	M	Unsigned 8	1	N
ZERO POINT UNIT	–	84	X	X	Simple	M	Unsigned 16	2	S
NOMINAL SIZE	–	85	X	X	Simple	M	Float	4	S
NOMINAL SIZE UNIT	–	86	X	X	Simple	M	Unsigned 16	2	S
VOLUME FLOW	100	87	X	–	Record	M	DS-33	5	D
VOLUME FLOW UNITS	103	88	X	X	Simple	M	Unsigned 16	2	S
VOLUME FLOW LO LIMIT	–	89	X	X	Simple	M	Float	4	S
VOLUME FLOW HI LIMIT	–	90	X	X	Simple	M	Float	4	S
MASS FLOW	100	91	X	–	Record	O	DS-33	5	D
MASS FLOW UNITS	104	92	X	X	Simple	O	Unsigned 16	2	S
MASS FLOW LO LIMIT	–	93	X	X	Simple	O	Float	4	S
MASS FLOW HI LIMIT	–	94	X	X	Simple	O	Float	4	S
DENSITY	101	95	X	–	Record	O	DS-33	5	D
DENSITY UNITS	104	96	X	X	Simple	O	Unsigned 16	2	S
DENSITY LO LIMIT	–	97	X	X	Simple	M	Float	4	S
DENSITY HI LIMIT	–	98	X	X	Simple	M	Float	4	S
TEMP	100	99	X	–	Record	O	DS-33	5	D
TEMPERATURE UNITS	103	100	X	X	Simple	O	Unsigned 16	2	S
TEMPERATURE LO LIMIT	–	101	X	X	Simple	M	Float	4	S
TEMPERATURE HI LIMIT	–	102	X	X	Simple	M	Float	4	S
VORTEX FREQ	101	103	X	–	Record	M	DS-33	5	D
VORTEX FREQ UNITS	105	104	X	X	Simple	M	Unsigned 16	2	S
VORTEX FREQ LO LIMIT	–	105	X	X	Simple	M	Float	4	S
VORTEX FREQ HI LIMIT	–	106	X	X	Simple	M	Float	4	S
Not used	–	107 to 126	–	–	–	–	–	–	–
SYSUNITARBITRARYVOL	–	127	X	X	Simple	O	Octet String	16	N
SYSUNITARBITRARYVOLFACTOR	–	128	X	X	Simple	O	Float	4	N
HMILANGUAGE	106	129	X	X	Simple	O	Unsigned 16	2	N
HMIACCESSCODE	106	130	X	X	Simple	O	Float	4	N
HMIPRIVATECODE	106	131	X	X	Simple	O	Float	4	N
HMISTATELOCKING	106	132	X	X	Simple	O	Unsigned 16	2	N
HMIASSIGNLINE	107	133	X	X	Simple	O	Unsigned 16	2	N
HMIASSIGNLINE2	109	134	X	X	Simple	O	Unsigned 16	2	N
HMIHUNDREDPERCENTVAL	–	135	X	X	Simple	O	Float	4	N
HMIFORMAT	111	111	X	X	Simple	O	Unsigned 16	2	N
HMIDAMPING	111	111	X	X	Simple	O	Float	4	N
HMILCDCONTRAST	111	111	X	X	Simple	O	Float	4	N
HMITST	111	111							
Not used	–	140 to 143	–	–	–	–	–	–	–
PROCPARAMATINGPIPE	116	144	X	X	Simple	O	Float	4	N
PROCPARAASSIGNLOWFLOW	121	145	X	X	Simple	O	Unsigned 16	2	N
PROCPARALOWFLOWCUTONVAL	121	146	X	X	Simple	O	Float	4	N
PROCPARALOWFLOWCUTHYST	122	147	X	X	Simple	O	Unsigned 16	2	N
SYSPARAPOSITIVEZERORETURN	–	148	X	X	Simple	O	Unsigned 16	2	N
SYSPARAFLOWDAMPING	124	149	X	X	Simple	O	Float	4	N
SENSVORTEXPARACALFACTOR	123	150	X	X	Simple	O	Float	4	N
SENSVORTEXPARACOMPENSATED-CALF	123	151	X	X	Simple	O	Float	4	N
SENSVORTEXPARASENSORBODYTYPE	123	152	X	X	Simple	O	Float	4	N

Parameter Transducer Block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
SENSVORTEXPARACALIBDIAMETER	123	153	X	X	Simple	O	Float	4	N
SENSVORTEXPARAMATERIALTEMP-COEFF	123	154	X	X	Simple	O	Float	4	N
SENSVORTEXPARAAMPLIFIERDAMP-ING	–	155	X	X	Simple	O	Float	4	N
SENSVORTEXPARAFILTERLOWPASS-VALFREQ	–	156	X	X	Simple	O	Float	4	N
SENSVORTEXPARAFILTERHIGHPASS-VALFREQ	–	157	X	X	Simple	O	Float	4	N
SUPERVISIONPRESENTSYSCONDITION	125	158	X	–	Simple	O	Unsigned 16	2	N
SUPERVISIONPREVIOUSSYSCONDI-TION	125	159	X	–	Simple	O	Unsigned 16	2	N
SUPERVISIONASSIGNSYSERROR	–	160	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONCATEGORYSYSERROR	–	161	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONASSIGNPROCERROR	–	162	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONCATEGORYPROCERROR	–	163	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONALARMDELAY	125	164	X	X	Simple	O	Float	4	N
SUPERVISIONRST	126	165	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONRSTFCTBLOCKFAILURE	–	166	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONOPERATIONHOURS	126	167	X	–	Simple	O	Float	4	N
SUPERVISIONOPERATIONHOURS-SINCERESET	–	168	X	–	Simple	O	Float	4	N
SUPERVISIONSIMFAILSAFEMODE	127	169	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONSIMMEASVAR	127	170	X	X	Simple	O	Unsigned 16	2	N
SUPERVISIONSIMVAL	127	171	X	X	Simple	O	Float	4	N
VERSIONINFOSENSTYPE	127	172	X	X	Simple	O	Octet String	16	N
VERSIONINFODSCSENSNR	127	173	X	X	Simple	O	Octet String	16	N
Not used	–	140 to 206	–	–	–	–	–	–	–
MEASVARFLOWVELOCITY	122	207	X	–	Simple	O	Float	4	N
Not used	–	208 to 210	–	–	–	–	–	–	–
STDVOLFLOW	100	211	X	–	Simple	O	DS-33	4	N
Not used	–	212	–	–	–	–	–	–	–
STDVOLFLOW UNIT	104	213	X	X	Simple	O	Unsigned 16	2	N
Not used	–	214 to 219	–	–	–	–	–	–	–
VIEW TRANSDUCER BLOCK	–	220	X	–	Simple	M	Unsigned16,DS-37, DS-42, DS-33	23	D
Not used	–	221 to 223	–	–	–	–	–	–	–
HMIZEROPERCENTVALLINE1	108	224	X	X	Simple	O	Float	4	N
HMIHUNDREDPERCENTVALLINE1	108	225	X	X	Simple	O	Float	4	N
HMIZEROPERCENTVALLINE2	108	226	X	X	Simple	O	Float	4	N
HMIHUNDREDPERCENTVALLINE2	110	227	X	X	Simple	O	Float	4	N
HMIACCESCODECNTR	106	228	X	–	Simple	O	Float	4	D
HMIACTIVATENX19	107	229	X	X	Simple	O	Unsigned 32	4	N
HMIACTIVATEADVDIAG	107	230	X	X	Simple	O	Unsigned 32	4	N
Not used	–	231	–	–	–	–	–	–	–
SYSUNITDYNVISC	–	232	X	X	Simple	O	Unsigned 16	2	N
SYSUNITKINVISC	–	233	X	X	Simple	O	Unsigned 16	2	N
SYSUNITTHCONDUCT	–	234	X	X	Simple	O	Unsigned 16	2	N

Totalizer function block (1 to 2), slot 5/6:

Parameter Totalizer function block	see Page	Index	read	write	Object Type	Para.	Data Type	Byte Size	Storage Class
Not used	–	0 to 15	–	–	–	–	–	–	–
BLOCK OBJECT	–	16	X	–	Record	M	DS-32	20	Cst
ST REV	–	17	X	–	Simple	M	Unsigned16	2	N
TAG DESC	–	18	X	X	Simple	M	Octet String	32	S
STRATEGY	–	19	X	X	Simple	M	Unsigned 16	2	S
ALERT KEY	–	20	X	X	Simple	M	Unsigned 8	1	S
TARGET MODE	–	21	X	X	Simple	M	Unsigned 8	1	S
MODE BLK	–	22	X	–	Record	M	DS-37	3	D
ALARM SUM	–	23	X	–	Record	M	DS-42	8	D
BATCH	–	24	X	X	Record	M	DS-67	10	S
Not used	–	25	–	–	–	–	–	–	–
TOTAL	–	26	X	–	Record	M	DS-33	5	N
UNIT TOT	–	27	X	X	Simple	M	Unsigned 16	2	S
CHANNEL	–	28	X	X	Simple	M	Unsigned 16	2	S
SET TOT	–	29	X	X	Simple	M	Unsigned 8	1	N
MODE TOT	–	30	X	X	Simple	M	Unsigned 8	1	N
FAIL TOT	–	31	X	X	Simple	M	Unsigned 8	1	S
PRESET TOT	–	32	X	X	Simple	M	Float	4	S
ALARM HYST	–	33	X	X	Simple	M	Float	4	S
HI HI LIM	–	34	X	X	Simple	M	Float	4	S
HI LIM	–	35	X	X	Simple	M	Float	4	S
LO LIM	–	36	X	X	Simple	M	Float	4	S
LO LO LIM	–	37	X	X	Simple	M	Float	4	S
HI HI ALM	–	38	X	–	Record	M	DS-39	16	D
HI ALM	–	39	X	–	Record	M	DS-39	16	D
LO ALM	–	40	X	–	Record	M	DS-39	16	D
LO LO ALM	–	41	X	–	Record	M	DS-39	16	D
Not used	–	42 to 64	–	–	–	–	–	–	–
VIEW TOT1 (2)	–	65	X	–	Record	M	Unsigned16,DS-37, DS-42, DS-33	18	D
Not used	–	66 to 68	–	–	–	–	–	–	–

11.8 Factory settings

11.8.1 SI units (not for USA and Canada)

Flow units (see Page 103 ff.)

Flow	Units factory setting	Units Profile version 3.0
Volume flow	m^3/h	m^3/h
Mass flow	kg/h	kg/s
Corrected volume flow	Nm^3/h	Nm^3/h
Heat flow	kW	kJ/h

Other units (see Page 104 ff.)

	Units factory setting	Units Profile version 3.0
Density	kg/m^3	kg/l
Length	mm	mm
Temperature	°C	K
Specific enthalpy	kWh/kg	kJ/kg
Specific thermal capacity	kWh / (kg · K)	W/mK
Pressure	bara	bar

Totalizer unit (see Page 120 ff.)

Flow	Unit
Volume flow	m^3
Mass flow	kg
Corrected volume flow	Nm^3
Heat flow	kW

Language (see Page 106)

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	Ceski
Luxembourg	Francais	Hungary	English
Malaysia	English	Other countries	English

11.8.2 US units (only for USA and Canada)

Flow unit (see Page 103 ff.)

Flow	Units factory setting	Units Profile version 3.0
Volume flow	US gal/h	m^3/h
Calculated mass flow	lb/min	kg/s
Corrected volume flow	Sm^3/h	Nm^3/h
Heat flow	tons	kJ/h

Density, length, temperature units (see Page 104 ff.)

	Units factory setting	Units Profile version 3.0
Density	lb/ft^3	kg/l
Length	Inch	mm
Temperature	°F	K
Specific enthalpy	Btu/lb	kJ/kg
Specific thermal capacity	Btu / (lb · °F)	W/mK
Pressure	psia	bar

Language (see Page 106)

Country	Language
USA	English
Canada	English

Totalizer unit (see Page 120 ff.)y

Flow	Unit
Volume flow	US gal
Calculated mass flow	lb
Corrected volume flow	Sm^3
Heat flow	tons

Index

T

V

W

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*

www.endress.com/worldwide

Endress+Hauser

People for Process Automation

BA00093D/06/EN/13.11
71154515
FM+SGML 9.0