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Technical Information

# Proline Prowirl 72F, 72W, 73F, 73W

## Vortex Flow Measuring System
## Reliable flow measurement of gas, steam and liquids

**Application**

For the universal measurement of the volume flow of gases, steam and liquids.
With integrated T-measurement, the mass flow of steam, water (as per IAPWS-IF97 ASME), natural gas (as per AGA NX-19), compressed air and other gases and liquids can be measured.

Maximum range of applications thanks to:
- Fluid temperature range from –200...+400 °C
- Pressure ratings up to PN250/Cl 1500

Approvals for hazardous areas:
- ATEX, FM, CSA, TIIS

Connection to all common process control systems:
- HART, PROFIBUS PA, FOUNDATION Fieldbus

Relevant safety aspects:
- Pressure Equipment Directive
- Up to SIL 2

**Your benefits**

The robust **Prowirl sensor**, tried and tested in over 100,000 applications offers:
- High resistance to:
  – Vibrations (over 1 g in all axes)
  – Temperature shocks (> 150 K/s)
  – Contaminated media
  – Water hammer
- No maintenance, no moving parts, no zero-point drift.
- Software initial settings save time and costs

In addition, Prowirl devices offer the following possibilities:
- Complete saturated steam or liquid-mass measuring point in one single device
- Calculation of the mass flow from the measured variables volume flow and temperature in the integrated flow computer
- External pressure value read-in for superheated steam and gas applications (optional)
- External temperature value read-in for delta heat measurement (optional)

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Endress+Hauser
People for Process Automation

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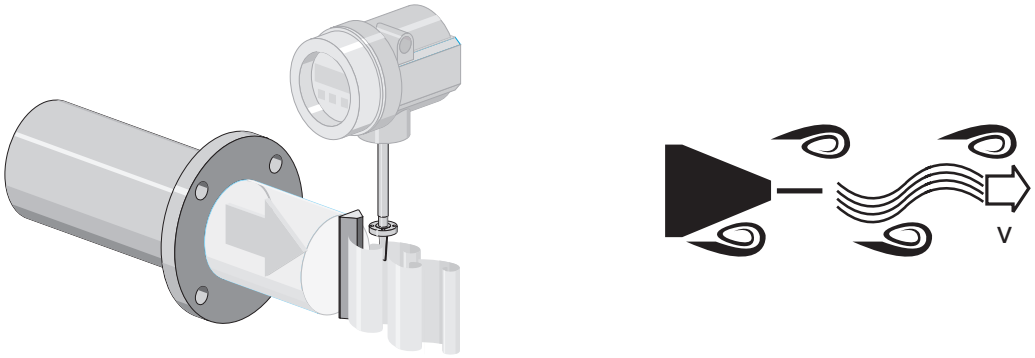
# Function and system design

**Measuring principle**

Vortex meters work on the principle of the Karman vortex street. When luid flows past a bluff body, vortices are alternately formed on both sides with opposite directions of rotation. These vortices each generate a local low pressure. The pressure fluctuations are recorded by the sensor and converted to electrical pulses.
The vortices develop very regularly within the permitted application limits of the device.
Therefore, the frequency of vortex shedding is proportional to the volume flow.

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The K-factor is used as the proportional constant:

$$\text{K-Factor} = \frac{\text{Pulses}}{\text{Unit Volume } [\text{dm}^3]}$$

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Within the application limits of the device, the K-factor only depends on the geometry of the device. It is independent of the fluid velocity and the fluid properties viscosity and density. In this way, the K-factor is also independent of the type of matter that is to be measured, regardless of whether this is steam, gas or liquid.
The primary measuring signal is already digital (frequency signal) and linear to the flow.
After production, the K-factor is determined in the factory by means of calibration and is not subject to long-time or zero-point drift.
The device does not contain any moving parts and does not require maintenance.

**The capacitive sensor**

The sensor of a vortex flowmeter has a major influence on the ability, robustness and reliability of the whole measuring system.

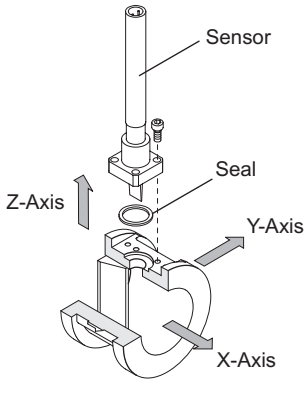
The robust DSC sensor – with an integrated temperature sensor (Pt 1000) with Prowirl 73 – is burst-tested and vibration and temperature-shock-tested (temperature shocks of 150 K/s).

The Prowirl uses the tried-and-tested capacitive measuring technology of Endress+Hauser applied in over 100,000 vortex measuring points worldwide.

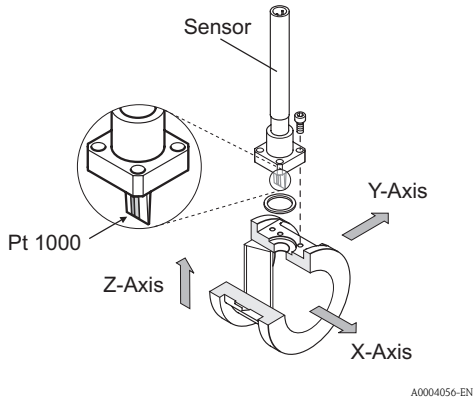
The DSC sensor (Differential Switched Capacitance) patented by Endress+Hauser has complete mechanical balancing. It only reacts to the measured variable (vortex), not to vibrations. Even in the event of pipe vibrations, the smallest of flows can be reliably measured at low density thanks to the unimpaired sensitivity of the sensor.

Thus, the wide turndown is also maintained even in the event of harsh operating conditions. Vibrations up to 1 g, in frequencies up to 500 Hz in every axis (X, Y, Z), do not affect the flow measurement.

Thanks to its design, the capacitive sensor is also particularly mechanically resistant to temperature shocks and water hammer in steam lines.




*DSC sensor, Prowirl 72*




*DSC sensor, Prowirl 73 with integrated thermometer (Pt 1000)*

**Temperature measurement (Prowirl 73)**

In addition to the volume flow, the measuring device also measures the fluid temperature.
The temperature is measured by means of a Pt 1000 temperature sensor which is located in the paddle of the DSC sensor, i.e. directly in the fluid (Fig. Pt 1000).

**Flow computer (Prowirl 73)**

The electronics of the measuring device have an integral flow computer. With the aid of this flow computer other process variables can be calculated from the primary measured variables (volume flow and temperature), e.g.:

- The mass flow and heat flow of saturated steam and water in accordance with IAPWS-IF97/ASME
- The mass flow and heat flow of superheated steam (at constant pressure or pressure read in via HART/ PROFIBUS PA/FOUNDATION Fieldbus) in accordance with IAPWS-IF97/ASME
- The mass flow and corrected volume flow of other gases (at a constant pressure or pressure read in via HART/PROFIBUS PA/FOUNDATION Fieldbus, e.g. compressed air or optional natural gas AGA NX-19)
- The mass flow of any liquid (linear equation)
- Delta heat between saturated steam and condensate (second temperature read in via HART) in accordance with IAPWS-IF97/ASME
- Delta heat between warm water and cold water (second temperature read in via HART) in accordance with IAPWS-IF97/ASME
- In saturated steam measurements, the pressure of the steam can also be calculated from the measured temperature and output in accordance with IAPWS-IF97/ASME

**Diagnostic options (Prowirl 73)**

Extensive diagnostic options, such as retracing fluid and ambient temperatures, extreme flows etc., are also optionally available for the measuring device.

**Measuring system**

The measuring system comprises a sensor and a transmitter.
Two versions are available:
- Compact version: sensor and transmitter form a mechanical unit.
- Remote version: sensor is mounted separate from the transmitter.

Sensor
- Prowirl F (flanged version)
- Prowirl W (wafer version)

Transmitter
- Prowirl 72
- Prowirl 73

# Input

**Measured variable**

**Prowirl 72**

- Volumetric flow (volume flow) is proportional to the frequency of vortex shedding after the bluff body.
- The volume flow or, if process conditions are constant, the mass flow or corrected volume flow can be output as the output variables.

**Prowirl 73**

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

**Measuring range**

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

**Start of measuring range**

Depends on the density and the Reynolds number ($Re_{min}$ = 4,000, $Re_{linear}$ = 20,000).
The Reynolds number is dimensionless and is the ratio of inertial forces to viscous forces of the fluid. It is used for characterizing the flow. The Reynolds number is calculated as follows:

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

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*Re = Reynolds number; Q = flow; di = internal diameter; m = dynamic viscosity, r = density*

$$\text{DN 15...25} \rightarrow v_{min.} = \frac{6}{\sqrt{\rho\,[kg/m^3]}}\,[m/s] \qquad \text{DN 40...300} \rightarrow v_{min.} = \frac{7}{\sqrt{\rho\,[kg/m^3]}}\,[m/s]$$

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**Full scale value**

- Gas/steam: $v_{max}$ = 75 m/s (DN 15: $v_{max}$ = 46 m/s)
- Liquids: $v_{max}$ = 9 m/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.

### Measuring range for gases [m³/h or Nm³/h]

In the case of gases, the start of the measuring range depends on the density. With ideal gases, the density [ρ] or corrected density [$\rho_N$] can be calculated using the following formulae:

$$\rho\ [kg/m^3] = \frac{\rho_N[kg/Nm^3] \cdot P\ [bar\ abs] \cdot 273.15\ [K]}{T\ [K] \cdot 1.013\ [bar\ abs]} \qquad \rho_N[kg/Nm^3] = \frac{\rho\ [kg/m^3] \cdot T\ [K] \cdot 1.013\ [bar\ abs]}{P\ [bar\ abs] \cdot 273.15\ [K]}$$

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The following formulae can be used to calculate the volume [Q] or corrected volume [$Q_N$] in the case of ideal gases:

$$Q\ [m^3/h] = \frac{Q_N[Nm^3/h] \cdot T\ [K] \cdot 1.013\ [bar\ abs]}{P\ [bar\ abs] \cdot 273.15\ [K]} \qquad Q_N[Nm^3/h] = \frac{Q\ [m^3/h] \cdot P\ [bar\ abs] \cdot 273.15\ [K]}{T\ [K] \cdot 1.013\ [bar\ abs]}$$

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*T = Operating temperature, P = operating pressure*

# Output

### Prowirl 72

By means of the outputs in the 4...20mA/HART version of Prowirl 72, the volume flow and, if process conditions are constant, the calculated mass flow and corrected volume flow can be output via the current output and optionally via the pulse output or as a limit value via the status output.

### Prowirl 73

By means of the outputs in the 4...20mA/HART version of Prowirl 73, the following measured variables can generally be output:

| | Current output | Frequency output | Pulse output | Status output |
|---|---|---|---|---|
| **Volume flow** | If configured | If configured | If configured | Limit value* |
| **Temperature** | If configured | If configured | – | Limit value |
| **Mass flow** | If configured | If configured | If configured | Limit value* |
| **Corrected volume flow** | If configured | If configured | If configured | Limit value* |
| **Heat flow (performance)** | If configured | If configured | If configured | Limit value* |
| **Saturation steam pressure (only for saturated steam)** | If configured | If configured | If configured | Limit value* |
| **Operating pressure (if read in externally)** | If configured | If configured | If configured | Limit value* |
| * Limit value for flow or totalizer | | | | |

If configured, the calculated measured variables density, specific enthalpy, saturation steam pressure (for saturated steam), Z-factor and flow velocity can also be shown on the local display for Prowirl 73.

**Output signal**

**Prowirl 72**

*Current output:*

- 4...20 mA with HART,
- Full scale value and time constant (0...100 s) can be set

*Pulse/status output:*

- Open collector, passive, galvanically isolated
  - Non-Ex, Ex d version:
    $U_{max}$ = 36 V, with 15 mA current limiting, $R_i$ = 500 Ω
  - Ex i and Ex n version:
    $U_{max}$ = 30 V, with 15 mA current limiting, $R_i$ = 500 Ω

The pulse/status output can be configured as:

- Pulse output:
  - Pulse value and polarity can be selected (5...2,000 ms)
  - Pulse width can be configured (0.005...2s)
  - Pulse frequency max. 100 Hz
- Status output:
  Can be configured for error messages or flow limit values
- Vortex frequency:
  - Direct output of unscaled vortex pulses 0.5...2,850 Hz
    (e.g. for connecting to an RMC 621 flow computer)
  - Pulse ratio 1:1

*PROFIBUS PA interface:*

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption = 16 mA
- Error current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 1 x Analog Input, 1 x totalizer
- Output data: volume flow, calculated mass flow, corrected volume flow, totalizer
- Input data: positive zero return (ON/OFF), totalizer control
- Bus address can be set at the device via DIP switches

*FOUNDATION Fieldbus interface:*

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Current consumption = 16 mA
- Error current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 2 x Analog Input, 1 x Discrete Output
- Output data: volume flow, calculated mass flow, corrected volume flow, totalizer
- Input data: positive zero return (ON/OFF), totalizer reset
- Link Master (LM) functionality is supported

**Prowirl 73**

*Current output:*

- 4...20 mA with HART,
- Full scale value and time constant (0...100 s) can be set

*Frequency output, pulse/status output:*

- Frequency output (optional): open collector, passive, galvanically isolated
  - Non-Ex, Ex d version:
    $U_{max}$ = 36 V, with 15 mA current limiting, $R_i$ = 500 Ω
  - Ex i and Ex n version:
    $U_{max}$ = 30 V, with 15 mA current limiting, $R_i$ = 500 Ω

The pulse/status output can be configured as:

- Frequency output:
  - End frequency 0...1,000 Hz (fmax = 1,250 Hz)
- Pulse output:
  - Pulse value and polarity can be selected (5...2,000 ms)
  - Pulse width can be configured (0.005...2s)
  - Pulse frequency max. 100 Hz
- Status output:
  Can be configured for error messages or flow values, temperature values, pressure limit values
- Vortex frequency:
  - Direct output of unscaled vortex pulses 0.5...2,850 Hz
    (e.g. for connecting to an RMC 621 flow computer)
  - Pulse ratio 1:1

*PROFIBUS PA interface:*

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption = 16 mA
- Error current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 4 x Analog Input, 2 x totalizer
- Output data: volume flow, mass flow, corrected volume flow, heat flow, temperature, density, specific enthalpy, calculated steam pressure (saturated steam), operating Z-factor, vortex frequency, electronics temperature, Reynolds number, velocity, totalizer
- Input data: positive zero return (ON/OFF), totalizer control, pressure, display value
- Bus address can be set at the device via DIP switches

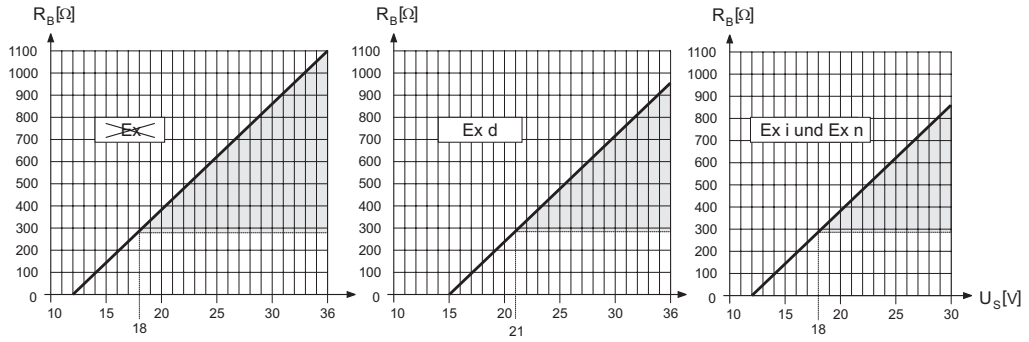
*FOUNDATION Fieldbus interface:*

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Current consumption = 16 mA
- Error current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 6 x Analog Input, 1 x Discrete Output, 1 x Analog Output
- Output data: volume flow, mass flow, corrected volume flow, heat flow, temperature, density, specific enthalpy, calculated steam pressure (saturated steam), operating Z-factor, vortex frequency, electronics temperature, Reynolds number, velocity, totalizer 1 + 2
- Input data: positive zero return (ON/OFF), totalizer reset, pressure
- Link Master (LM) functionality is supported

**Signal on alarm**

- Current output: error response can be selected (e.g. in accordance with NAMUR Recommendation NE 43)
- Pulse output: error response can be selected
- Status output: "not conducting" in event of fault (open circuit)

**Load**

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*The area shaded gray refers to the permitted load (for HART: min. 250 Ω)*
*The load is calculated as follows:*

$$R_B = \frac{(U_S - U_{KL})}{(I_{max} - 10^{-3})} = \frac{(U_S - U_{KL})}{0.022}$$

$R_B$ *Load, load resistance*
$U_S$ *Supply voltage: non-Ex = 12...36 V DC; Ex d = 15...36 V DC; Ex i and Ex n = 12...30 V DC*
$U_{KL}$ *Terminal voltage: non-Ex = min. 12 V DC; Ex d = min. 15 V DC; Ex i and Ex n = min. 12 V DC*
$I_{max}$ *Output current (22.6 mA)*

**Low flow cut off**

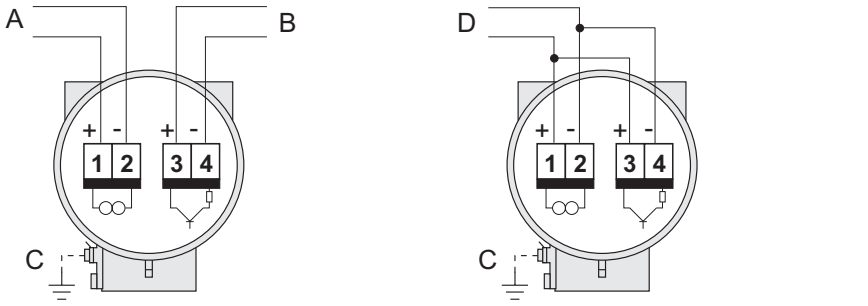
Switch points for low flow cut off can be selected as required

**Galvanic isolation**

All electrical connections are galvanically isolated from one another.

# Power supply

**Electrical connection**




*A – HART: power supply, current output*
*– PROFIBUS PA: 1 = PA+, 2 = PA–*
*– FOUNDATION Fieldbus: 1 = FF+, 2 = FF–*

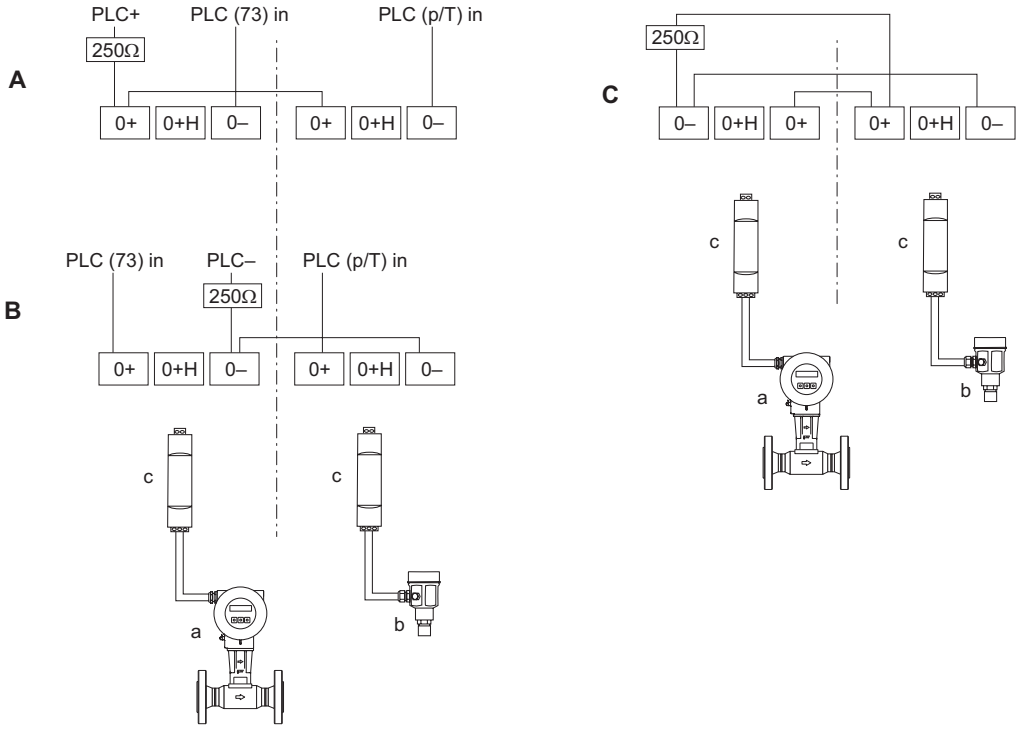
*B Optional frequency output (not for PROFIBUS PA and FOUNDATION Fieldbus), can also be operated as:*
*- Pulse or status output*
*- Only Prowirl 73: as a PFM output (pulse/frequency modulation) together with an RMC or RMS 621 flow computer*

*C Ground terminal (relevant for remote version)*

*D Only Prowirl 72: PFM (pulse-frequency modulation) wiring*

**Wiring when using the HART input**

Process for reading in pressure, temperature or density with Prowirl 73:




*A Process control system with common "plus"*

*B Process control system with common "minus"*

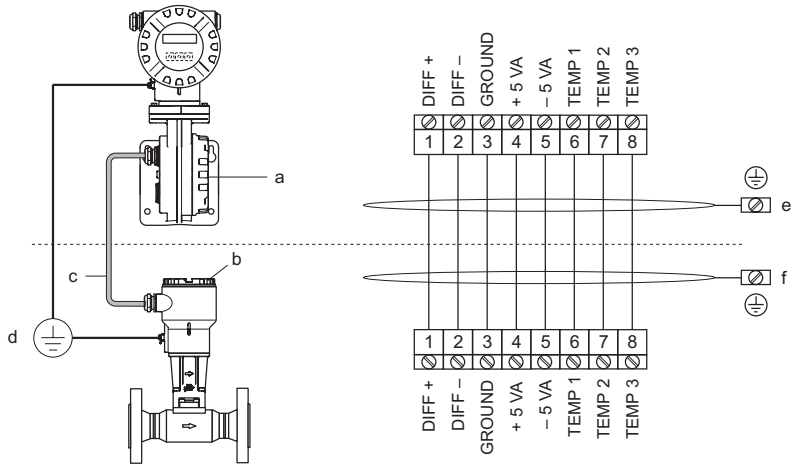
*C Connection diagram without process control system*

*a Prowirl 73*
*b Cerabar-M or other HART-enabled* **and** *burst-enabled pressure, temperature or density transmitter*
*c Active barrier preline RN221N*

**Wiring (remote version)**

Note!

- The remote version must be grounded. In doing so, the sensor and transmitter must be connected to the same potential matching system.

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*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 ground terminal in connection housing*

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

**Supply voltage**

*HART:*

- Non-Ex: 12...36 V DC (18...36 V DC)
- Ex i and Ex n: 12...30 V DC (18...30 V DC)
- Ex d: 15...36 V DC (21...36 V DC)

*PROFIBUS PA and FOUNDATION Fieldbus:*

- Non-Ex: 9...32 V DC
- Ex i and Ex n: 9...24 V DC
- Ex d: 9...32 V DC
- Current consumption → PROFIBUS PA: 16 mA, FOUNDATION Fieldbus: 16 mA

**Cable entry**

Power supply and signal cables (outputs):

- Cable entry M20 x 1.5 (8...11.5 mm)
- Thread for cable entry: ½" NPT, G ½", G ½" Shimada
- Fieldbus connector

**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

# Performance characteristics

**Reference operating conditions**

Error limits following ISO/DIN 11631:
20...30 °C, 2...4 bar, calibration rig traceable to national calibration standards
Calibration with the process connection corresponding to the standard in question

**Maximum measured error**

**Prowirl 72**

- Liquid:
  < 0.75% o.r. for Re > 20,000
  < 0.75% o.f.s for Re between 4,000...20,000
- Gas/steam:
  < 1% o.r. for Re > 20,000
  < 1% o.f.s for Re between 4,000...20,000

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

**Prowirl 73**

- Liquid (volume flow):
  < 0.75% o.r. for Re > 20,000
  < 0.75% o.f.s for Re between 4,000...20,000
- Gas/steam (volume flow):
  < 1% o.r. for Re > 20,000
  < 1% o.f.s for Re between 4,000...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 20...50 m/s, T > 150 °C (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 4,000...20,000
  – For flow velocities 10...70 m/s, T > 140 °C (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 4,000...20,000
- Mass flow (other media):
  – depending on the pressure value specified in the instrument functions and the chosen fluid
  – individual error observation must be carried out

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

**Repeatability**

±0.25% o.r. (of reading)

**Reaction time/step response time**

If all the configurable functions for filter times (flow damping, display damping, current output time constant, frequency output time constant, status output time constant) are set to 0, a reaction time/step response time of 200 ms must be reckoned with for vortex frequencies as of 10 Hz.
For other settings, a reaction time/step response time of 100 ms must always be added to the total filter reaction time for vortex frequencies as of 10 Hz.

**Influence of ambiente temperature**

**Current output (additional error, in reference to the span of 16 mA):**

- Zero point (4 mA):
  average Tk: 0.05%/10 K, max. 0.6% over the entire temperature range –40 °C ... +80 °C
- Span (20 mA):
  average Tk: 0.05%/10 K, max. 0.6% over the entire temperature range –40 °C ... +80 °C

**Digital outputs (pulse output, PFM, HART, frequency output (Prowirl 73 only))**
Due to the digital measuring signal (vortex pulse) and further digital processing, there is no interface-related error from changing ambient temperature.

# Operating conditions: installation

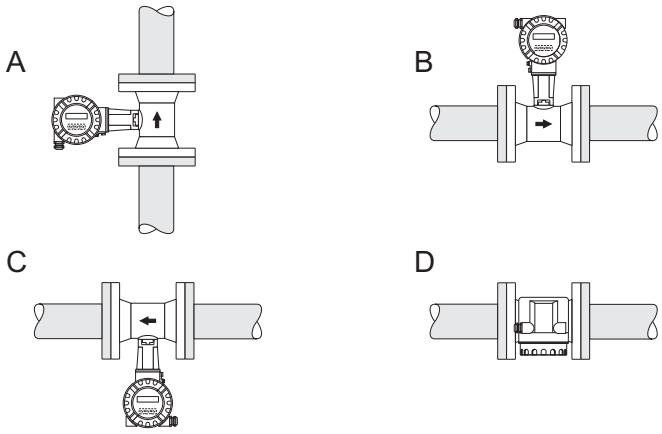
**Installation instructions**

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. For this reason, please note the following points when installing the device:

### Orientation

The device can generally be installed in any position in the piping.
In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (see orientation A).
In the case of hot media (e.g. steam or fluid temperature ≥ 200 °C), select orientation C or D so that the permitted ambient temperature of the electronics is not exceeded. Orientations B and D are recommended for very cold media (e.g. liquid nitrogen).
Orientations B, C and D are possible with horizontal installation.
The arrow indicated on the device must always point in the direction of flow in all orientations.

Caution!
- If fluid temperature is ≥ 200 °C, orientation B is not permitted for the wafer version (Prowirl 72W, 73W) with a nominal diameter of DN 100 and DN 150.
- To guarantee the flow measurement of liquids, the measuring tube must always be completely full in pipes with vertical downward flow.

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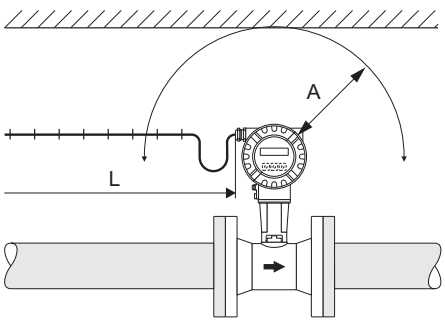
### Minimum spacing and cable length

To ensure problem-free access to the measuring device for service purposes, we recommend you observe the following dimensions:

- Minimum spacing in all directions = 100 mm (A)
- Necessary cable length L + 150 mm

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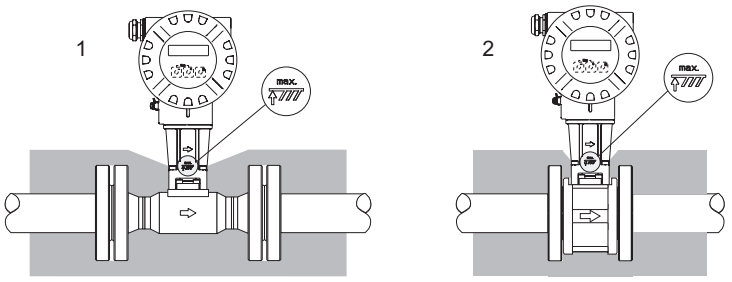
### Rotating the electronics housing and the display

The electronics housing can be rotated continuously 360 ° on the housing support. The display unit can be rotated in 45 ° stages. This means you can read off the display comfortably in all orientations.

### Piping insulation

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

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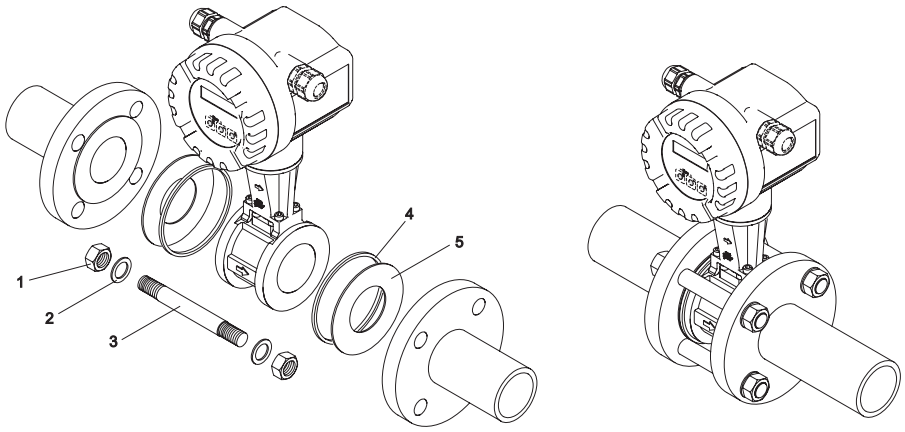
*1 = Flanged version*
*2 = Wafer version*

### Wafer version mounting set

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

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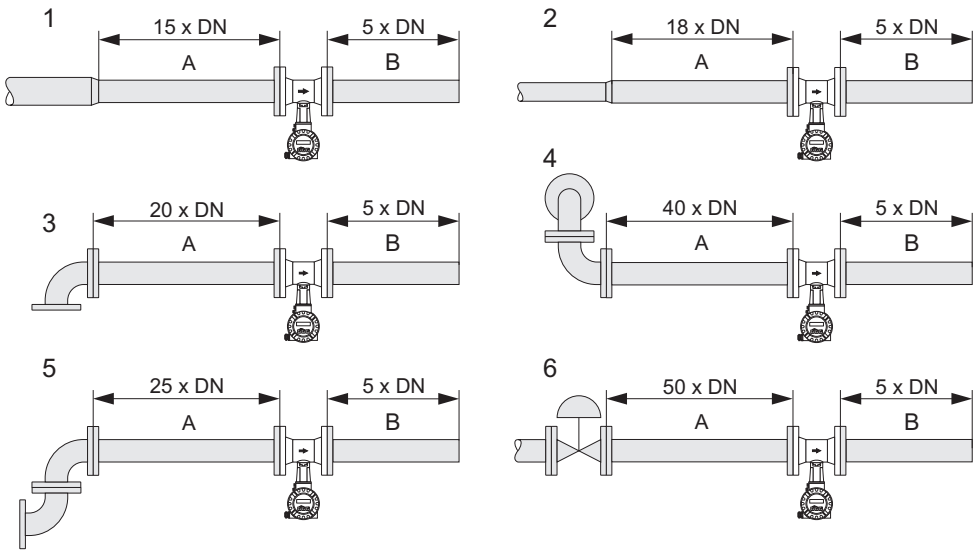
*Mounting wafer version*
*1 = Nut*
*2 = Washer*
*3 = Tie rod*
*4 = Centering ring (is supplied with the device)*
*5 = Seal*

**Inlet and outlet run**

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




A0001867

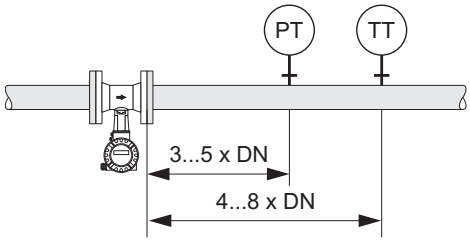
*Minimum inlet and outlet runs with various flow obstructions*

*A = Inlet run*
*B = Outlet run*
*1 = Reduction*
*2 = Extension*
*3 = 90° elbow or T-piece*
*4 = 2 x 90° elbow, -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 (→ Page 16).

**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.

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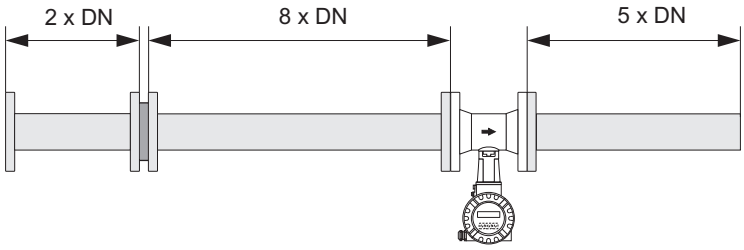
*PT = Pressure measuring point*
*TT = Temperature measuring point*

**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 the mounting bolts. Generally, this reduces the inlet run required to 10 x DN with complete accuracy.




A0001887

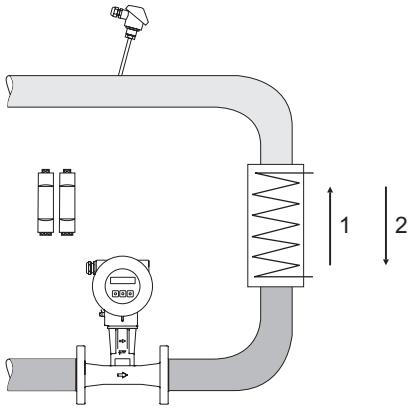
The pressure loss for flow conditioners is calculated as follows:
$\Delta p$ [mbar] = 0.0085 · $\rho$ [kg/m³] · v² [m/s]

*Examples of pressure loss for flow conditioner*

- Example with steam
  p = 10 bar abs
  t = 240 °C → $\rho$ = 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)
  $\rho$ = 965 kg/m³
  v = 2.5 m/s
  $\Delta p = 0.0085 \cdot 965 \cdot 2.5^2 = 51.3$ mbar

**Installation of delta heat measurement (Prowirl 73 HART)**

- The second temperature measurement takes place by means of a separate sensor and is read in via HART.
- Prowirl 73 generally has to be installed on the steam side for saturated steam delta heat measurement.
- For water-delta heat measurement, Prowirl 73 can be installed on both the cold side and the warm side.
- The inlet and outlet runs specified above must be observed.

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*Layout for delta heat measurement of saturated steam and water*

# Operating conditions: environment

**Ambient temperature range**

- Compact version: –40...+70 °C
  (EEx-d version: –40...+60 °C; ATEX II 1/2 GD version/dust ignition-proof: –20...+55 °C)
  Display can be read between –20 °C...+70 °C
- Remote version:
  Sensor –40...+85 °C
  (ATEX II 1/2 GD version/dust ignition-proof: –20...+55 °C)
  Transmitter –40...+80 °C
  (EEx-d version: –40...+60 °C; ATEX II 1/2 GD version/dust ignition-proof: –20...+55 °C)
  Display can be read between –20 °C...+70 °C

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

**Storage temperature**

–40...+80 °C (ATEX II 1/2 GD version/dust ignition-proof: –20...+55°C)

**Degree of protection**

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

**Vibration resistance**

Acceleration up to 1 g, 10...500 Hz, following IEC 60068-2-6

**Electromagnetic compatibility (EMC)**

To EN 61326/A1 and NAMUR Recommendation NE 21

# Operating conditions: process

**Fluid temperature range**

**Prowirl 72**

| | |
|---|---|
| DSC standard sensor | –40...+260 °C |
| DSC high/low temperature sensor | –200...+400 °C |
| DSC sensor Inconel (PN 63...160, Class 600, JIS 40K and Dualsens version) | –200...+400 °C |
| DSC sensor titanium Gr. 5 (PN 250, Class 900…1500 and butt-weld version) | –50…+400 °C |
| DSC sensor Alloy C-22 | –200...+400 °C |

- Seal:

| | |
|---|---|
| Graphite | –200...+400 °C |
| Viton | –15...+175 °C |
| Kalrez | –20...+275 °C |
| Gylon (PTFE) | –200...+260 °C |

**Prowirl 73**

| | |
|---|---|
| DSC standard sensor | –200...+400 °C |
| DSC sensor Inconel (PN 63...160, Class 600, JIS 40K and Dualsens version in development) | –200...+400 °C |

- Seal:

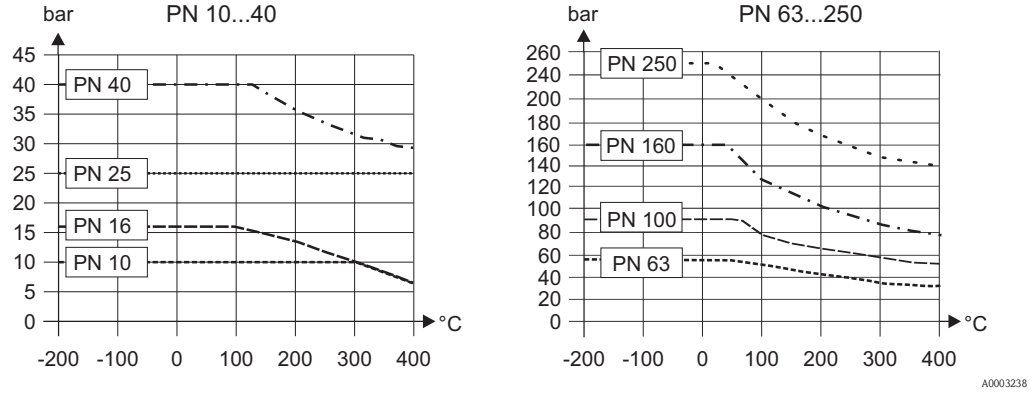
| | |
|---|---|
| Graphite | –200...+400 °C |
| Viton | –15...+175 °C |
| Kalrez | –20...+275 °C |
| Gylon (PTFE) | –200...+260 °C |

**Fluid pressure**

**Prowirl 72**

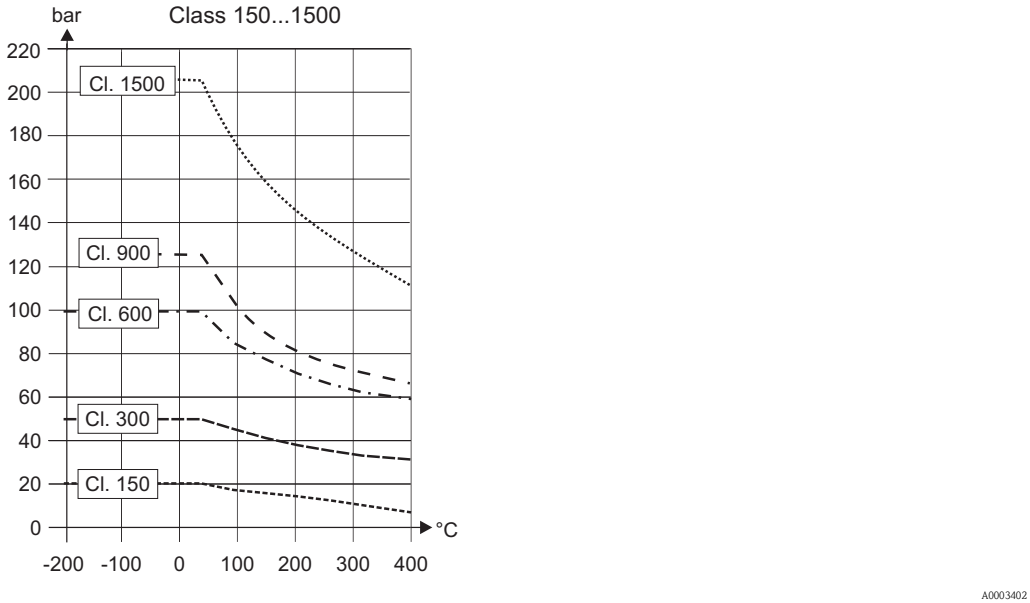
*Pressure-temperature curve to EN (DIN), stainless steel*

PN 10...40 → Prowirl 72W and 72F
PN 63...250 → Prowirl 72F



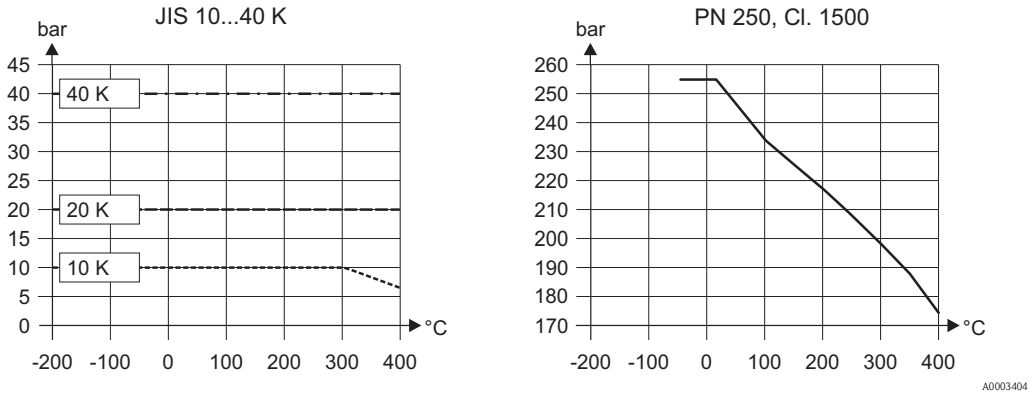

*Pressure-temperature curve to ANSI B16.5, stainless steel*

ANSI B16.5:
Class 150...300 → Prowirl 72W and 72F
Class 600...1500 → Prowirl 72F



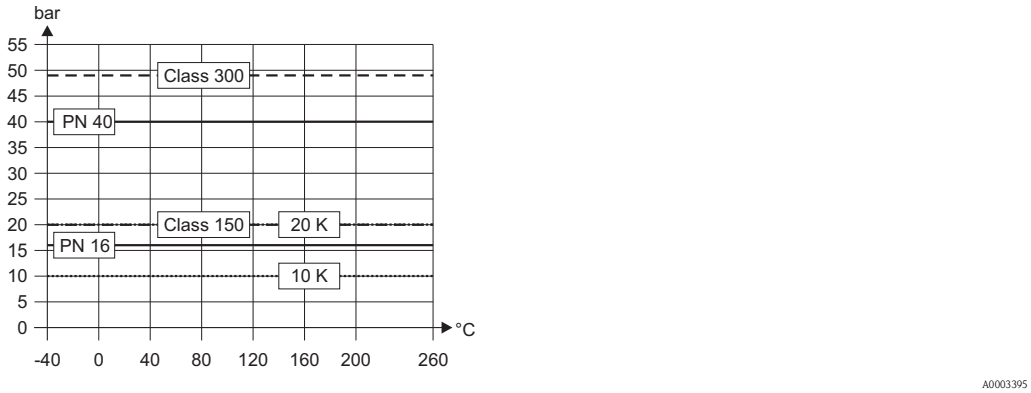
*Pressure-temperature curve to JIS B2238 and butt-weld version, stainless steel:*

- JIS B2238:
  10...20K → Prowirl 72W and 72F
  40K → Prowirl 72F
- Butt-weld version:
  PN250, Cl 1500 → Prowirl 72F




*Pressure-temperature curve to EN (DIN), ANSI B16.5 and JIS B2238, Alloy C-22*

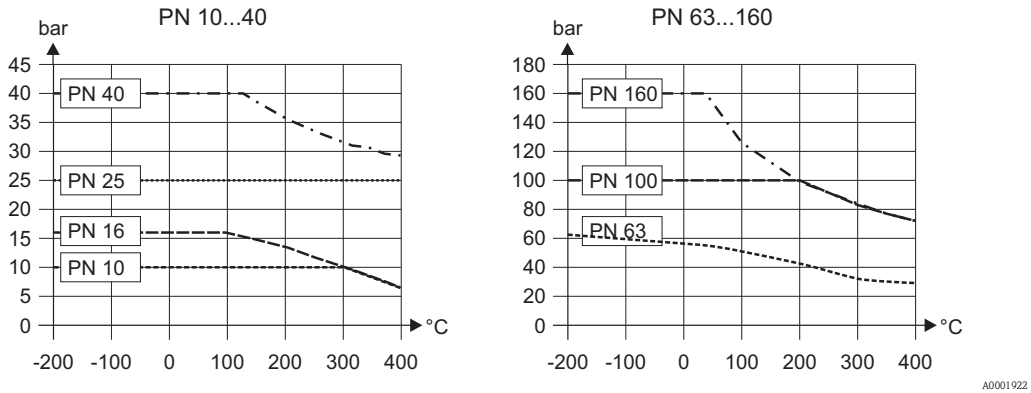
PN 16...40, Class 150...300, 10...20K → Prowirl 72F




**Prowirl 73**

*Pressure-temperature curve to EN (DIN), stainless steel*

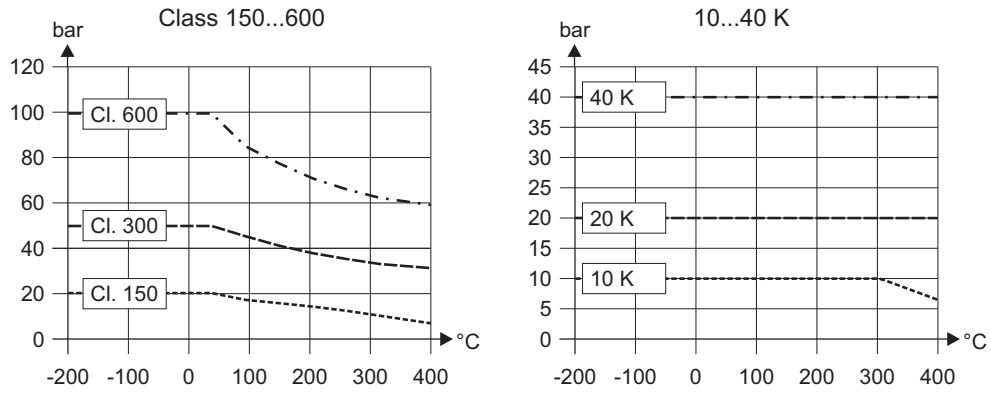
PN 10...40 → Prowirl 73W and 73F
PN 63...160 → Prowirl 73F (in development)



*Pressure-temperature curve to ANSI B16.5 and JIS B2238, stainless steel*

ANSI B 16.5:
Class 150...300 → Prowirl 73W and 73F
Class 600 → Prowirl 73F (in development)

JIS B2238
10...20 K → Prowirl 73W and 73F
40 K → Prowirl 73F (in development)

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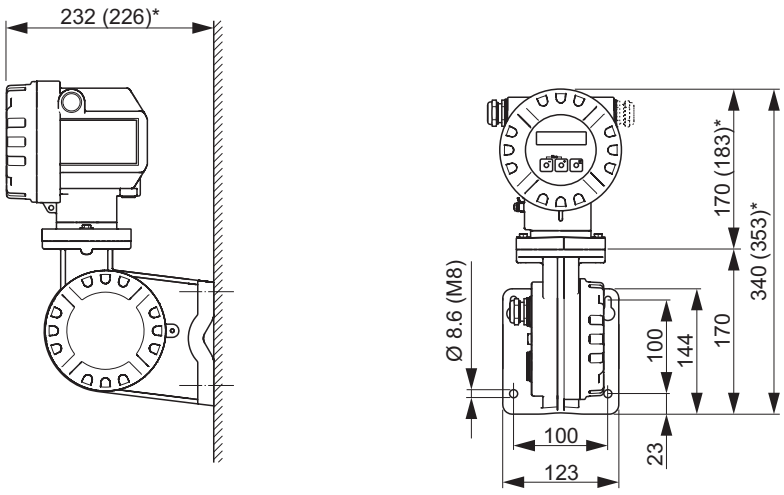
**Pressure loss**

The pressure loss can be determined with the aid of Applicator. 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.

# Mechanical construction

**Design, dimensions**

**Dimensions of transmitter, remote version**

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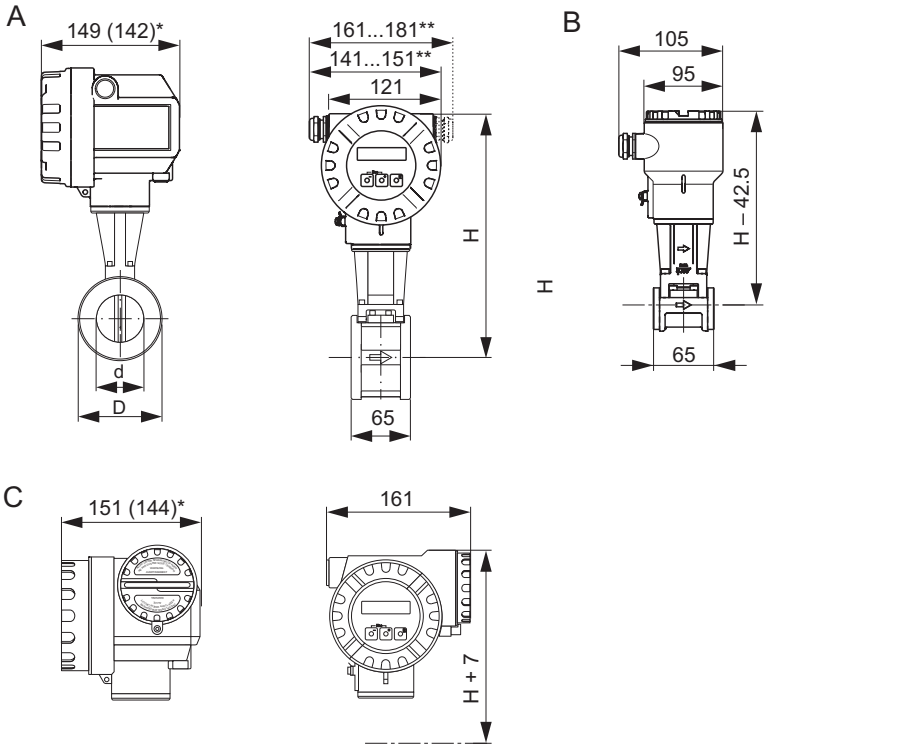
** The following dimensions differ depending on the version:*
*– The dimension 232 mm changes to 226 mm in the blind version (without local operation).*
*– The dimension 170 mm changes to 183 mm in the Ex d version.*
*– The dimension 340 mm changes to 353 mm in the Ex d version.*

**Dimensions of Prowirl 72W, 73 W**

Wafer version for flanges to:
- EN 1092-1 (DIN 2501), PN 10...40
- ANSI B16.5, Class 150...300, Sch. 40
- JIS B2238, 10...20 K, Sch. 40




*A = Standard as well as Ex i and Ex n version*
*B = Remote version*
*C = Ex d version (transmitter)*

** The following dimensions change as follows in the blind version (without local operation):*
*– Standard as well as Ex i and Ex n version: the dimension 149 mm changes to 142 mm in the blind version.*
*– Ex d version: the dimension 151 mm changes to 144 mm in the blind version.*

*** The dimension depends on the cable gland used.*

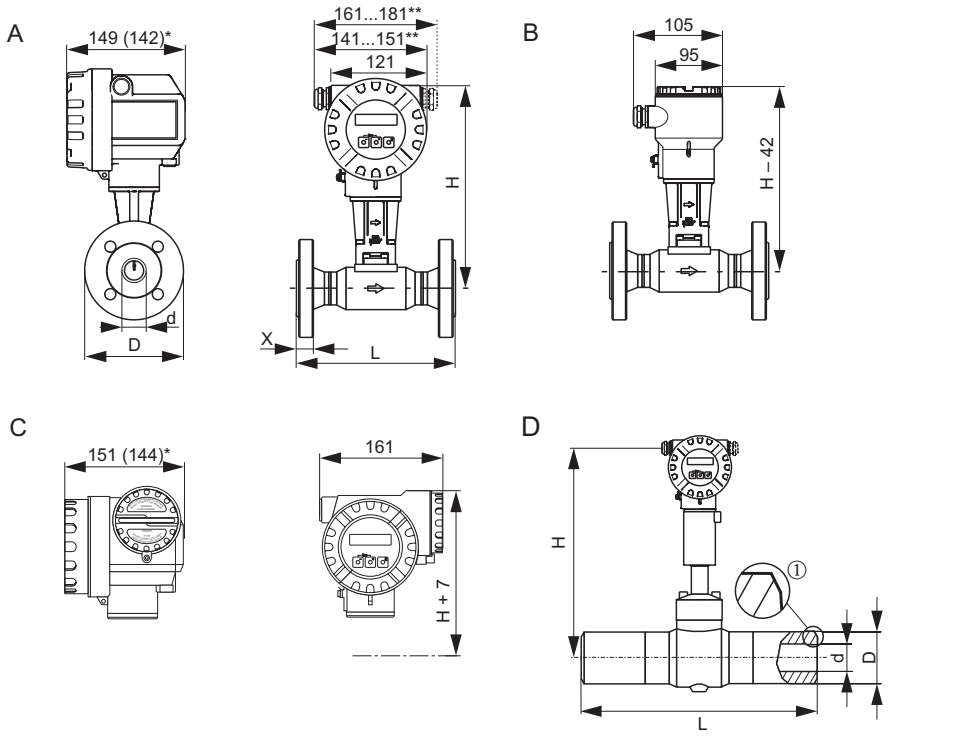
Note!
- In the following tables, dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (version with extended temperature range).
- The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22 and for Prowirl 73 (version with extended temperature range).

| Prowirl 72W, 73W | | | | | |
|---|---|---|---|---|---|
| DN | | d | D | H | Weight |
| DIN/JIS | ANSI | [mm] | [mm] | [mm] | [kg] |
| 15 | ½" | 16.50 | 45.0 | 247 | 3.0 |
| 25 | 1" | 27.60 | 64.0 | 257 | 3.2 |
| 40 | 1½" | 42.00 | 82.0 | 265 | 3.8 |
| 50 | 2" | 53.50 | 92.0 | 272 | 4.1 |
| 80 | 3" | 80.25 | 127.0 | 286 | 5.5 |
| 100 (DIN only) | – | 104.75 | 157.2 | 299 | 6.5 |
| 100 (JIS only) | 4" | 102.3 | 157.2 | 299 | 6.5 |
| 150 | 6" | 156.75 | 215.9 | 325 | 9.0 |

**Dimensions of Prowirl 72F, 73F**

Flanged version to:
- EN 1092-1 (DIN 2501), Ra = 6.3...12.5 mm
- Raised face to:
  - EN 1092-1 Form B1 (DIN 2526 Form C), PN 10...40, Ra = 6.3...12.5 mm, optional with groove to EN1091-1 Form D (DIN 2512 Form N)
  - EN 1092-1 Form B2 (DIN 2526 Form E), PN 63...100, Ra = 1.6...3.2 mm[1) 2)]
  - DIN 2526 Form E, PN 160...2503), Ra = 1.6...3.2 mm[1)]
- ANSI B16.5, Class 150...15001) 2), Ra = 125...250 min2)
- JIS B2238, 10...40K1), Ra = 125...250 min

[1)] Prowirl 73F: PN63...160, Cl 600 and 40K in development
[2)] Prowirl 73F: only Class 150...600
3) Prowirl 73F: only PN 160




*A = Standard, Ex i and Ex n version*
*B = Remote version*
*C = Ex d version (transmitter)*
*D = Butt-weld version (only available for Prowirl 72)*

** The following dimensions change as follows in the blind version (without local operation):*
*– Standard, Ex i and Ex n version: the dimension 149 mm changes to 142 mm in the blind version.*
*– Ex d version: the dimension 151 mm changes to 144 mm in the blind version.*

*** The dimension depends on the cable gland used.*

① *Groove type 22 in accordance with DIN 2559*

Note!
- In the following tables, dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).
- The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22 and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K).

| Prowirl 72F, 73F to EN 1092-1 (DIN 2501) | | | | | | | |
|---|---|---|---|---|---|---|---|
| DN | Pressure rating | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| 15 | PN 40 | 17.3 | 95.0 | 248 | 200 | 16 | 5 |
| | PN 160[2)] | 17.3 | 105.0 | 288 | 200 | 23 | 7 |
| | PN 250[1)] | 14.0 | 130.0 | 310 | 248 | 26 | 15 |
| | Butt-weld[1)] | 14.0 | 21.3 | 310 | 248 | - | 9 |
| 25 | PN 40 | 28.5 | 115.0 | 255 | 200 | 18 | 7 |
| | PN 100[2)] | 28.5 | 140.0 | 295 | 200 | 27 | 11 |
| | PN 160[2)] | 27.9 | | | | | |
| | PN 250[1)] | 24.3 | 15.0 | 310 | 248 | 28 | 16 |
| | Butt-weld[1)] | 24.3 | 26.5 | 310 | 248 | - | 9 |
| 40 | PN 40 | 43.1 | 150.0 | 263 | 200 | 18 | 10 |
| | PN 100[2)] | 42.5 | 170.0 | 303 | 200 | 31 | 15 |
| | PN 160[2)] | 41.1 | | | | | |
| | PN 250[1)] | 38.1 | 185.0 | 315 | 278 | 34 | 21 |
| | Butt-weld[1)] | 38.1 | 48.3 | 315 | 278 | - | 9 |
| 50 | PN 40 | 54.5 | 165.0 | 270 | 200 | 20 | 12 |
| | PN 63[2)] | 54.5 | 180.0 | 310 | 200 | 33 | 17 |
| | PN 100[2)] | 53.9 | 195.0 | | | | 19 |
| | PN 160[2)] | 52.3 | | | | | |
| | PN 250[1)] | 47.7 | 200.0 | 306 | 288 | 38 | 23 |
| | Butt-weld[1)] | 47.7 | 60.3 | 306 | 288 | - | 9 |
| 80 | PN 40 | 82.5 | 200.0 | 283 | 200 | 24 | 20 |
| | PN 63[2)] | 81.7 | 215.0 | 323 | 200 | 39 | 24 |
| | PN 100[2)] | 80.9 | 230.0 | | | | 27 |
| | PN 160[2)] | 76.3 | | | | | |
| | PN 250[1)] | 73.7 | 255.0 | 311 | 325 | 46 | 41 |
| | Butt-weld[1)] | 73.7 | 95.7 | 311 | 325 | - | 13 |
| 100 | PN 16 | 107.1 | 220.0 | 295 | 250 | 20 | 27 |
| | PN 40 | 107.1 | 235.0 | | | 24 | |
| | PN 63[2)] | 106.3 | 250.0 | 335 | 250 | 49 | 39 |
| | PN 100[2)] | 104.3 | 265.0 | | | | 42 |
| | PN 160[2)] | 98.3 | | | | | |
| | PN 250[1)] | 97.3 | 300.0 | 323 | 394 | 54 | 64 |
| | Butt-weld[1)] | 97.3 | 125.7 | 323 | 394 | - | 21 |
| 150 | PN 16 | 159.3 | 285.0 | 319 | 300 | 22 | 51 |
| | PN 40 | 159.3 | 300.0 | | | 28 | |
| | PN 63[2)] | 157.1 | 345.0 | 359 | 300 | 64 | 86 |
| | PN 100[2)] | 154.1 | 355.0 | | | | 88 |
| | PN 160[2)] | 146.3 | | | | | |
| | PN 250[1)] | 131.8 | 390.0 | 339 | 566 | 68 | 152 |
| | Butt-weld[1)] | 131.8 | 168.3 | 339 | 566 | - | 53 |
| 200 | PN 10 | 207.3 | 340.0 | 348 | 300 | 42 | 63 |
| | PN 16 | 207.3 | 340.0 | | | | 62 |
| | PN 25 | 206.5 | 360.0 | | | | 68 |
| | PN 40 | 206.5 | 375.0 | | | | 72 |
| 250 | PN 10 | 260.4 | 395.0 | 375 | 380 | 48 | 88 |
| | PN 16 | 260.4 | 405.0 | | | | 92 |
| | PN 25 | 258.8 | 425.0 | | | | 100 |
| | PN 40 | 258.8 | 450.0 | | | | 111 |
| 300 | PN 10 | 309.7 | 445.0 | 398 | 450 | 51 | 121 |
| | PN 16 | 309.7 | 460.0 | | | | 129 |
| | PN 25 | 307.9 | 485.0 | | | | 140 |
| | PN 40 | 307.9 | 515.0 | | | | 158 |

[1)] In contrast to the other versions, devices have a sensor in the bluff body.
Only available for 72F.
[2)] Pressure ratings are in development for Prowirl 73.

| **Prowirl 72F, 73F to ANSI B16.5** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DN | Pressure rating | | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| ½" | Schedule 40 | Cl. 150 | 15.7 | 88.9 | 248 | 200 | 11.2 | 5 |
| | | Cl. 300 | 15.7 | 95.0 | | | 14.2 | |
| | Schedule 80 | Cl. 150 | 13.9 | 88.9 | | | 11.2 | |
| | | Cl. 300 | 13.9 | 95.0 | | | 14.2 | |
| | | Cl. 600[2)] | 13.9 | 95.3 | 288 | 200 | 23 | 6 |
| | | Cl. 1500[1)] | 14.0 | 120.6 | 310 | 262 | 22.3 | 13 |
| | | Butt-weld[1)] | 14.0 | 21.3 | 310 | 248 | - | 9 |
| 1" | Schedule 40 | Cl. 150 | 26.7 | 107.9 | 255 | 200 | 15.7 | 7 |
| | | Cl. 300 | 26.7 | 123.8 | | | 19.1 | |
| | Schedule 80 | Cl. 150 | 24.3 | 107.9 | | | 15.7 | |
| | | Cl. 300 | 24.3 | 123.8 | | | 19.1 | |
| | | Cl. 600[2)] | 24.3 | 124.0 | 295 | 200 | 27 | 9 |
| | | Cl. 1500[1)] | 24.3 | 149.3 | 310 | 287.7 | 28.4 | 17 |
| | | Butt-weld[1)] | 24.3 | 33.4 | 310 | 248 | - | 9 |
| 1½" | Schedule 40 | Cl. 150 | 40.9 | 127.0 | 263 | 200 | 17.5 | 10 |
| | | Cl. 300 | 40.9 | 155.6 | | | 20.6 | |
| | Schedule 80 | Cl. 150 | 38.1 | 127.0 | | | 17.5 | |
| | | Cl. 300 | 38.1 | 155.6 | | | 20.6 | |
| | | Cl. 600[2)] | 38.1 | 155.4 | 303 | 200 | 31 | 13 |
| | | Cl. 1500[1)] | 38.1 | 177.8 | 315 | 305.8 | 31.7 | 20 |
| | | Butt-weld[1)] | 38.1 | 48.3 | 315 | 278 | - | 9 |
| 2" | Schedule 40 | Cl. 150 | 52.6 | 152.4 | 270 | 200 | 19.1 | 12 |
| | | Cl. 300 | 52.6 | 165.0 | | | 22.4 | |
| | Schedule 80 | Cl. 150 | 49.2 | 152.4 | | | 19.1 | |
| | | Cl. 300 | 49.2 | 165.0 | | | 22.4 | |
| | | Cl. 600[2)] | 49.2 | 165.1 | 310 | 200 | 33 | 14 |
| | | Cl. 1500[1)] | 47.7 | 215.9 | 306 | 344 | 38.1 | 30 |
| | | Butt-weld[1)] | 47.7 | 60.3 | 306 | 288 | - | 9 |
| 3" | Schedule 40 | Cl. 150 | 78.0 | 190.5 | 283 | 200 | 23.9 | 20 |
| | | Cl. 300 | 78.0 | 210.0 | | | 28.4 | |
| | Schedule 80 | Cl. 150 | 73.7 | 190.5 | | | 23.9 | |
| | | Cl. 300 | 73.7 | 210.0 | | | 28.4 | |
| | | Cl. 600[2)] | 73.7 | 209.6 | 323 | 200 | 39 | 22 |
| | | Cl. 900[1)] | 73.7 | 241.3 | 311 | 349 | 38.1 | 37 |
| | | Cl. 1500[1)] | 73.7 | 266.7 | 311 | 380.4 | 47.7 | 49 |
| | | Butt-weld[1)] | 73.7 | 95.7 | 311 | 325 | - | 13 |
| 4" | Schedule 40 | Cl. 150 | 102.4 | 228.6 | 295 | 250 | 24.5 | 27 |
| | | Cl. 300 | 102.4 | 254.0 | | | 31.8 | |
| | Schedule 80 | Cl. 150 | 97.0 | 228.6 | | | 24.5 | |
| | | Cl. 300 | 97.0 | 254.0 | | | 31.8 | |
| | | Cl. 600[2)] | 97.0 | 273.1 | 335 | 250 | 49 | 43 |
| | | Cl. 900[1)] | 97.3 | 292.1 | 323 | 408 | 44.4 | 57 |
| | | Cl. 1500[1)] | 97.3 | 311.1 | 323 | 427 | 53.8 | 71 |
| | | Butt-weld[1)] | 97.3 | 125.7 | 323 | 394 | - | 21 |
| 6" | Schedule 40 | Cl. 150 | 154.2 | 279.4 | 319 | 300 | 25.4 | 51 |
| | | Cl. 300 | 154.2 | 317.5 | | | 36.6 | |
| | Schedule 80 | Cl. 150 | 146.3 | 279.4 | | | 25.4 | |
| | | Cl. 300 | 146.3 | 317.5 | | | 36.6 | |
| | | Cl. 600[2)] | 146.3 | 355.6 | 359 | 300 | 64 | 87 |
| | | Cl. 900[1)] | 131.8 | 381.0 | 339 | 538 | 55.6 | 131 |
| | | Cl. 1500[1)] | 131.8 | 393.7 | 339 | 602 | 82.5 | 173 |
| | | Butt-weld[1)] | 131.8 | 168.3 | 339 | 566 | - | 53 |
| 8" | Schedule 40 | Cl. 150 | 202.7 | 342.9 | 348 | 300 | 42 | 64 |
| | | Cl. 300 | 202.7 | 381.0 | | | | 76 |

| **Prowirl 72F, 73F to ANSI B16.5** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DN | Pressure rating | | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| 10" | Schedule 40 | Cl. 150 | 254.5 | 406.4 | 375 | 380 | 48 | 92 |
| | | Cl. 300 | 254.5 | 444.5 | | | | 109 |
| 12" | Schedule 40 | Cl. 150 | 304.8 | 482.6 | 398 | 450 | 60 | 143 |
| | | Cl. 300 | 304.8 | 520.7 | | | | 162 |

[1] In contrast to the other versions, devices have a sensor in the bluff body.
Only available for 72F.
[2] Pressure ratings are in development for Prowirl 73.

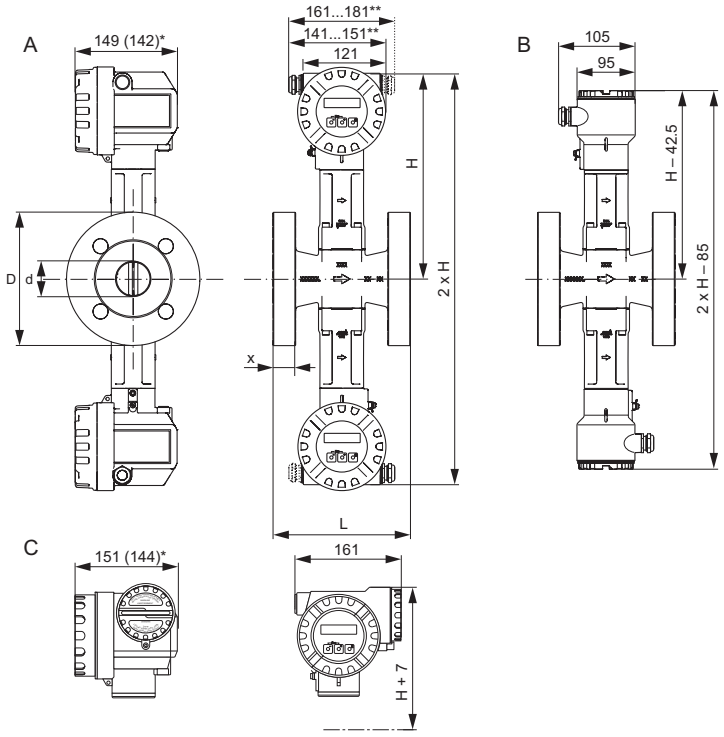
| **Prowirl 72F, 73F to JIS B2238** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DN | Pressure rating | | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| 15 | Schedule 40 | 20K | 16.1 | 95.0 | 248 | 200 | 14 | 5 |
| | Schedule 80 | 20K | 13.9 | 95.0 | | | 14 | |
| | | 40K[1] | 13.9 | 115.0 | 288 | 200 | 23 | 8 |
| 25 | Schedule 40 | 20K | 27.2 | 125.0 | 255 | 200 | 16 | 7 |
| | Schedule 80 | 20K | 24.3 | 125.0 | | | 16 | |
| | | 40K[1] | 24.3 | 130.0 | 295 | 200 | 27 | 10 |
| 40 | Schedule 40 | 20K | 41.2 | 140.0 | 263 | 200 | 18 | 10 |
| | Schedule 80 | 20K | 38.1 | 140.0 | | | 18 | |
| | | 40K[1] | 38.1 | 160.0 | 303 | 200 | 31 | 14 |
| 50 | Schedule 40 | 10K | 52.7 | 155.0 | 270 | 200 | 16 | 12 |
| | | 20K | 52.7 | 155.0 | | | 18 | |
| | Schedule 80 | 10K | 49.2 | 155.0 | | | 16 | |
| | | 20K | 49.2 | 155.0 | | | 18 | |
| | | 40K[1] | 49.2 | 165.0 | 310 | 200 | 33 | 15 |
| 80 | Schedule 40 | 10K | 78.1 | 185.0 | 283 | 200 | 18 | 20 |
| | | 20K | 78.1 | 200.0 | | | 22 | |
| | Schedule 80 | 10K | 73.7 | 185.0 | | | 18 | |
| | | 20K | 73.7 | 200.0 | | | 22 | |
| | | 40K[1] | 73.7 | 210.0 | 323 | 200 | 39 | 24 |
| 100 | Schedule 40 | 10K | 102.3 | 210.0 | 295 | 250 | 18 | 27 |
| | | 20K | 102.3 | 225.0 | | | 24 | |
| | Schedule 80 | 10K | 97.0 | 210.0 | | | 18 | |
| | | 20K | 97.0 | 225.0 | | | 24 | |
| | | 40K[1] | 97.0 | 240.0 | 335 | 250 | 49 | 36 |
| 150 | Schedule 40 | 10K | 151.0 | 280.0 | 319 | 300 | 22 | 51 |
| | | 20K | 151.0 | 305.0 | | | 28 | |
| | Schedule 80 | 10K | 146.3 | 280.0 | | | 22 | |
| | | 20K | 146.3 | 305.0 | | | 28 | |
| | | 40K[1] | 146.6 | 325.0 | 359 | 300 | 64 | 77 |
| 200 | Schedule 40 | 10K | 202.7 | 330.0 | 348 | 300 | 42 | 58 |
| | | 20K | 202.7 | 350.0 | | | | 64 |
| 250 | Schedule 40 | 10K | 254.5 | 400.0 | 375 | 380 | 48 | 90 |
| | | 20K | 254.5 | 430.0 | | | | 104 |
| 300 | Schedule 40 | 10K | 304.8 | 445.0 | 398 | 450 | 51 | 119 |
| | | 20K | 304.8 | 480.0 | | | | 134 |

[1] Pressure rating 40 K for Prowirl 73 in development

**Dimensions of Prowirl 72F, Dualsens version**

Flanged version to:
- EN 1092-1 (DIN 2501), Ra = 6.3...12.5 mm
- Raised face to:
  - EN 1092-1 Form B1 (DIN 2526 Form C), PN 10...40, Ra = 6.3...12.5 mm, optional with groove to EN1091-1 Form D (DIN 2512 Form N)
  - EN 1092-1 Form B2 (DIN 2526 Form E), PN 63...100, Ra = 1.6...3.2 mm[1) 2)]
  - DIN 2526 Form E, PN 160...2503), Ra = 1.6...3.2 mm[1)]
- ANSI B16.5, Class 150...15001) 2), Ra = 125...250 min2)
- JIS B2238, 10...40K1), Ra = 125...250 min

[1)] Prowirl 73F: PN63...160, Cl 600 and 40K in development
[2)] Prowirl 73F: only Class 150...600
3) Prowirl 73F: only PN 160




*A = Standard, Ex i and Ex n version*
*B = Remote version*
*C = Ex d version (transmitter)*

** The following dimensions change as follows in the blind version (without local operation):*
*– Standard, Ex i and Ex n version: the dimension 149 mm changes to 142 mm in the blind version.*
*– Ex d version: the dimension 151 mm changes to 144 mm in the blind version.*

*** The dimension depends on the cable gland used.*

Note!
The weight data refer to the compact version.

| Prowirl 72F Dualsens version to EN 1092-1 (DIN 2501) | | | | | | | |
|---|---|---|---|---|---|---|---|
| DN DIN/JIS | Pressure rating | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| 40 | PN 40 | 43.1 | 150.0 | 303 | 200 | 31 | 16 |
| | PN 100 | 42.5 | 170.0 | | | | 18 |
| | PN 160 | 41.1 | 170.0 | | | | |
| 50 | PN 40 | 54.5 | 165.0 | 310 | 200 | 33 | 18 |
| | PN 63 | 54.5 | 180.0 | | | | 20 |
| | PN 100 | 53.9 | 195.0 | | | | 22 |
| | PN 160 | 52.3 | 195.0 | | | | |
| 80 | PN 40 | 82.5 | 200.0 | 323 | 200 | 39 | 25 |
| | PN 63 | 81.7 | 215.0 | | | | 27 |
| | PN 100 | 80.9 | 230.0 | | | | 30 |
| | PN 160 | 76.3 | 230.0 | | | | |
| 100 | PN 16 | 107.1 | 220.0 | 335 | 250 | 49 | 42 |
| | PN 40 | 107.1 | 235.0 | | | | |
| | PN 63 | 106.3 | 250.0 | | | | |
| | PN 100 | 104.3 | 265.0 | | | | 45 |
| | PN 160 | 98.3 | 265.0 | | | | |
| 150 | PN 16 | 159.3 | 285.0 | 359 | 300 | 64 | 80 |
| | PN 40 | 159.3 | 300.0 | | | | |
| | PN 63 | 157.1 | 345.0 | | | | 89 |
| | PN 100 | 154.1 | 355.0 | | | | 91 |
| | PN 160 | 146.3 | 355.0 | | | | |

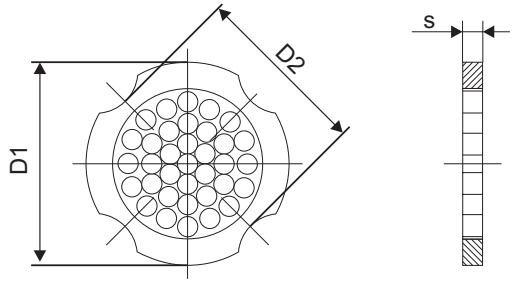
| Prowirl 72F Dualsens version to ANSI B16.5 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DN ANSI | Pressure rating | | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| 1½" | Schedule 40 | Cl. 150 | 40.9 | 127.0 | 303 | 200 | 31 | 16 |
| | | Cl. 300 | 40.9 | 155.6 | | | | |
| | Schedule 80 | Cl. 150 | 38.1 | 127.0 | | | | |
| | | Cl. 300 | 38.1 | 155.6 | | | | |
| | | Cl. 600 | 38.1 | 155.4 | | | | |
| 2" | Schedule 40 | Cl. 150 | 52.6 | 152.4 | 310 | 200 | 33 | 18 |
| | | Cl. 300 | 52.6 | 165.0 | | | | |
| | Schedule 80 | Cl. 150 | 49.2 | 152.4 | | | | |
| | | Cl. 300 | 49.2 | 165.0 | | | | |
| | | Cl. 600 | 49.2 | 165.1 | | | | |
| 3" | Schedule 40 | Cl. 150 | 78.0 | 190.5 | 323 | 200 | 39 | 25 |
| | | Cl. 300 | 78.0 | 210.0 | | | | |
| | Schedule 80 | Cl. 150 | 73.7 | 190.5 | | | | |
| | | Cl. 300 | 73.7 | 210.0 | | | | |
| | | Cl. 600 | 73.7 | 209.6 | | | | |
| 4" | Schedule 40 | Cl. 150 | 102.4 | 228.6 | 335 | 250 | 49 | 42 |
| | | Cl. 300 | 102.4 | 254.0 | | | | |
| | Schedule 80 | Cl. 150 | 97.0 | 228.6 | | | | |
| | | Cl. 300 | 97.0 | 254.0 | | | | |
| | | Cl. 600 | 97.0 | 273.1 | | | | |
| 6" | Schedule 40 | Cl. 150 | 154.2 | 279.4 | 359 | 300 | 64 | 80 |
| | | Cl. 300 | 154.2 | 317.5 | | | | |
| | Schedule 80 | Cl. 150 | 146.3 | 279.4 | | | | |
| | | Cl. 300 | 146.3 | 317.5 | | | | |
| | | Cl. 600 | 146.3 | 355.6 | | | | |

| **Prowirl 72F Dualsens version to JIS B2238** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DN DIN/JIS | Pressure rating | | d [mm] | D [mm] | H [mm] | L [mm] | X [mm] | Weight [kg] |
| 40 | Schedule 40 | 20K | 41.2 | 140.0 | 303 | 200 | 31 | 16 |
| | Schedule 80 | 20K | 38.1 | 140.0 | | | | |
| | | 40K | 38.1 | 160.0 | | | | 17 |
| 50 | Schedule 40 | 10K | 52.7 | 155.0 | 310 | 200 | 33 | 18 |
| | | 20K | 52.7 | 155.0 | | | | |
| | Schedule 80 | 10K | 49.2 | 155.0 | | | | |
| | | 20K | 49.2 | 155.0 | | | | |
| | | 40K | 49.2 | 165.0 | | | | |
| 80 | Schedule 40 | 10K | 78.1 | 185.0 | 323 | 200 | 39 | 25 |
| | | 20K | 78.1 | 200.0 | | | | |
| | Schedule 80 | 10K | 73.7 | 185.0 | | | | |
| | | 20K | 73.7 | 200.0 | | | | |
| | | 40K | 73.7 | 210.0 | | | | 27 |
| 100 | Schedule 40 | 10K | 102.3 | 210.0 | 335 | 250 | 49 | 42 |
| | | 20K | 102.3 | 225.0 | | | | |
| | Schedule 80 | 10K | 97.0 | 210.0 | | | | |
| | | 20K | 97.0 | 225.0 | | | | |
| | | 40K | 97.0 | 240.0 | | | | 49 |
| 150 | Schedule 40 | 10K | 151.0 | 280.0 | 359 | 300 | 64 | 80 |
| | | 20K | 151.0 | 305.0 | | | | |
| | Schedule 80 | 10K | 146.3 | 280.0 | | | | |
| | | 20K | 146.3 | 305.0 | | | | |
| | | 40K | 146.6 | 325.0 | | | | |

**Dimensions of flow conditioner (accessory)**

Dimensions to:
- EN 1092-1 (DIN 2501)
- ANSI B16.5
- JIS B2238

Material 1.4435 (316L), in conformity with NACE MR 0175 and MR 0103




A0001941

*D1: The flow conditioner is fitted at the external diameter between the bolts.*

*D2: The flow conditioner is fitted at the indentations between the bolts.*

| **Flow conditioner to EN (DIN) / ANSI / JIS** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DN | | 15 / ½" | 25 / 1" | 40 / 1½" | 50 / 2" | 80 / 3" | 100 / 4" | 150 / 6" | 200 / 8" | 250 / 10" | 300 / 12" |
| s [mm] | | 2.0 | 3.5 | 5.3 | 6.8 | 10.1 | 13.3 | 20.0 | 26.3 | 33.0 | 39.6 |
| EN (DIN) Weight in [kg] | PN 10 | 0.04 | 0.12 | 0.30 | 0.50 | 1.40 | 2.40 | 6.30 | 11.5 | 25.7 | 36.4 |
| | PN 16 | 0.04 | 0.12 | 0.30 | 0.50 | 1.40 | 2.40 | 6.30 | 12.3 | 25.7 | 36.4 |
| | PN 25 | 0.04 | 0.12 | 0.30 | 0.50 | 1.40 | 2.40 | 7.80 | 12.3 | 25.7 | 36.4 |
| | PN 40 | 0.04 | 0.12 | 0.30 | 0.50 | 1.40 | 2.40 | 7.80 | 15.9 | 27.5 | 44.7 |
| | PN 63 | 0.05 | 0.15 | 0.40 | 0.60 | 1.40 | 2.40 | 7.80 | 15.9 | 27.5 | 44.7 |
| ANSI Weight in [kg] | Cl. 150 | 0.03 | 0.12 | 0.30 | 0.50 | 1.20 | 2.70 | 6.30 | 12.3 | 25.7 | 36.4 |
| | Cl. 300 | 0.04 | 0.12 | 0.30 | 0.50 | 1.40 | 2.70 | 7.80 | 15.8 | 27.5 | 44.6 |
| JIS Weight in [kg] | 10K | 0.06 | 0.14 | 0.31 | 0.47 | 1.1 | 1.8 | 4.5 | 9.2 | 15.8 | 26.5 |
| | 20K | 0.06 | 0.14 | 0.31 | 0.47 | 1.1 | 1.8 | 5.5 | 9.2 | 19.1 | 26.5 |
| | 40K | 0.06 | 0.14 | 0.31 | 0.5 | 1.3 | 2.1 | 6.2 | - | - | - |

**Weight**

- Weight of Prowirl 72W, 73W → see dimension table on Page 21.
- Weight of Prowirl 72 F, 73 F → see dimension tables on Page 22 ff.
- Weight of flow conditioner to EN (DIN) /ANSI / JIS → see dimension table on Page 29.

**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 MR 0175 and MR0103
  – Pressure ratings PN 250, Cl 900…1500 and butt-weld version (only for Prowirl 72) 1.4571 (316Ti; UNS S31635); in conformity with NACE MR0175 and MR0103
- Alloy C-22 version (only for Prowirl 72)
  – Alloy C-22 2.4602 (A 494-CX2MW/N 26022); in conformity with NACE MR0175 and MR0103
- Wafer version
  – Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR 0175 and MR0103

**Flanges**

- EN (DIN)
  - Stainless steel, 316/316L/1.4404, in conformity with NACE MR 0175 and MR 0103
  - DN 15...150 with pressure ratings PN 63-160 (in development for Prowirl 73) and nominal diameters DN 200-300: fully cast construction A351-CF3M (1.4404); in conformity with NACE MR 0175 and MR0103
  - Pressure rating PN 250 (only for Prowirl 72) 1.4571 (316Ti, UNS S31635); in conformity with NACE MR 0175 and MR 0103
- ANSI and JIS
  - Stainless steel, 316/316L, in conformity with NACE MR 0175 and MR0103
  - ½"...6" with pressure ratings Cl 600 (in development for Prowirl 73), DN 15...150 with pressure rating 40 K, (in development for Prowirl 73), nominal diameters 8"-12" and DN 200-300: fully cast construction A351-CF3M; in conformity with NACE MR 0175 and MR0103
- Pressure ratings Cl 900…1500: 316/316L; in conformity with NACE MR0175 and MR0103 (only Prowirl 72)
- Alloy C-22 version (EN/DIN/ANSI/JIS, only Prowirl 72)
  - Alloy C-22 2.4602 (A 494-CX2MW/N 26022); in conformity with NACE MR 0175 and MR 0103

**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, Cl 300, JIS 40 K (apart from Dualsens version): Stainless steel 1.4435 (316L), in conformity with NACE MR 0175 and MR 0103
  - Pressure ratings PN 63…160, Cl 600, 40 K and Dualsens version (in development for Prowirl 73): Inconel 2.4668/N 07718 (B637) (Inconel 718); in conformity with NACE MR 0175 and MR 0103
  - Pressure ratings PN 250, Cl 900…1500 and butt-weld version (only for Prowirl 72): titanium Gr. 5 (B-348; UNS R50250; 3.7165)
  - Alloy C-22 sensor (only for Prowirl 72): Alloy C-22, 2.4602/N 06022; in conformity with NACE MR 0175 and MR 0103

**Non- wetted parts**

- Non-wetted parts:
  - Stainless steel 1.4301 (304)

**Support**

- Support:
  - Stainless steel, 1.4308 (CF8)

  Pressure ratings PN 250, Cl 900…1500 and butt-weld version (only for Prowirl 72): 1.4305 (303)

**Seals**

- Graphite (Grafoil)
- Viton
- Kalrez 6375
- Gylon (PTFE) 3504

# Human interface

**Display elements**

Liquid crystal display, double-spaced, plain text display, 16 characters per line
Display can be configured individually, e.g. for measured variables and status values, totalizers

**Operating elements (HART)**

Local operation with three keys (⊞, ⊟, E)
Quick Setup for quick commissioning
Operating elements accessible also in Ex-zones

**Remote operation**

Remote operation possible via:
- HART
- PROFIBUS PA
- FOUNDATION Fieldbus
- Endress+Hauser Service Protocol

# Certificates and approvals

**CE mark**

The device is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing the CE mark.

**C-tick**

The measuring system is in conformity with the EMC requirements of the Australian Communications Authority (ACA).

**Ex-approval**

- Ex i and Ex n:
  - ATEX/CENELEC
    II1/2G, EEx ia IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
    II1/2GD, EEx ia IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
    II1G, EEx ia IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
    II2G, EEx ia IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
    II3G, EEx nA IIC T1...T6 X (T1...T4 X for PROFIBUS PA and FOUNDATION Fieldbus)
  - FM
    Class I/II/III Div. 1/2, Group A...G; Class I Zone 0, Group IIC
  - CSA
    Class I/II/III Div. 1/2, Group A...G; Class I Zone 0, Group IIC
    Class II Div. 1, Group E...G
    Class III
- Ex d:
  - ATEX/CENELEC
    II1/2G, EEx d [ia] IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
    II1/2GD, EEx ia IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
    II2G, EEx d [ia] IIC T1...T6 (T1...T4 for PROFIBUS PA and FOUNDATION Fieldbus)
  - FM
    Class I/II/III Div. 1, Groups A...G
  - CSA
    Class I/II/III Div. 1/2 Groups A...G
    Class II Div. 1, Groups E...G
    Class III

More information on the Ex-approvals can be found in the separate Ex-documentation.

**Pressure measuring device approval**

Devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3 (3) of the EC Directive 97/23/EC (Pressure Equipment Directive). Optional approvals to Category III are also available for larger nominal diameters, where necessary (depending on fluid and process pressure). The devices are suitable for all media as well as unstable gases and have been designed and manufactured according to good engineering practice.

**Certification FOUNDATION Fieldbus**

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

- Certified to FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus-H1.
- Interoperability Test Kit (ITK), revision status 4.5 (device certification number available on request): The device can also be operated with certified devices of other manufacturers.
- Physical Layer Conformance Test of the Fieldbus FOUNDATION

**Certification PROFIBUS PA**

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

- Certified to PROFIBUS PA Profile Version 3.0 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers (interoperability)

**Other standards and guidelines**

- EN 60529: Degrees of protection by housing (IP code).
- EN 61010: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures.
- EN 61326/A1: Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43: Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NACE Standard MR 0103: Standard Material Requirements - Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments
- NACE Standard MR 0175: Standard Material Requirements - Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment
- VDI 2643: Measurement of fluid flow by means of vortex flowmeters.
- ANSI/ISA-S82.01: Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category II
- CAN/CSA-C22.2 No. 1010.1-92: Safety Standard for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II
- 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.

**Functional safety**

Prowirl 72: SIL 2 in accordance with IEC 61508 / IEC 61511-1

Prowirl 73: SIL 1

# Ordering information

Ordering information and detailed information on the order code can be obtained from your Endress+Hauser Service Organization.

Additional ordering information for Prowirl 72:
You can order your Prowirl 72 preconfigured.
For this purpose, the following information is needed when ordering:
- 20 mA value = at which measured value a current of 20 mA should be set
- Pulse value (if the device has a pulse output)

If you require the flow output in units of mass, we need:
- The average operating density of the fluid including the enginering unit to be used

If you require the flow output in units of corrected volume, we need:
- The operating and reference density of the fluid including the enginering unit to be used

The measuring device can be reset to the delivery state indicated in the order at any time.

Additional ordering information for Prowirl 73:
You can order your Prowirl 73 as preconfigured.
For this purpose, the following information is needed when ordering:
- Fluid (saturated steam, superheated steam, water or compressed air)
- Average operating pressure in bar absolute (not needed for saturated steam)
- 4 mA value = at which measured value (e.g. 50 kg/h) a current of 4 mA should be output, incl. enginering unit to be used
- 20 mA value = at which measured value (e.g. 1,000 kg/h) a current of 20 mA should be output, incl. enginering unit to be used
- Pulse value (if the device has a pulse output), incl. enginering unit to be used

The measuring device can be reset to the delivery state indicated in the order at any time.

## Accessories

- Spare parts as per separate price list
- Wafer version mounting set
- Pipe and wall mounting kit for transmitter remote version DK5WM-B
- Replacement transmitter
- Universal flow and energy computer RMC 621
- Steam computer RMS 621
- Flow conditioner
- HART Communicator DXR 375 handheld terminal
- Active barrier preline RN 221 N
- Resistance thermometer Omnigrad TR10 (HART-enabled and burst-enabled, for delta heat applications with Prowirl 73)
- Pressure transmitter Cerabar M (HART-enabled and burst-enabled for superheated steam and gas applications with Prowirl 73)
- Pressure transmitter Cerabar T or Cerabar S (PROFIBUS PA, FOUNDATION Fieldbus)
- Process display RIA 250, RIA 251
- Field display unit RIA 261 or RID 261 (PROFIBUS PA)
- Applicator
- ToF Tool – Fieldtool Package
- Fieldgate FXA 520 (HART), FXA 720 (PROFIBUS PA) for data transmission
- Paperless Recorder Ecograph T for displaying, recording and communication of data

## Documentation

- Operating Instructions Proline Prowirl 72
- Operating Instructions Proline Prowirl 72 PROFIBUS PA
- Operating Instructions Proline Prowirl 72 FOUNDATION Fieldbus
- Operating Instructions Proline Prowirl 73
- Operating Instructions Proline Prowirl 73 PROFIBUS PA
- Operating Instructions Proline Prowirl 73 FOUNDATION Fieldbus
- Related Ex-documentation
- Supplementary documentation on Pressure Equipment Directive

## Registered trademarks

- GYLON®
  Registered trademark of Garlock Sealing Technologies, Palmyar, NY, USA
- HART®
  Registered trademark of the HART Communication Foundation, Austin, USA
- INCONEL®
  Registered trademark of Inco Alloys International Inc., Huntington, USA
- KALREZ®, VITON®
  Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA
- ToF Tool – Fieldtool® Package, Fieldcheck®, Applicator®
  Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

**Subject to modifications and amendments!**

**International Head Quarter**

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