Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Proline Prowirl 73

Reliable Flow Measurement of Gas, Steam and Liquids. Two-Wire Saturated Steam Mass Flowmeter.

Application

For universal volume or mass flow measurement of steam, water (according to IAPWS-IF97 ASME), natural gas (according to AGA NX-19), compressed air and other liquids or gases.

Maximum application range:

- fluid temperatures from –200 to +400 °C
- pressure ratings up to PN40/Cl300 (higher pressure ratings in preparation)

Approvals for hazardous areas:

- ATEX, FM, CSA, TIIS

Connection to all prevalent systems:

- HART, PROFIBUS PA, FOUNDATION Fieldbus

Relevant safety aspects:

- PED, SIL-1

Your benefits at a glance

Prowirl 73 offers a complete measuring point for saturated steam or liquid mass in a single device: mass flow is calculated from the measured variables of volume flow and temperature in the integrated flow computer.

For superheated steam or gas applications an external pressure value can read in optionally, for delta heat applications an external temperature value can be read in.

The instrument can be ordered pre-programmed (customer or application specific)

The **Prowirl sensor** is robust, reliable and proven in more than a 100'000 applications. It offers:

- multivariable flow measurement in compact design
- high robustness against:
  – vibrations (above 1 g in all axes)
  – temperature shocks (>150 K/s)
  – clogging fluids
  – water hammer
- no maintenance, no moving parts, no zero point drift

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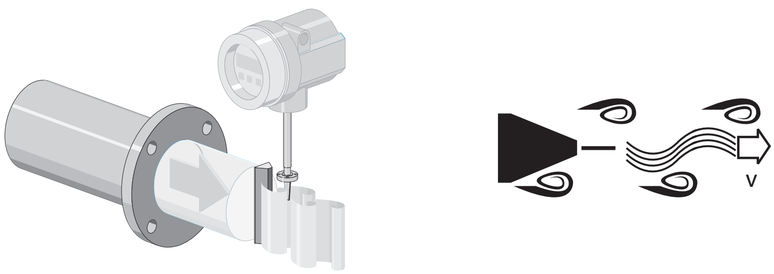
Function and system design

Measuring principle

Vortex shedding flowmeters work on the principle of the Karman vortex street. When a fluid flows past a bluff body vortices are alternately formed and shed and each generates a local low pressure point downstream of the bluff body. The pressure fluctuations are detected by the sensor and converted to electrical pulses (digital signal). Within the operating limits of the device the frequency of vortices generated is directly proportional to the volume flow.



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The K-factor is used as the proportional constant:

$$\text{K-Factor} = \frac{\text{pulses}}{\text{unit volume [dm}^3\text{]}}$$

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Within the application limits of the device the K-factor (calibration factor) is dependant only on its mechanical geometry and is independent of the fluid, velocity, viscosity and density. (gas, liquid or steam)
The primary measurement signal is digital (frequency signal) and a linear function of the flow. After manufacture the K-factor is determined during a factory calibration and once derived is not subject to zero or long term drift.
The device does not contain any moving parts and requires no maintenance.

The DSC (Differential Switched Capsitance) sensor

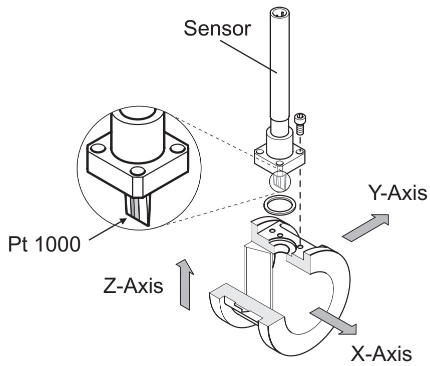
The measuring sensor for a vortex flowmeter has a major influence on the performance, robustness and reliability of the whole measuring system.

The DSC sensor of the new Prowirl 73 incorporates the experience gained from an installed base of over 100.000 vortex measurement points with the benefits of an integrated temperature sensor (PT 1000).
To ensure that the DSC sensor meets the range of demands required in today's applications it has been burst tested to pressures in excess of 400 bar, vibrations in excess of 1g in all axes and temperature shocks of 150 K/s.

Prowirl 73 is capable of measuring low flow rates even with low density fluids and where pipe line vibrations are present. The meter will maintain its wide turn down ratio even under conditions where vibrations of 1g or more and frequencies up 500 Hz are experienced.

Due to its internal mechanical balance the DSC sensor reads only the pressure pulses caused by the vortices and is immune to any influence from mechanical pipe line vibrations.

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



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Temperature measurement

In addition to the volume flow the instrument measures the temperature. This measurement is performed by a resistance thermometer Pt 1000 located close to the process in the DSC sensor's paddle (s. fig. Pt 1000 → Page 2).

Flow computer

The electronics of the measuring device is equipped with a flow computer. By means of this computer using the primary measurands (volume flow and temperature) a variety of other process variables can be calculated, e.g.:

- the mass and heat flow of saturated steam and water
- the mass and heat flow of superheated steam (at constant pressure)
- the mass and corrected volume flow of other gases (at constant pressure)
- the mass flow of any liquid

Diagnostics

The device offers a wide variety of diagnostics, e.g. tracking of the temperature of media and ambient, as well as extreme flow events etc.

Measuring system

The measuring system consists of 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 (Flange version)
- Prowirl W (Wafer version)

Transmitter

- Prowirl 73

Input

Measured variable

- Volumetric flow (volume flow)
  is proportional to the frequency of vortex shedding after the bluff body.
- Temperature
  can be available and used for the calculation of mass flow e.g..

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

Measuring range

The measuring range is dependant on the fluid and 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 indicates the ratio of a fluid's inertial forces to its viscous forces. It is used to characterise the flow. The Reynolds number is calculated as follows:

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

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Re = Reynolds number; Q = Flow; di = Internal diameter; m = Dynamic viscosity; r = Density

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

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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 sizing software Applicator, you can determine the exact values for the fluid you use. You can obtain Applicator from your Endress+Hauser sales centre or on the Internet at 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 [ρ_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

Outputs, general

The following measured variables of a device (4...20mA / HART-version) can generally be output via the outputs:

	Current output	Frequency output	Impulse output	Status output
Volume flow	X	X	X	limit value*
Temperature	X	X	–	limit value
Mass flow	if programmed	if programmed	if programmed	limit value*
Standard volume flow	if programmed	if programmed	if programmed	limit value*
Heat flow (power)	if programmed	if programmed	if programmed	limit value*
Saturated steam pressure (only for saturated steam pressure)	if programmed	if programmed	if programmed	limit value*
Operating pressure (if read in)	if programmed	if programmed	if programmed	limit value*
* limit value for flow or totalizer				

In addition, the calculated measured variables density, if programmed, specific enthalpy, saturation steam pressure (for saturated steam), Z-factor and flow velocity can be displayed, if available, via the local display.

Output signal

- Current output: 4...20 mA with HART, Start value, Full scale value and time constant (0...100 s) can be set, Temperature coefficient: typically 0.005% o.r. / °C (o.r. = of reading)
- Frequency output (optional): Open collector, passive, Galvanically isolated,
  Non-Ex, Ex d: U_{max} = 36 V, with 15 mA current limit, R_i = 500 W
  Ex i: U_{max} = 30 V, with 15 mA current limit, R_i = 500 W

Can be configured as:
- Frequency output (optional): Full scale frequency 0...1'000 Hz (f_{max} = 1'250 Hz)
  Pulse output: Pulse value and polarity can be selected,
  Pulse width can be selected (0.005...10 s) Pulse frequency max. 100 Hz
- Status output: Can be configured for error messages or flow-, temperature- or pressure limit values
- Vortex frequency: Direct output of unscaled vortex pulses 0.5...2'850 Hz
- PFM signal (pulse-frequency modulation): by external connecting with flow computer RMC or RMC 621

PROFIBUS PA interface:

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption = 16 mA
- 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, Saturated steam pressure, Z-Factor, Vortex frequency, Electronic temperature, Reynoldsnumber, Flow velocity, Totalizer
- Input data: Pressure, Empty pipe detection (ON/OFF), Control totalizer, Display value
- Bus address adjustable via DIP-switches at the measuring device

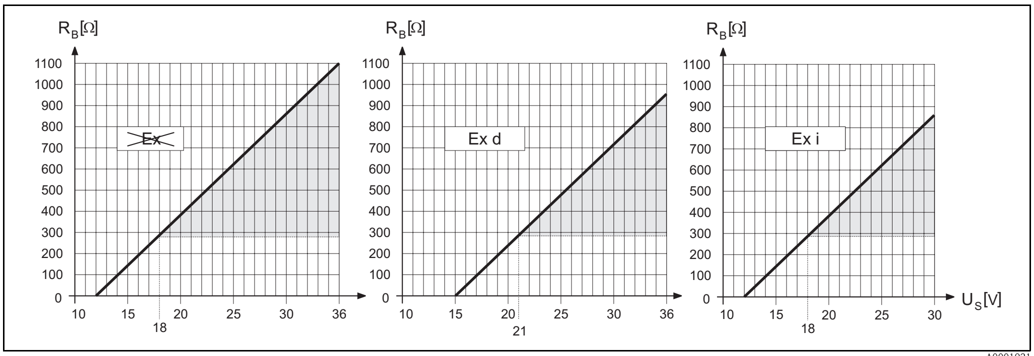
FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Current consumption = 16 mA
- Signal encoding = Manchester II
- FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: Supported baudrate = 31.25 kBit/s
- 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, Saturated steam pressure, Z-Factor, Vortex frequency, Electronic temperature, Reynoldsnumber, Flow velocity, Totalizer 1 + 2
- Input data: Pressure, Empty pipe detection (ON/OFF), Reset totalizer
- 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)
- Frequency output: error response can be selected
- Status output: "not conducting" in event of fault

Load



The grey shaded area indicates the permissible load (for HART: min. 250 Ω)
The load can be calculated as follows:

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

R_B Load
U_S Supply voltage: Non-Ex = 12...36 V DC; Ex d = 15...36 V DC; Ex i = 12...30 V DC
U_{Kl} Terminal voltage: Non-Ex = min. 12 V DC; Ex d = min. 15 V DC; Ex i = min. 12 V DC
I_{max} Output current (22.6 mA)

Low flow cut off

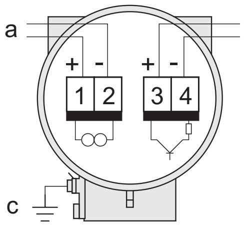
Switch points for low flow cut off can be selected as required

Galvanic isolation

The electrical connections are galvanically isolated from one another.

Power supply

Electrical connection

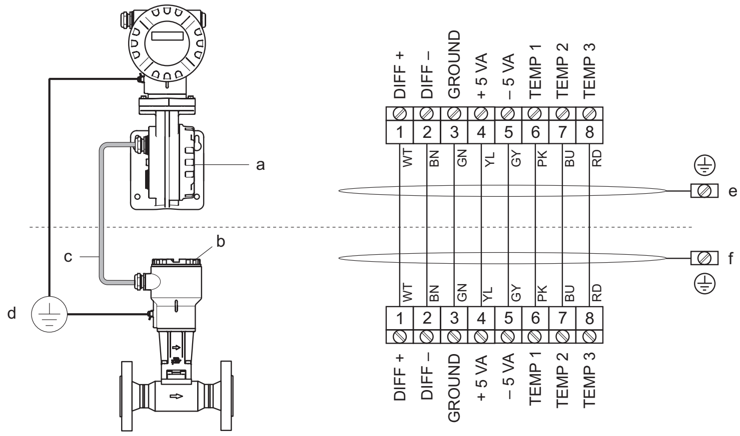


Electrical connection Prowirl 73

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 als be operated:
- as pulse or status output (except PROFIBUS PA and FOUNDATION Fieldbus)
- together with the flow computer RMC or RMS 621 as PFM output (pulse-frequency modulation)
c Ground terminal (relevant for remote version)

Connecting the remote version

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



Connecting the remote version

Supply voltage

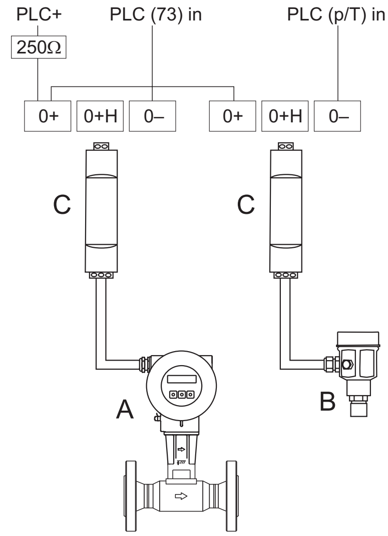
Non-Ex: 12...36 V DC (with HART 18...36 V DC)
Ex i: 12...30 V DC (with HART 18...30 V DC)
Ex d: 15...36 V DC (with HART 21...36 V DC)

PROFIBUS PA and FOUNDATION Fieldbus
Non-Ex, Ex d: 9...32 V DC
Ex i: 9...24 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

Connecting diagram for the input of an external temperature or pressure value via HART protocol

1. Process control system with common “positive”



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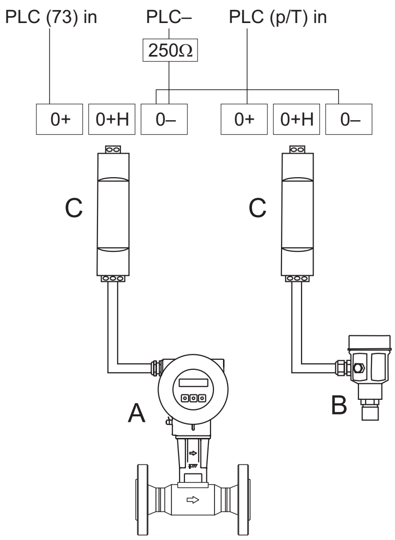
Connecting diagram for process control system with common “positive”

A) Prowirl 73
B) Cerabar-M or other HART- **and** *burst-able pressure-, temperature, and density-transmitter*
C) Active barrier RN221N

2. Process control system with common “negative”



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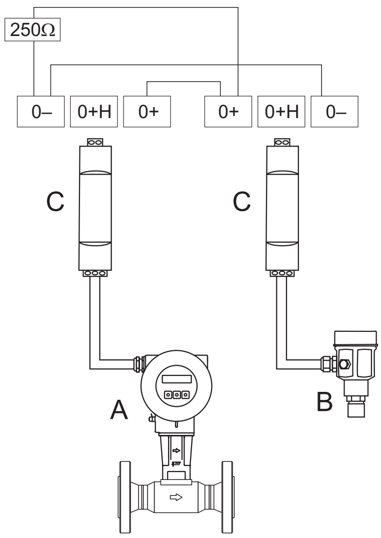
Connecting diagram for process control system with common “negative”

A) Prowirl 73
B) Cerabar-M or other HART- **and** *burst-able pressure-, temperature, and density-transmitter*
C) Active barrier RN221N

3. Connecting diagram without process control system



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Connecting diagram without process control system

A) Prowirl 73
B) Cerabar-M or other HART- **and** *burst-able pressure-, temperature, and density-transmitter*
C) Active barrier RN221N

Performance characteristics

Reference operating conditions

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

Maximum measured error

- 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% (stirred under water, following IEC 60751): 8 s
- Mass flow (saturated steam):
  - for flow velocity v 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 velocity v 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 fluids):
  Depends on the quality of the pressure value specified in the device functions.
  An individual error observation must be carried out.

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

Repeatability

±0.25% o.r. (of reading)

Operating conditions: installation

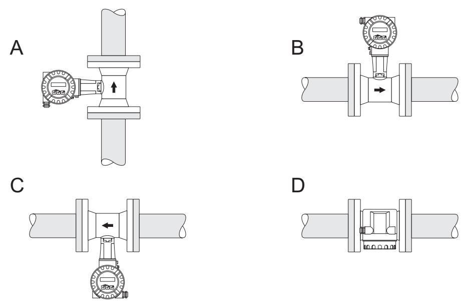
Installation instructions

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, upward flow is prefered in vertical pipes to avoid partial pipe filling (see orientation A).
In the case of hot fluids (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 fluid (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 mounting orientations.

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



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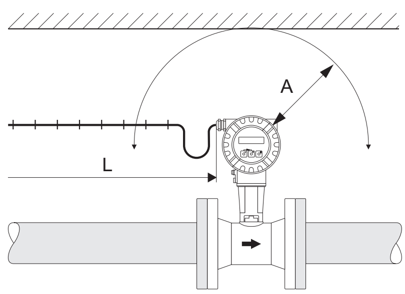
Possible orientations of the device

Minimum spacing and cable length

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



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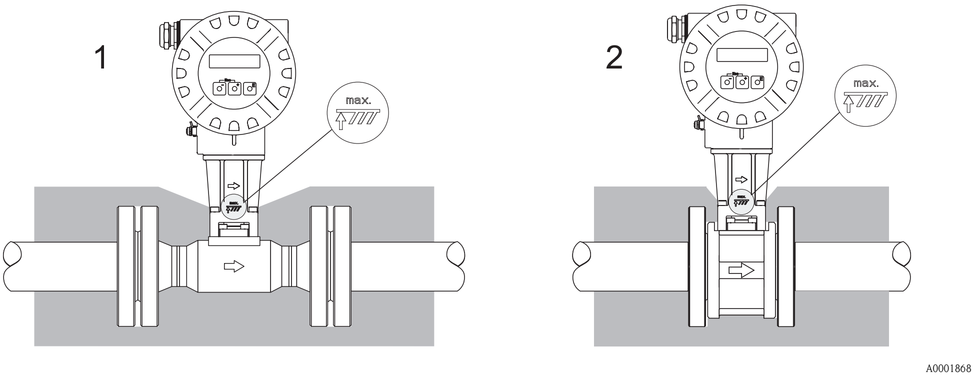
Rotating the electronics housing and the display

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

Piping insulation

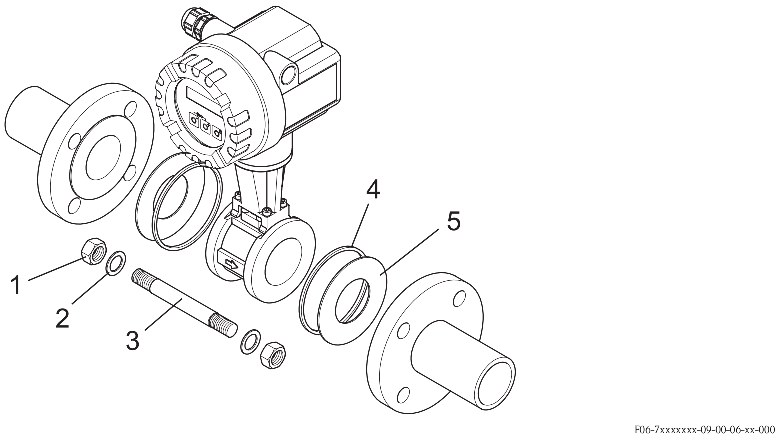
When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part serves as a radiator and protects the electronics from overheating (or undercooling).
The maximum insulation height permitted is illustrated in the diagrams. These apply equally to both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



1 = Flanged version
2 = Wafer version

Wafer version mounting set

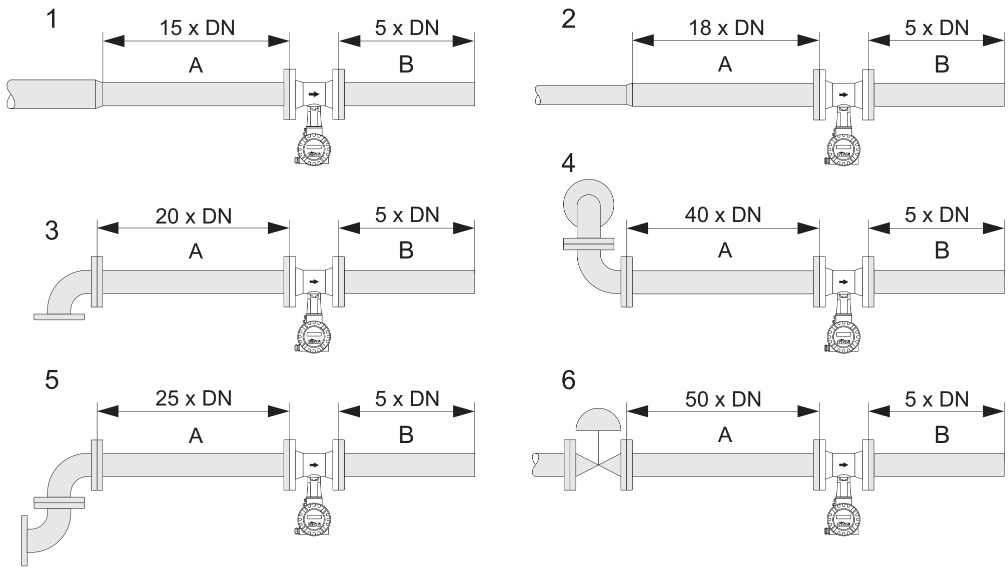
The centering rings supplied with the wafer style meters are used to mount and center the instrument.
A mounting set consisting of tie rods, seals, nuts and washers can be ordered separately.



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.



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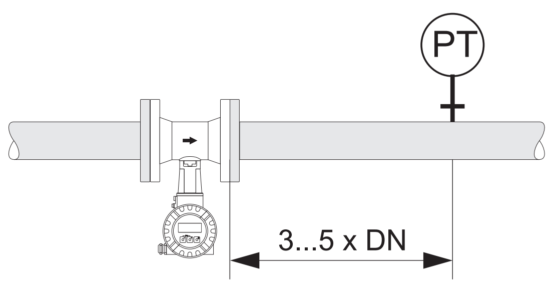
Minimum inlet and outlet runs with various flow obstructions

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

Note!
A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required (→ Page 12).

Outlet runs with pressure measuring point

If a pressure measuring point is installed after the device, please ensure there is sufficient enough distance between the device and the measuring point to avoid effects caused by the generated vortices.



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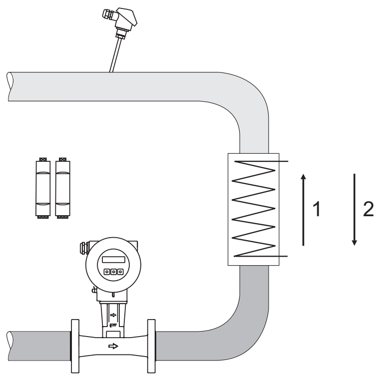
Installing a pressure measuring point (PT)

Installation of Delta Heat Applications (second temperature - value read in via HART)

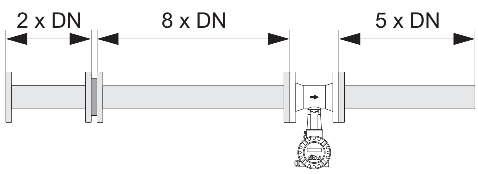
- For Saturated Steam Delat Heat Applications Prowirl 73 has to be installed on the steam side. Temperature of the cold side is read in via HART.
- For Water Delta Heat Applications Prowirl 73 can be installed on either warm or cold side.
- The inlet and outlet lenghts specified above have to be followed:



Saturated Steam or Water Delta Heat Application

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 x DN whilst maintaining accuracy.



Flow conditioner

The pressure loss for flow conditioners is calculated as follows:
Δp [mbar] = $0.0085 \cdot \rho$ [kg/m³] $\cdot v^2$ [m/s]

Examples of pressure loss for flow conditioner

- 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

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) according to EN 60529

Vibration resistance

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

Electromagnetic compatibility (EMC)

According to EN 61326/A1 and NAMUR Recommendation NE 21.

Operating conditions: process

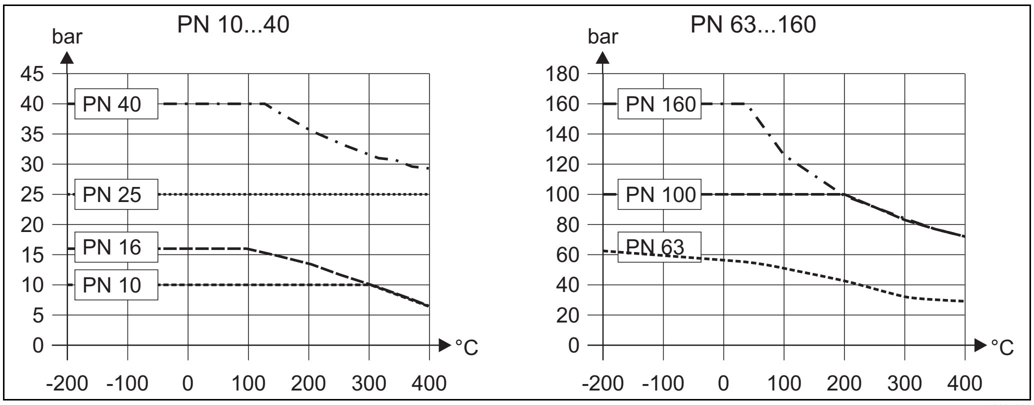
Medium temperature range

- DSC sensor (differential switched capacitor) capacitive sensor: –200...+400 °C
- Seal:
  - Graphite: –200...+400 °C
  - Kalrez: –20...+275 °C
  - Viton: –15...+175 °C
  - Gylon (PTFE): –200...+260 °C

Medium pressure

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

PN 10...40 → Prowirl 73 F, 73 W
PN 63...160 → Prowirl 73 F (in preparation)



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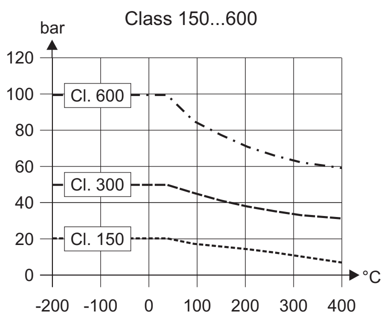
Pressure-temperature curve according to ANSI B16.5 and JIS, stainless steel
ANSI B 16.5:
Class 150...300 → Prowirl 73 W und 73 F
Class 600 → Prowirl 73 F (in preparation)

JIS B2238
10...20 K → Prowirl 73 W und 73 F
40 K → Prowirl 73 F (in preparation)



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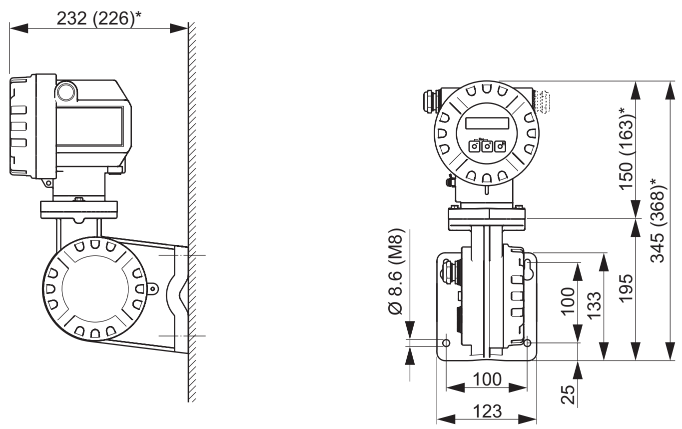
Pressure loss

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

Mechanical construction

Design, dimensions

Dimensions of transmitter, remote version

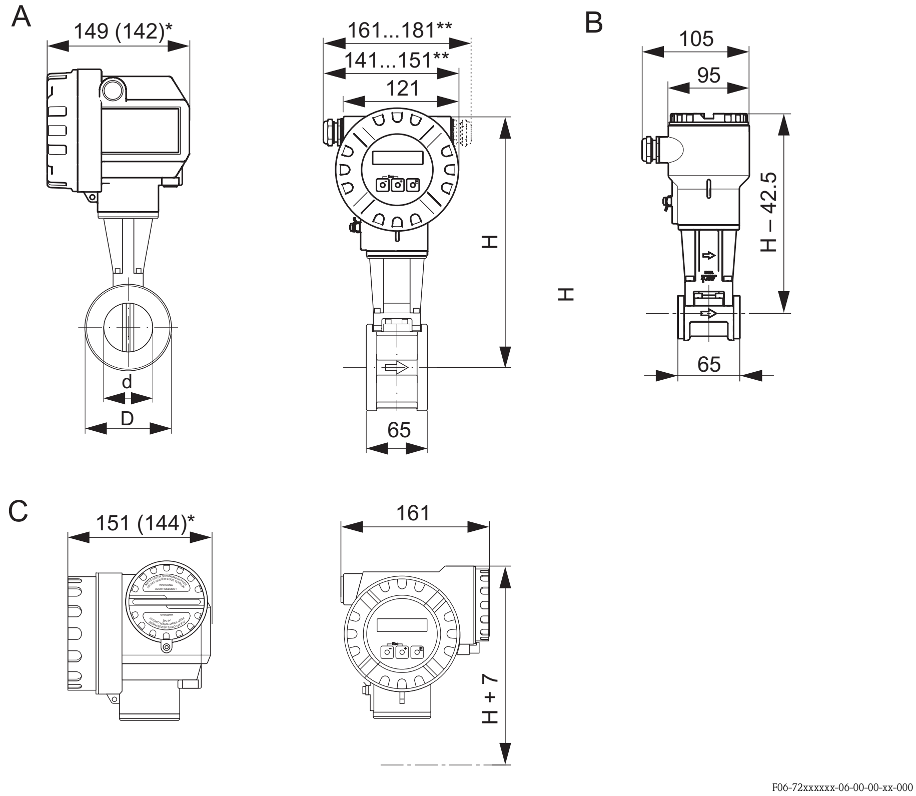


F06-72xxxxxx-06-03-00-xx-000

** 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 150 mm changes to 163 mm in the Ex d version.*
- *The dimension 345 mm changes to 368 mm in the Ex d version.*

Dimensions of Prowirl 73 W

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



Dimensions:
A = Standard and Ex i version
B = Remote version
C = Ex d version (transmitter)

** The following dimensions change as follows in the blind version (without local operation):*
– Standard and Ex i 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.

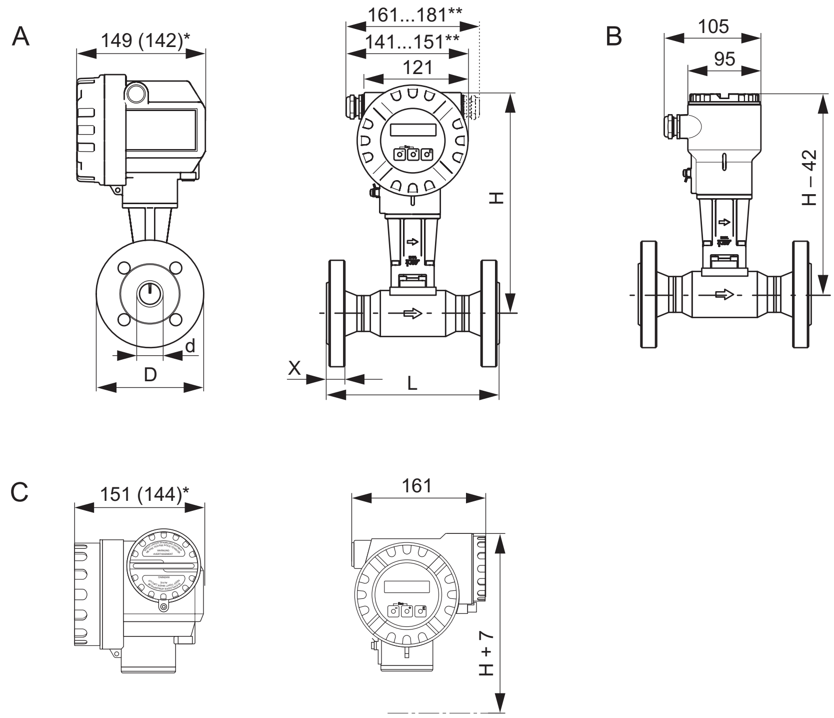
*** The dimension depends on the cable gland used.*

DN		d	D	H	Weight
DIN/JIS	ANSI	[mm]	[mm]	[mm]	[kg]
15	½"	16.50	45.0	276	3.0
25	1"	27.60	64.0	286	3.2
40	1½"	42.00	82.0	294	3.8
50	2"	53.50	92.0	301	4.1
80	3"	80.25	127.0	315	5.5
100	4"	104.75	157.2	328	6.5
150	6"	156.75	215.9	354	9.0

Dimensions of Prowirl 73 F

- EN 1092-1 (DIN 2501), PN 10...40, Ra = 6.3...12.5 mm,
  raised face according to EN 1092-1 Form B1 (DIN 2526 Form C), PN 10...40, Ra=6.3...12.5 µm
  raised face according to EN 1092-1 Form B2 (DIN 2526 Form E), PN 63...100, Ra=1.6...3.2 µm*
  raised face according to EN 2526 Form B2, PN 160, Ra=1.6...3.2 µm*
- ANSI B16.5, Class 150...300 , Ra = 125...250 min
- JIS B2238, 10...20K, Ra = 125...250 min

*... Pressure Rating PN63...160, Cl 600, 40K in preparation.



F06-72xxxxxx-06-00-00-xx-001

A = Standard and Ex i version, B = Remote version, C = Ex d version (transmitter)
** The following dimensions change as follows in the blind version (without local operation):*
– Standard and Ex i 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.*

Table: dimensions of Prowirl 73 F according to EN 1092-1 (DIN 2501)

DN	Pressure rateing	d [mm]	D [mm]	H [mm]	L [mm]	x [mm]	Wight [kg]
15	PN 40	17.3	95.0	277	200	16	5
	PN 160*	17.3	105.0	288	200	23	7
25	PN 40	28.5	115.0	284	200	18	7
	PN 100*	28.5	140	295	200	27	11
	PN 160*	27.9					
40	PN 40	43.1	150.0	292	200	21	10
	PN 100*	42.5	170.0	303	200	31	15
	PN 160*	41.1					
50	PN 40	54.5	165.0	299	200	23	12
	PN 63*	54.5	180.0	310	200	33	17
	PN 100*	53.9	195.0				19
	PN 160*	52.3					
80	PN 40	82.5	200.0	312	200	29	20
	PN 63*	81.7	215.0	323	200	39	24
	PN 100*	80.9	230.0				27
	PN 160*	76.3					
100	PN 16	107.1	220.0	324	250	32	27
	PN 40	107.1	235.0				
	PN 63*	106.3	250	335	250	49	39
	PN 100*	104.3	265				42
	PN 160*	98.3					
150	PN 16	159.3	285.0	338	300	37	51
	PN 40	159.3	300.0				
	PN 63*	157.1	345	359	300	64	86
	PN 100*	154.1	355.0				88
	PN 160*	146.3					
200	PN 10	207.3	340.0	377	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	404	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	427	450	51	121
	PN 16	309.7	460.0				129
	PN 25	307.9	485.0				140
	PN 40	307.9	515.0				158

*... Pressure Rating PN63...160, Cl 600, 40K in preparation.

Table: dimensions of Prowirl 73 F according to ANSI B16.5

<table>
<tr><th>DN</th><th colspan="2">Pressure rating</th><th>d [mm]</th><th>D [mm]</th><th>H [mm]</th><th>L [mm]</th><th>x [mm]</th><th>Weight [kg]</th></tr>
<tr><td rowspan="5">½"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>15.7</td><td>88.9</td><td rowspan="4">277</td><td rowspan="4">200</td><td rowspan="4">16</td><td rowspan="4">5</td></tr>
<tr><td>Cl. 300</td><td>15.7</td><td>95.0</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>13.9</td><td>88.9</td></tr>
<tr><td>Cl. 300</td><td>13.9</td><td>95.0</td></tr>
<tr><td>Cl. 600*</td><td>13.9</td><td>95.3</td><td>288</td><td>200</td><td>23</td><td>6</td></tr>
<tr><td rowspan="5">1"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>26.7</td><td>107.9</td><td rowspan="4">284</td><td rowspan="4">200</td><td rowspan="4">18</td><td rowspan="4">7</td></tr>
<tr><td>Cl. 300</td><td>26.7</td><td>123.8</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>24.3</td><td>107.9</td></tr>
<tr><td>Cl. 300</td><td>24.3</td><td>123.8</td></tr>
<tr><td>Cl. 600*</td><td>24.3</td><td>124.0</td><td>295</td><td>200</td><td>27</td><td>9</td></tr>
<tr><td rowspan="5">1½"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>40.9</td><td>127.0</td><td rowspan="4">292</td><td rowspan="4">200</td><td rowspan="4">21</td><td rowspan="4">10</td></tr>
<tr><td>Cl. 300</td><td>40.9</td><td>155.6</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>38.1</td><td>127.0</td></tr>
<tr><td>Cl. 300</td><td>38.1</td><td>155.6</td></tr>
<tr><td>Cl. 600*</td><td>38.1</td><td>155.4</td><td>303</td><td>200</td><td>31</td><td>13</td></tr>
<tr><td rowspan="5">2"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>52.6</td><td>152.4</td><td rowspan="4">299</td><td rowspan="4">200</td><td rowspan="4">23</td><td rowspan="4">12</td></tr>
<tr><td>Cl. 300</td><td>52.6</td><td>165.0</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>49.2</td><td>152.4</td></tr>
<tr><td>Cl. 300</td><td>49.2</td><td>165.0</td></tr>
<tr><td>Cl. 600*</td><td>49.2</td><td>165.1</td><td>310</td><td>200</td><td>33</td><td>14</td></tr>
<tr><td rowspan="5">3"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>78.0</td><td>190.5</td><td rowspan="4">312</td><td rowspan="4">200</td><td rowspan="4">29</td><td rowspan="4">20</td></tr>
<tr><td>Cl. 300</td><td>78.0</td><td>210.0</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>73.7</td><td>190.5</td></tr>
<tr><td>Cl. 300</td><td>73.7</td><td>210.0</td></tr>
<tr><td>Cl. 600*</td><td>73.7</td><td>209.6</td><td>323</td><td>200</td><td>39</td><td>22</td></tr>
<tr><td rowspan="5">4"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>102.4</td><td>228.6</td><td rowspan="4">324</td><td rowspan="4">250</td><td rowspan="4">32</td><td rowspan="4">27</td></tr>
<tr><td>Cl. 300</td><td>102.4</td><td>254.0</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>97.0</td><td>228.6</td></tr>
<tr><td>Cl. 300</td><td>97.0</td><td>254.0</td></tr>
<tr><td>Cl. 600*</td><td>97.0</td><td>273.1</td><td>335</td><td>250</td><td>49</td><td>43</td></tr>
<tr><td rowspan="5">6"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>154.2</td><td>279.4</td><td rowspan="4">348</td><td rowspan="4">300</td><td rowspan="4">37</td><td rowspan="4">51</td></tr>
<tr><td>Cl. 300</td><td>154.2</td><td>317.5</td></tr>
<tr><td rowspan="3">Schedule 80</td><td>Cl. 150</td><td>146.3</td><td>279.4</td></tr>
<tr><td>Cl. 300</td><td>146.3</td><td>317.5</td></tr>
<tr><td>Cl. 600*</td><td>146.3</td><td>355.6</td><td>359</td><td>300</td><td>64</td><td>87</td></tr>
<tr><td rowspan="2">8"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>202.7</td><td>342.9</td><td rowspan="2">377</td><td rowspan="2">300</td><td rowspan="2">42</td><td>64</td></tr>
<tr><td>Cl. 300</td><td>202.7</td><td>381.0</td><td>76</td></tr>
<tr><td rowspan="2">10"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>254.5</td><td>406.4</td><td rowspan="2">404</td><td rowspan="2">380</td><td rowspan="2">48</td><td>92</td></tr>
<tr><td>Cl. 300</td><td>254.5</td><td>444.5</td><td>109</td></tr>
<tr><td rowspan="2">12"</td><td rowspan="2">Schedule 40</td><td>Cl. 150</td><td>304.8</td><td>482.6</td><td rowspan="2">427</td><td rowspan="2">450</td><td rowspan="2">60</td><td>143</td></tr>
<tr><td>Cl. 300</td><td>304.8.9</td><td>520.7</td><td>162</td></tr>
</table>

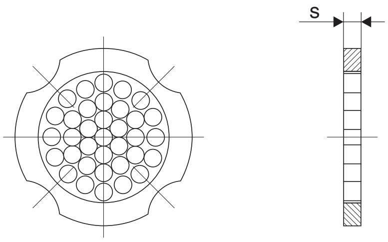
*... Pressure rating Cl 600 in preparation.

Table: dimensions of Prowirl 73 F according 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	277	200	16	5
	Schedule 80	20K	13.9	95.0				
		40K*	13.9	115.0	288	200	23	8
25	Schedule 40	20K	27.2	125.0	284	200	18	7
	Schedule 80	20K	24.3	125.0				
		40K*	24.3	130.0	295	200	27	10
40	Schedule 40	20K	41.2	140.0	292	200	21	10
	Schedule 80	20K	38.1	140.0				
		40K*	38.1	160.0	303	200	31	14
50	Schedule 40	10K	52.7	155.0	299	200	23	12
		20K	52.7	155.0				
	Schedule 80	10K	49.2	155.0				
		20K	49.2	155.0				
		40K*	49.2	165.0	310	200	33	15
80	Schedule 40	10K	78.1	185.0	312	200	29	20
		20K	78.1	200.0				
	Schedule 80	10K	73.7	185.0				
		20K	73.7	200.0				
		40K*	73.7	210.0	323	200	39	24
100	Schedule 40	10K	102.3	210.0	324	250	32	27
		20K	102.3	225.0				
	Schedule 80	10K	97.0	210.0				
		20K	97.0	225.0				
		40K*	97.0	240.0	335	250	49	36
150	Schedule 40	10K	151.0	280.0	348	300	37	51
		20K	151.0	305.0				
	Schedule 80	10K	146.3	280.0				
		20K	146.3	305.0				
		40K*	146.6	325.0	359	300	64	77
200	Schedule 40	10K	202.7	330.0	377	300	42	58
		20K	202.7	350.0				64
250	Schedule 40	10K	254.5	400.0	404	380	48	90
		20K	254.5	430.0				104
300	Schedule 40	10K	304.8	445.0	427	450	51	119
		20K	304.8	480.0				134

*... Pressure rating 40 K in preparation.

Dimensions of flow conditioner according to EN (DIN)/ANSI/JIS



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Flow conditioner according to EN (DIN)/ANSI/JIS, material 1.4435 (316L)

Table: dimensions of flow conditioner

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]	10 K	0.06	0.14	0.31	0.47	1.1	1.8	4.5	9.2	15.8	26.5
	20 K	0.06	0.14	0.31	0.47	1.1	1.8	5.5	9.2	19.1	26.5
	40 K	0.06	0.14	0.31	0.50	1.3	2.1	6.2	–	–	–

Weight

- Weight of Prowirl 73 W → see dimension table on Page 15.
- Weight of Prowirl 73 F → see dimension tables on Page 16 ff.
- Weight of flow conditioner according to DIN/ANSI/JIS → see dimension table on Page 20.

Material

- Transmitter housing:
  Powder-coated die-cast aluminium
- Sensor:
  – Flanged and wafer version.3
    Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR 0175
- Flanges:
  – EN (DIN) → Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR 0175 (DN 15...150: as of 2005 changeover from fully cast construction to construction with weld-on flanges in 1.4404)
  – ANSI and JIS → Stainless steel, A351-CF3M, in conformity with NACE MR 0175 (DN 15...150, ½"...6": as of 2005 changeover from fully cast construction to construction with weld-on flanges in 316/316L, in conformity with NACE MR 0175)
- DSC sensor (Differential Switched Capacitor; Capacitive Sensor):
  Wetted parts (marked as “wet” on the DSC sensor flange):
  – Standard for pressure rating up to PN 40, Cl 300, JIS 20K (excluding Dualsens version):
    Stainless steel 1.4435 (316L), in conformity with NACE MR 0175
  – Higher pressure rating and Dualsens-version (in preparation):
    Inconel 2.4668/N 07718 (B637) (Inconel 718), conform to NACE MR 0175
- Non-wetted parts:
  – Stainless steel, 1.4301 (CF3)
- Support:
  – Stainless steel, 1.4308 (CF8)
- Seal:
  – 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.

Ex-approval

- Ex i:
  - 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). For larger nominal diameters, certified flowmeters to Category III are optionally also available if necessary (depends on fluid and operating pressure). All devices are applicable for all fluids and instable gases on principle and have been designed and manufactured in accordance to sound 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 according 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 no. 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 Organisation). The device thus meets all the requirements of the specifications following:
- Certified according to PROFIBUS PA profile version 3.0 (device certification number available 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: Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.
- NACE Standard MR0175: 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 Labatory 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)

Ordering information

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

Accessories

- Spare parts as per separate price list
- Replacement transmitter Prowirl 73
- Flow conditioner
- Universal flow and energy computer RMC 621
- HART Communicator DXR 375 handheld terminal
- Active barrier preline RN 221 N
- Resistance thermometer Omnigrad TR10 (HART-able and burst-able) for Delta Heat Applications
- Pressure transmitter Cerabar M (HART-able and burst-able)
- Pressure transducer Cerabar S (PROFIBUS PA, FOUNDATION Fieldbus)
- Process display RIA 250, RIA 251
- Field display RIA 261 resp. RID 261 (PROFIBUS PA)
- Applicator
- ToF Tool - FieldTool Package
- Fieldgate FXA 520

Documentation

- Operating Instructions Proline Prowirl 73
- Operating Instructions Proline Prowirl 73 PROFIBUS PA
- Operating Instructions Proline Prowirl 73 FOUNDATION Fieldbus
- Related Ex-documentation
- System Information Proline Prowirl 72/73
- Related documentation for Pressure Equipment Directive

Subject to modification

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People for Process Automation

TI064D/06/en/03.05
50106388
FM+SGML 6.0