Technical Information
TI 062D/06/en
No. 50103356

Vortex Flow Measuring System
PROline prowirl 72

Reliable Flow Measurement of Gas, Steam and Liquids

Application
For measuring the volume flow of steam, gases and liquids.
For utility and process applications in the chemical, petrochemical, power and district heating industries and in many other branches.

Your benefits

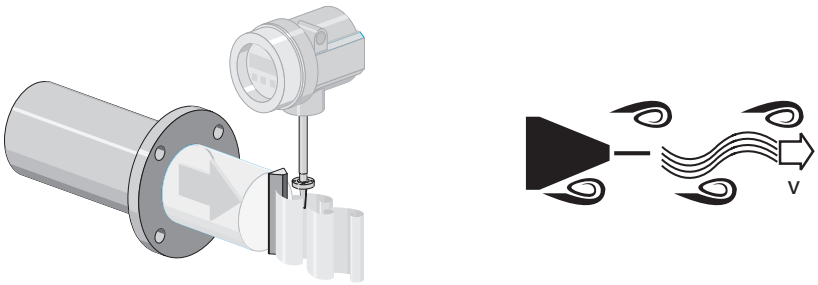
- Proven capacitive sensor (installed base > 100,000)
- Immune to:
  – Vibrations (over 1 g in all axes)
  – Temperature shocks (> 150 K/s)
  – Dirty media
  – Water hammer
- Process temp. range –200...+400 °C
- Universal:
  – Compact or remote version
  – Dualsens version, with two sensors and electronics (for redundancy)
  – Alloy C-22 version
- Connection to all common systems:
  – HART
  – PROFIBUS-PA
  – FOUNDATION Fieldbus
- Galvanically isolated pulse output available (for alarm, limit value etc.).
- Permanent self-monitoring and diagnosis of electronics and sensor.
- Correction of diameter mismatch.
- No maintenance, no moving parts, no zero-point drift.

Endress+Hauser
The Power of Know How

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 on both sides with opposite senses 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 application limits of the device. Therefore, the frequency of vortex shedding is directly proportional to the volume flow.



F06-7xxxxxxx-15-xx-06-xx-000

The K-factor is used as the proportional constant:

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

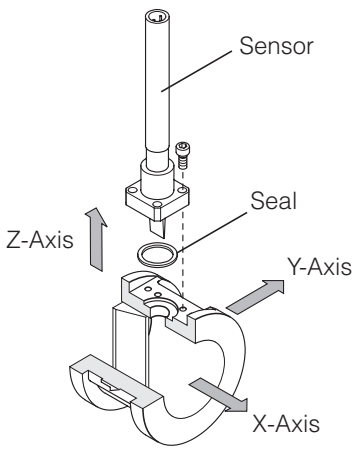
F06-7xxxxxxx-19-xx-06-en-000

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 its properties viscosity and density. In this way, the K-factor is also independent of the type of fluid to be measured, regardless of whether this is steam, a gas or a liquid.
The primary measuring signal is already digital (frequency signal) and a linear function of the flow. After manufacturing the meter, the K-factor is determined once-off in the factory by means of calibration and is not subjected to any long term drift or zero point shift.
The device does not contain any moving parts and requires no maintenance.

The capacitive sensor

The sensor of a vortex flowmeter has a major influence on the performance, robustness and reliability of the whole measuring system.
Prowirl 72 uses Endress + Hauser's proven and patented capacitive measuring technology, with to date more than 100,000 Vortex measuring points installed world wide.

Due to its internal mechanical balance, the DSC sensor (Differential Switched Capacitance), reads only the pressure pulses caused by the vortices and stays immune to any influence from mechanical pipe line vibrations.
The DSC sensor measures low flow rates at low fluid density even when pipe line vibrations are present. Therefore, Prowirl 72 keeps its wide turndown ratio even under rough operating conditions.
Vibrations of at least 1g at frequencies up to 500 Hz in all axes do not affect the flow measurement.
Thanks to its mechanical design, the capacitive sensor is also especially resistant to temperature shocks and water hammer in steam lines.



F06-7xxxxxxx-14-05-06-en-000

Measuring system

The measuring system consist 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 (DN 15...300)
  Flanged version (also available as version with two sensors and electronics for redundancy, DN 40...150)
- Prowirl W (DN 15...150)
  Wafer version

Transmitter
- Prowirl 72

Input

Measured variable

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

The output variables are volume flow or, if the process conditions are non-varying, calculated mass flow or corrected volume flow.

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 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:

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

F06-7xxxxxxx-19-xx-06-xx-000

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

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

F06-72xxxxxx-19-xx-06-xx-002

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:

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

F06-7xxxxxxx-19-xx-xx-en-002

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

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

F06-7xxxxxxx-19-xx-xx-en-003

T = Operating temperature;P = Operating pressure

Output

Output signal

- Current output:
  4...20 mA with HART, Full scale value and time constant (0...100 s) can be set
  Temperature coefficient: typically 0.005% o.r. / °C (o.r. = of reading)

- Pulse/status output:
  Open collector, passive,
  Galvanically isolated,
  Non-Ex, Ex d: U_{max} = 36 V, with 15 mA current limit, R_i = 500 Ω
  Ex i: U_{max} = 30 V, with 15 mA current limit, R_i = 500 Ω
  Can be configured as:
  – Pulse output:
    Pulse value and polarity can be selected (5...2000 ms),
    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...2850 Hz (pulse ratio 1:1).
  – PFM signal (pulse-frequency modulation):
    By connecting the pulse and current output.

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: 1 x Analog Input, 1 x Totalizer
– Output data: Volume flow, Calculated mass flow, Corrected volume flow, Totalizer
– Input data: Empty pipe detection (ON/OFF), Control totalizer
– Bus address adjustable via DIP-switches at the measuring device

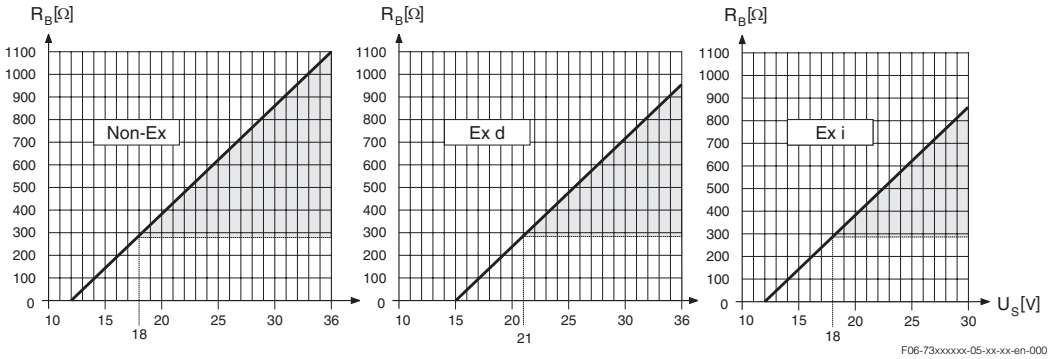
FOUNDATION Fieldbus interface:

– 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: 2 x Analog Input, 1 x Discrete Output
– Output data: Volume flow, calculated Mass flow, corrected Volume flow, Totalizer
– Input data: 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)
- Pulse 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:

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

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_{KI} 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

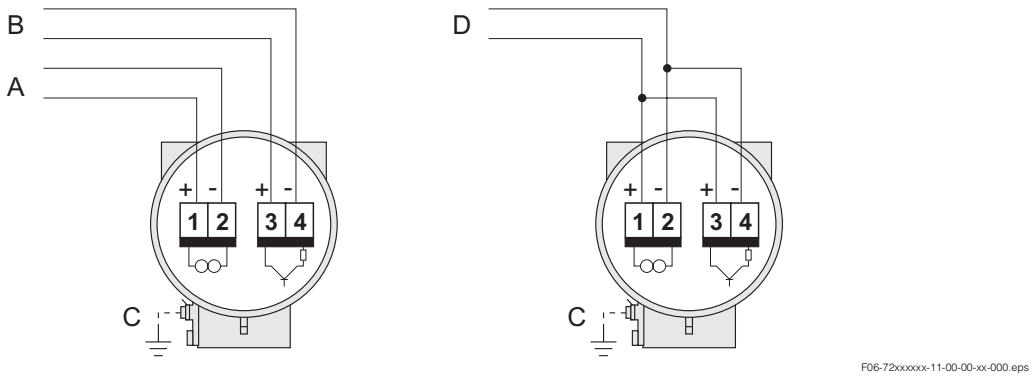
Switch points for low flow cut off can be selected as required

Galvanic isolation

The electrical connections are galvanically isolated from one another.

Power supply

Electrical connection



Electrical connection Prowirl 72

A - HART: Power supply, current output
- PROFIBUS-PA: 1 = PA+, 2 = PA–
- FOUNDATION Fieldbus: 1 = FF+, 2 = FF–
B Optional pulse output,
can also be operated as status output (except PROFIBUS-PA and FOUNDATION Fieldbus)
C Ground terminal (relevant for remote version)
D PFM wiring (pulse-frequency modulation)

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: 9...32 V DC
Ex i: 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" (not for remote version)
- 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 traccable to national standards
Calibration with the corresponding process connection of the respective norms

Maximum measured error

- Liquid:
  < 0.75% o.r. for Re > 20000
  < 0.75% o.f.s for Re between 4000...20000

- Gas/steam:
  < 1% o.r. for Re > 20000
  < 1% o.f.s for Re between 4000...20000

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

Repeatability

±0.25% o.r. (of reading)

Operating conditions: installation

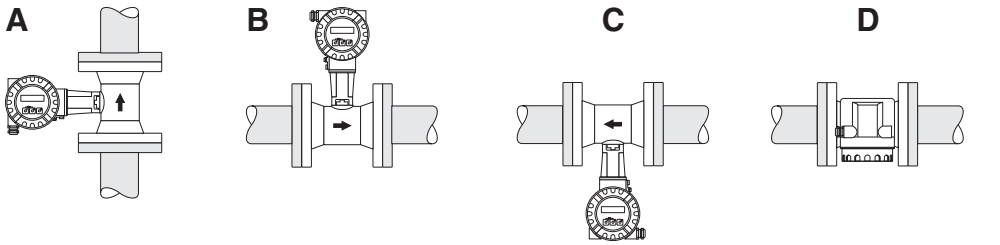
Installation instructions

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.

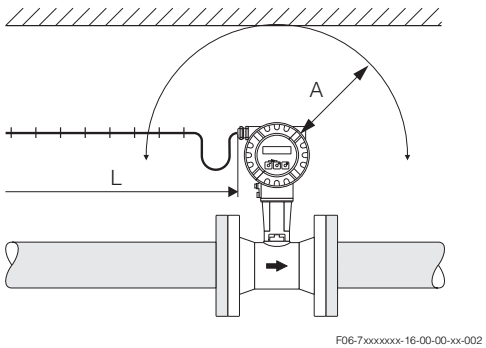
Caution!
- If fluid temperature is ≥ 200 °C, orientation B is not permitted for the wafer version (Prowirl 72 W) with a nominal diameter of DN 100 and DN 150.
- In case of vertical orientation and downward flowing liquid, the piping has always to be completely filled.



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



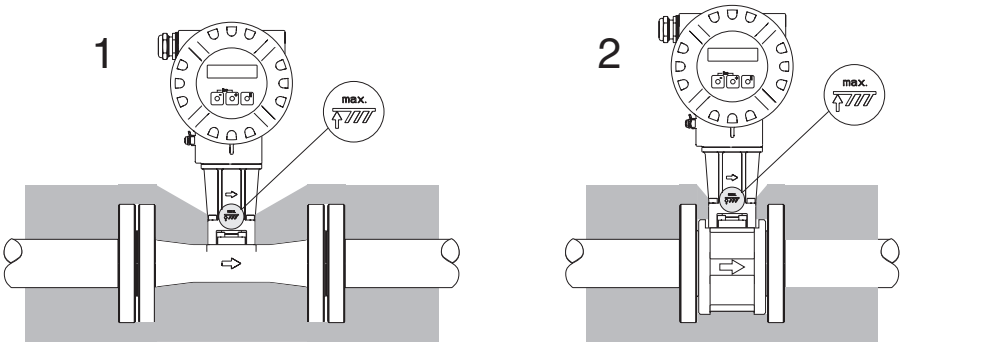
Rotating the electronics housing and the display

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.

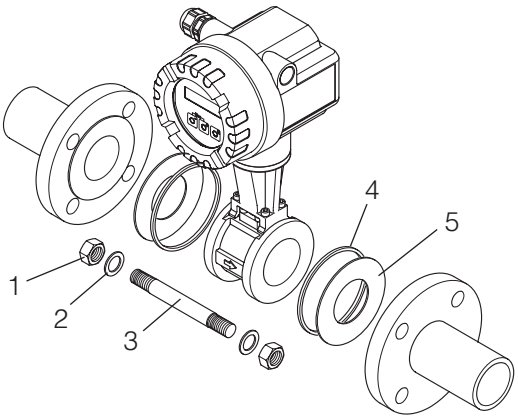


F06-7xxxxxxx-16-00-00-xx-001

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.

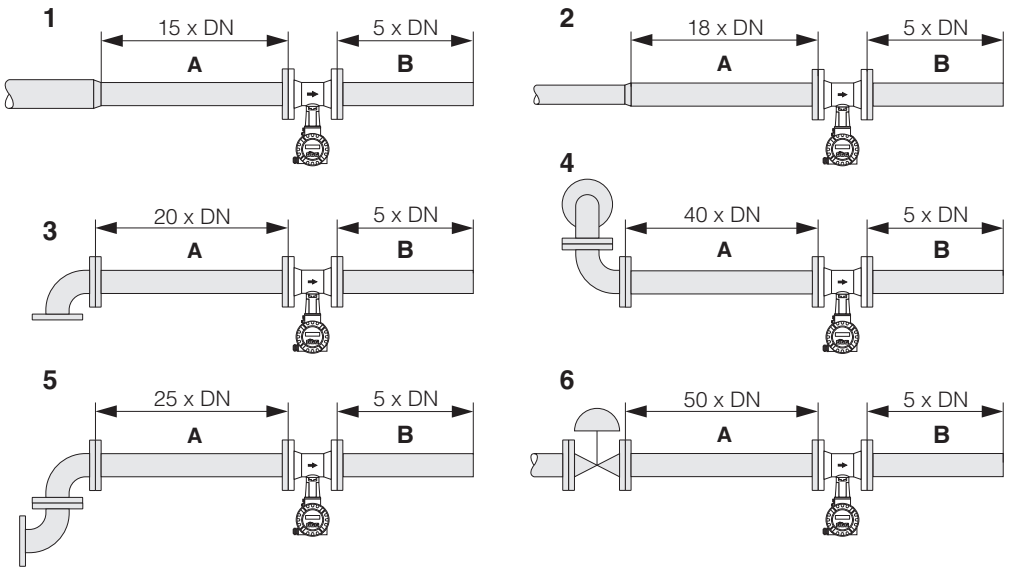


F06-7xxxxxxx-09-00-06-xx-000

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.



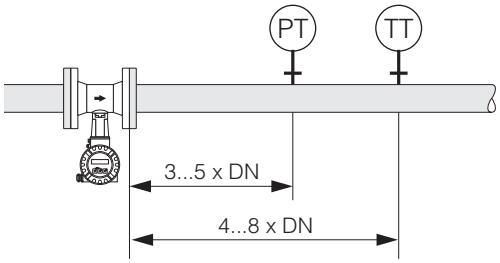
Minimum inlet and outlet runs with various flow obstructions

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

Note!
A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required (see Page 10).

Outlet runs with pressure and temperature measuring points

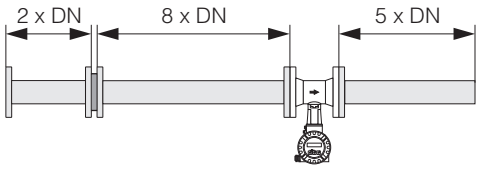
If pressure and temperature measuring points are installed after the device, please ensure there is a large enough distance between the device and the measuring point so there are no negative effects on the vortex shedding.



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



F06-7xxxxxxx-04-xx-xx-xx-001

Flow conditioner

The pressure loss for flow conditioners is calculated as follows:
Δp [mbar] = 0.0085 • ρ [kg/m³] • v² [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:

DSC standard sensor	–40...+260 °C
DSC high/low temperature sensor	–200...+400 °C
DSC sensor Inconel (PN 64...160, Class 600, JIS 40K and Dualsens version)	–200...+400 °C
DSC sensor Alloy C-22	–200...+400 °C

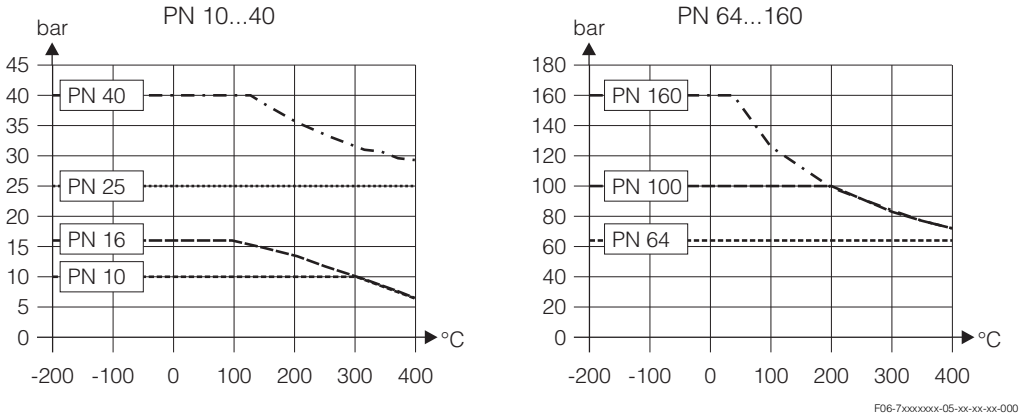
- Seal:

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

Medium pressure

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

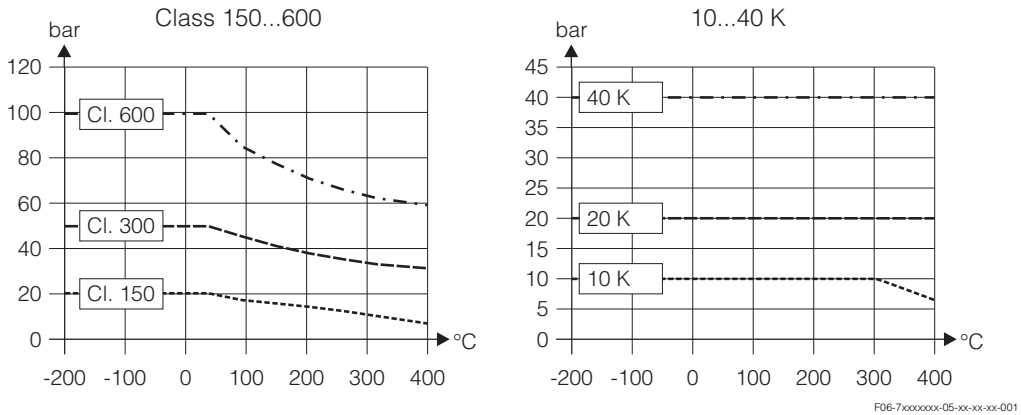
PN 10...40 → Prowirl 72 W and 72 F
PN 64...160 → Prowirl 72 F



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

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

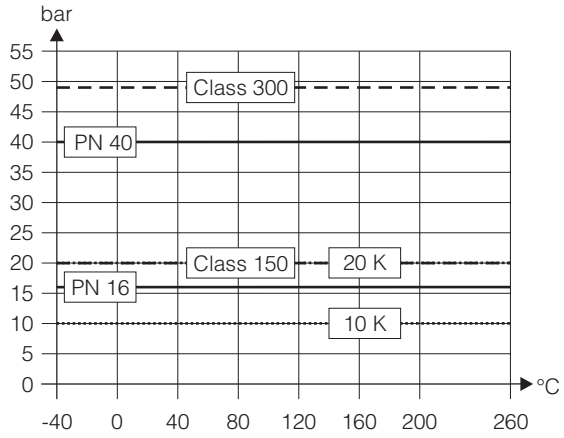
JIS B2238:
10...20K → Prowirl 72 W and 72 F
40K → Prowirl 72 F



Continued on next page.

Pressure-temperature curve according to DIN, ANSI B16.5 and JIS B2238, Alloy C-22

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



F06-7xxxxxxx-05-xx-xx-xx-002

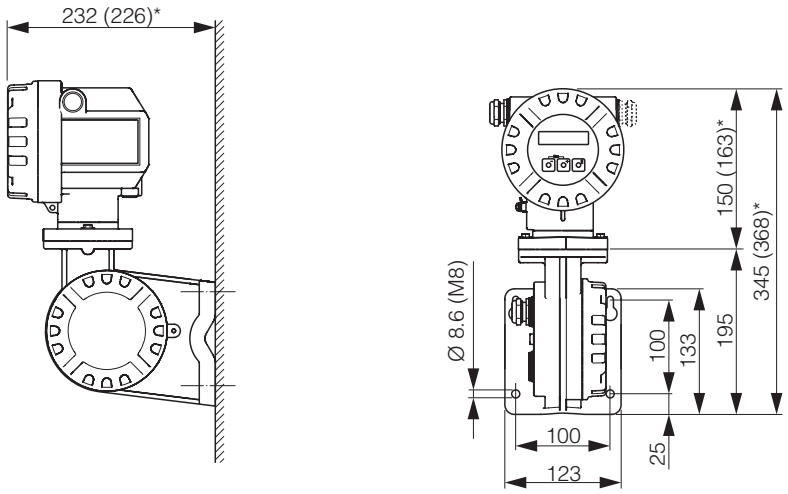
Pressure loss

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

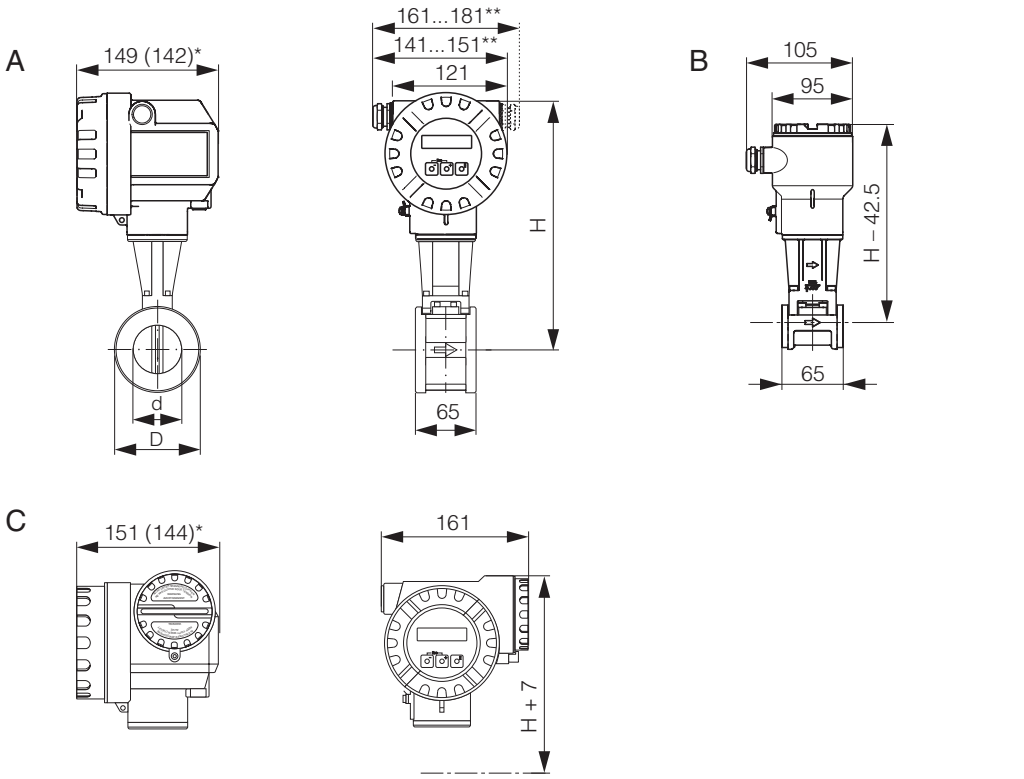


F06-72xxxxxx-06-03-00-xx-000.eps

** 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 72 W

Wafer version according to:
- EN 1092-1 (DIN 2501), PN 10...40
- ANSI B16.5, Class 150...300, Sch40
- JIS B2238, 10...20K, Sch40



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.

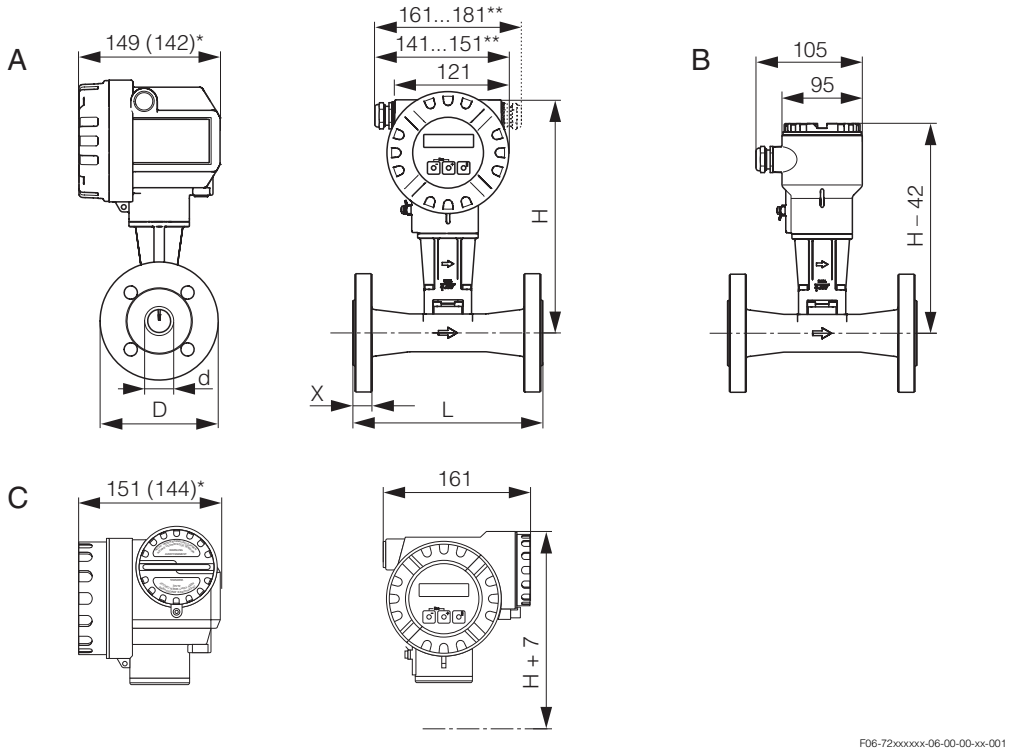
*** The dimension depends on the cable gland used.*

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

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	4"	104.75	157.2	299	6.5
150	6"	156.75	215.9	325	9.0

Dimensions of Prowirl 72 F

Flanged version according to:
- EN 1092-1 (DIN 2501), R_a = 6,3...12,5 µm
  raised face according to EN 1092-1 form B1 (DIN 2526 form C), PN 10...40, R_a = 6,3...12,5 µm
  raised face according to EN 1092-1 form B2 (DIN 2526 form E), PN 64...100, R_a = 1,6...3,2 µm
  raised face according to DIN 2526 form B2, PN 160, R_a = 1,6...3,2 µm
- ANSI B16.5, Class 150...600, R_a = 125...250 µin
- JIS B2238, 10...40K, R_a = 125...250 µin



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.*

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

Table: dimensions of Prowirl 72 F according 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	17.3	105.0	288	200	23	7
25	PN 40	28.5	115.0	255	200	18	7
	PN 100	28.5	140.0	295	200	27	11
	PN 160	27.9					
40	PN 40	43.1	150.0	263	200	21	10
	PN 100	42.5	170.0	303	200	31	15
	PN 160	41.1					

DN	Pressure rating	d [mm]	D [mm]	H [mm]	L [mm]	x [mm]	Weight [kg]
50	PN 40	54.5	165.0	270	200	23	12
	PN 64	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	283	200	29	20
	PN 64	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	295	250	32	27
	PN 40	107.1	235.0				
	PN 64	106.3	250.0	335	250	49	39
	PN 100	104.3	265.0				42
	PN 160	98.3					
150	PN 16	159.3	285.0	319	300	37	51
	PN 40	159.3	300.0				
	PN 64	157.1	345.0	359	300	64	86
	PN 100	154.1	355.0				88
	PN 160	146.3					
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

Table: dimensions of Prowirl 72 F according 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	16	5
		Cl. 300	15.7	95.0				
	Schedule 80	Cl. 150	13.9	88.9				
		Cl. 300	13.9	95.0				
		Cl. 600	13.9	95.3	288	200	23	6
1"	Schedule 40	Cl. 150	26.7	107.9	255	200	18	7
		Cl. 300	26.7	123.8				
	Schedule 80	Cl. 150	24.3	107.9				
		Cl. 300	24.3	123.8				
		Cl. 600	24.3	124.0	295	200	27	9
1½"	Schedule 40	Cl. 150	40.9	127.0	263	200	21	10
		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	303	200	31	13
2"	Schedule 40	Cl. 150	52.6	152.4	270	200	23	12
		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	310	200	33	14
3"	Schedule 40	Cl. 150	78.0	190.5	283	200	29	20
		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	323	200	39	22

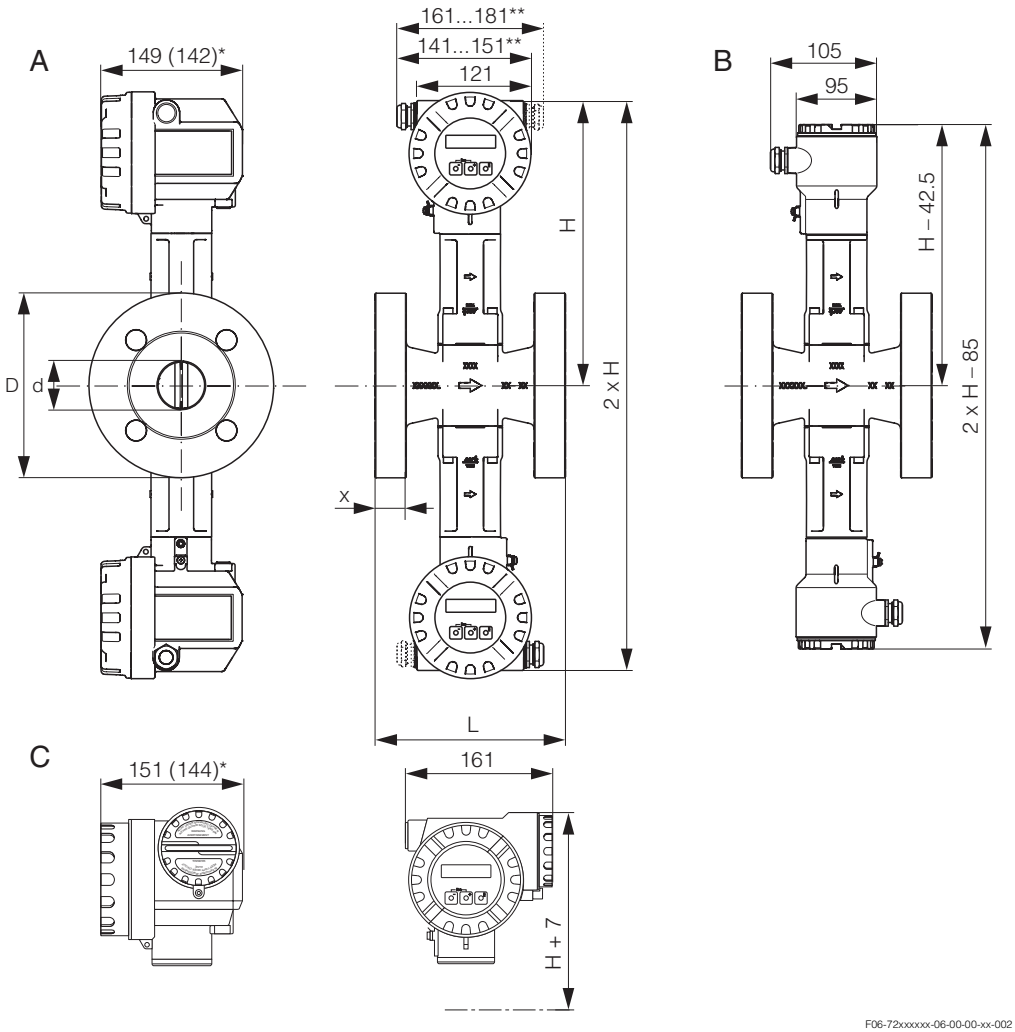
DN	Pressure rating		d [mm]	D [mm]	H [mm]	L [mm]	x [mm]	Weight [kg]
4"	Schedule 40	Cl. 150	102.4	228.6	295	250	32	27
		Cl. 300	102.4	254.0				
	Schedule 80	Cl. 150	97.0	228.6				
		Cl. 300	97.0	254.0				
		Cl. 600	97.0	273.1	335	250	49	43
6"	Schedule 40	Cl. 150	154.2	279.4	319	300	37	51
		Cl. 300	154.2	317.5				
	Schedule 80	Cl. 150	146.3	279.4				
		Cl. 300	146.3	317.5				
		Cl. 600	146.3	355.6	359	300	64	87
8"	Schedule 40	Cl. 150	202.7	342.9	348	300	42	64
		Cl. 300	202.7	381.0				76
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

Table: dimensions of Prowirl 72 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	248	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	255	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	263	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	270	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	283	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	295	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	319	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	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

Dimensions of Prowirl 72 F, Dualsens version

- EN 1092-1 (DIN 2501), R_a = 6,3...12,5 µm
  raised face according to EN 1092-1 form B1 (DIN 2526 form C), PN 10...40, R_a = 6,3...12,5 µm
  raised face according to EN 1092-1 form B2 (DIN 2526 form E), PN 64...100, R_a = 1,6...3,2 µm
  raised face according to DIN 2526 form B2, PN 160, R_a = 1,6...3,2 µm
- ANSI B16.5, Class 150...600, R_a = 125...250 µin
- JIS B2238, 10...40K, R_a = 125...250 µin



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.*

Note!
The weight data refer to the compact version.
The weight increases by 0.5 kg for the version with extended temperature range.

Table: dimensions of Prowirl 72 F Dualsens version according 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 64	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 64	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 64	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 64	157.1	345.0				89
	PN 100	154.1	355.0				91
	PN 160	146.3	355.0				

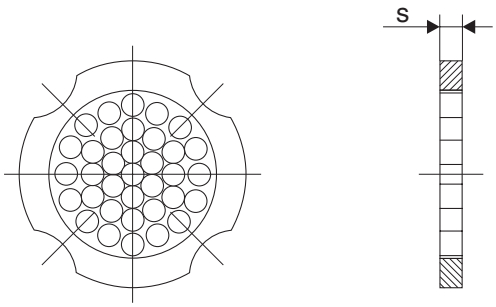
Table: dimensions of Prowirl 72 F Dualsens version according to ANSI B16.5

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				
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				

Table: dimensions of Prowirl 72 F Dualsens version according 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 according to EN (DIN) / ANSI



F06-7xxxxxxx-06-00-06-xx-001

Flow conditioner according to EN (DIN) / ANSI, 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 64	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

Weight

- Weight of Prowirl 72 W → see dimension table on Page 13.
- Weight of Prowirl 72 F → see dimension tables on Page 14 ff.
- Weight of Prowirl 72 F, Dualsens version → see dimen. tab. on Page 17 ff.
- Weight of flow conditioner according to EN (DIN)/ANSI → see dimension table on Page 19.

Material

- Transmitter housing:
  – Powder-coated die-cast aluminium
- Sensor:
  – Flanged version:
  Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR 0175;
  Alloy C-22 version → Alloy C-22 2.4602 (A 494-CX2MW/N 26022)
  – Wafer version:
  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 with pressure rating up to PN 40: as of 2004 changeover from fully cast construction to construction with weld-on flanges in 1.4404)
  – ANSI und JIS → Stainless steel, A351-CF3M, in conformity with NACE MR 0175
  (½"...6" with pressure rating up to Cl 300 and DN 15...150 with pressure rating up to 20 K: as of 2004 changeover from fully cast construction to construction with weld-on flanges in 316/316L, in conformity with NACE MR 0175)
  – Alloy C-22 version (EN/DIN/ANSI/JIS) → Alloy C-22 2.4602 (A 494-CX2MW/N 26022)
- 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
  – Higher pressure ratings and Dualsens version:
  Inconel 2.4668/N 07718 (B637) (Inconel 718), in conformity with NACE MR 0175
  – Alloy C-22 sensor: Alloy C-22, 2.4602/N 06022, in conformity with 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
  - CSA
    Class I/II/III Div. 1/2, Group A...G
    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

Accessories

- Wafer version mounting set
- Spare parts as per separate price list
- Replacement transmitter Prowirl 72
- Universal flow and energy computer RMC 621
- Steam computer RMS-621
- Compart DXF 351 flow computer
- Flow conditioner
- HART Communicator DXR 275 handheld terminal
- HART Communicator DXR 375 handheld terminal
- Active barrier preline RN 221 N
- Pressure transducer Cerabar T resp. Cerabar S (PROFIBUS-PA, FOUNDATION Fieldbus)
- Thermoresistance Omnigrad TR 10
- 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 72
- Operating Instructions PROline Prowirl 72 PROFIBUS-PA
- Operating Instructions PROline Prowirl 72 FOUNDATION Fieldbus
- Related Ex-documentation
- System Information PROline Prowirl 72
- System Information PROline Prowirl 72/73
- Related documentation for Pressure Equipment Directive

Additional ordering information for Prowirl 72

You can order Prowirl 72 with pre-programming of the most important parameters. For this purpose the following informations are required when ordering the device:
- 20 mA value = measured value (z.B. 1000 kg/h) that shall result in a current of 20 mA
- Pulse value (if the device is ordered with a pulse output)

If you want to display the flow in mass units, please indicate in addition:
- the mean operation density of your media incl. unit

If you want to display the flow in corrected volume flow units, please indicate in addition:
- the operation and the reference density of your media incl. unit

You can reset the device to this ordered state later on.

Subject to modification

Endress+Hauser GmbH+Co.
Instruments International
P.O. Box 2222
D-79574 Weil am Rhein
Germany

Tel. (07621) 975-02
Tx 773926
Fax (07621) 975 345
e-mail: info@ii.endress.com

Internet:
http://www.endress.com

Endress+Hauser
The Power of Know How

11.01

TI 062D/06/en/12.03
50103356
FM+SGML 6.0