

## Proline Prowirl F/R/O 200

### Multivariable vortex flowmeter with integrated pressure and temperature measurement

#### For transparent and cost-efficient energy management of steam and gas

- Reduced installation costs: a single device for flow, pressure and temperature measurement; flow computer included
- Efficient steam plant operation thanks to globally unique wet steam detection/measurement
- Can be used anywhere: flexible alignment of the pressure measuring unit depending on installation position and space
- Increased plant availability: robust sensors with long-term stability and over 400 000 installations worldwide
- High resistance to vibration, temperature shocks, plug flow water hammer and condensation-induced water hammer
- Industry-compliant pressure signal transmission acc. to ISO 2186
- Maximum operational safety thanks to Heartbeat Technology: device verification without process interruption (TÜV-certified)
- Genuine two-wire technology for cost-effective system integration
- Traceable measurement results thanks to accredited calibration rigs



# Proline simply clever

Process monitoring is becoming more demanding and the need for maximum product quality is steadily increasing. This is why Endress+Hauser continues to provide industry-specific flow measurement solutions optimized for future technology requirements.

The new generation of our Proline flowmeters is based on a uniform device concept. This means time and cost savings, as well as maximum safety over the entire plant life cycle.



#### Heartbeat Technology

For permanent self-monitoring, diagnostic and device verification



#### Simple operation (HMI)

Time-saving operating concept



#### HistoROM

Automatic data storage and data restoration



#### W@M Life Cycle Management

Open information system for device documentation and management

## All-in-one

For maximum accuracy in steam and gas measurement

As a multivariable vortex flowmeter, Prowirl 200 offers all-in-one: simultaneous measurement of mass flow, corrected volume flow, energy flow, temperature, pressure and even the steam quality. Regardless of which process conditions are prevalent in your plant and how much your process variables fluctuate, Prowirl ensures highly precise measurements, providing comprehensive energy management for a wide variety of fluids:

- Wet steam, saturated steam, superheated steam
- Compressed air, nitrogen, oxygen, argon, natural gas
- Water, thermal oils, hydrocarbons

#### Many questions – Prowirl provides answers

In many applications in the process industry, pressure and temperature are often inconsistent, fluctuating greatly. If such effects are not compensated, this can lead to massive measurement errors and thus to losses of energy and money when measuring compressible fluids such as gas and steam. Therefore, the questions that plant operators ask themselves are always the same:

- Is the mass and energy flow that I measure with a vortex flowmeter correct?
- How great are the pressure and temperature fluctuations in my line?
- What are the causes for possible deviations between the expected and measured values?
- Does the mass balance between the main pipe and distribution system match?

Prowirl F/R/O 200 is guaranteed to provide an answer to all these questions! Thanks to integrated pressure and temperature measurement, Prowirl ensures maximum measuring accuracy when determining the steam density and energy content. Costly and time-consuming installation of separate measuring devices for flow, pressure and temperature is now a thing of the past (► page 4).



### 1 Heartbeat Technology – diagnostics and verification

- Continuous verification of signal chains for the flow, pressure and temperature measurement (sensor integrity)
- Device verification at the push of a button during operation
- Creation of verification reports

### 2 Flexible installation

Complete freedom when installing in horizontal and vertical pipes thanks to a pressure measuring unit that can be rotated in  $4 \times 90^\circ$  steps

### 3 Safe operation

- Robust meter body for long-term operation
- Typical industrial siphon (G $\frac{1}{2}$ "") for optimum protection from high temperatures and pressure peaks (ISO 2186)
- Robust pressure measuring cell with guaranteed overload resistance up to 40 times the nominal pressure

### 4 First-class accuracy

The most accurate mass flow measurement using a single vortex flowmeter because the volume flow, pressure and temperature are recorded at the same place.

### 5 Intelligent energy computer


- Automatic detection of changes in the steam state
- Automatic correction of the mass flow and energy flow calculation of steam (and/or condensate) in case of deviations from the saturated steam curve
- Automatic compensation also for gases





# Added value through multivariable measurement

Saving time and costs over the long term

|  | <b>Prowirl F/R/O 200</b><br>with integrated pressure and temperature measurement | <b>Traditional measuring point</b><br>with separate measuring devices |
|--|--|---|
| Flowmeter  | ↗↗↗  | ↗↗  |
| Pressure sensor  | -  | ↘   |
| Temperature sensor   | -  | ↘   |
| Flow computer  | -  | ↘   |
| Installation (mechanical)  | ↘  | ↗↗↗   |
| Wiring (electrical)  | ↘  | ↗↗  |
| Configuration costs  | low  | high  |
| Max. measured error  | ±1.5% o.r.   | ±2 to 5% o.r.   |

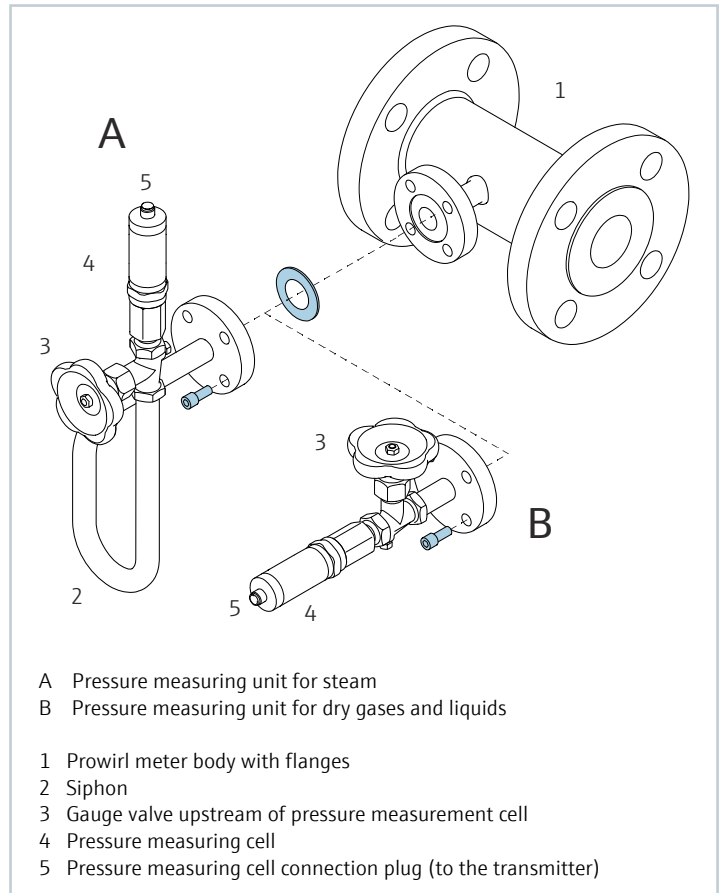
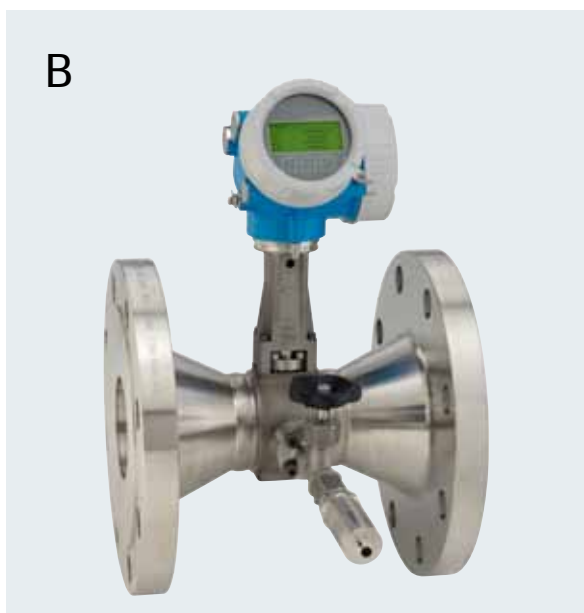
- No costs   ↘ Low costs   ↗↗ Average costs   ↗↗↗ High costs

# Prowirl fits everywhere

## Rotable pressure measuring unit for each orientation

The industrial and robust design of the pressure measuring unit enables operation even in harsh ambient conditions. The pressure measuring unit can be rotated in  $4 \times 90^\circ$  steps, enabling optimum alignment of the vortex flowmeter with respect to the following:

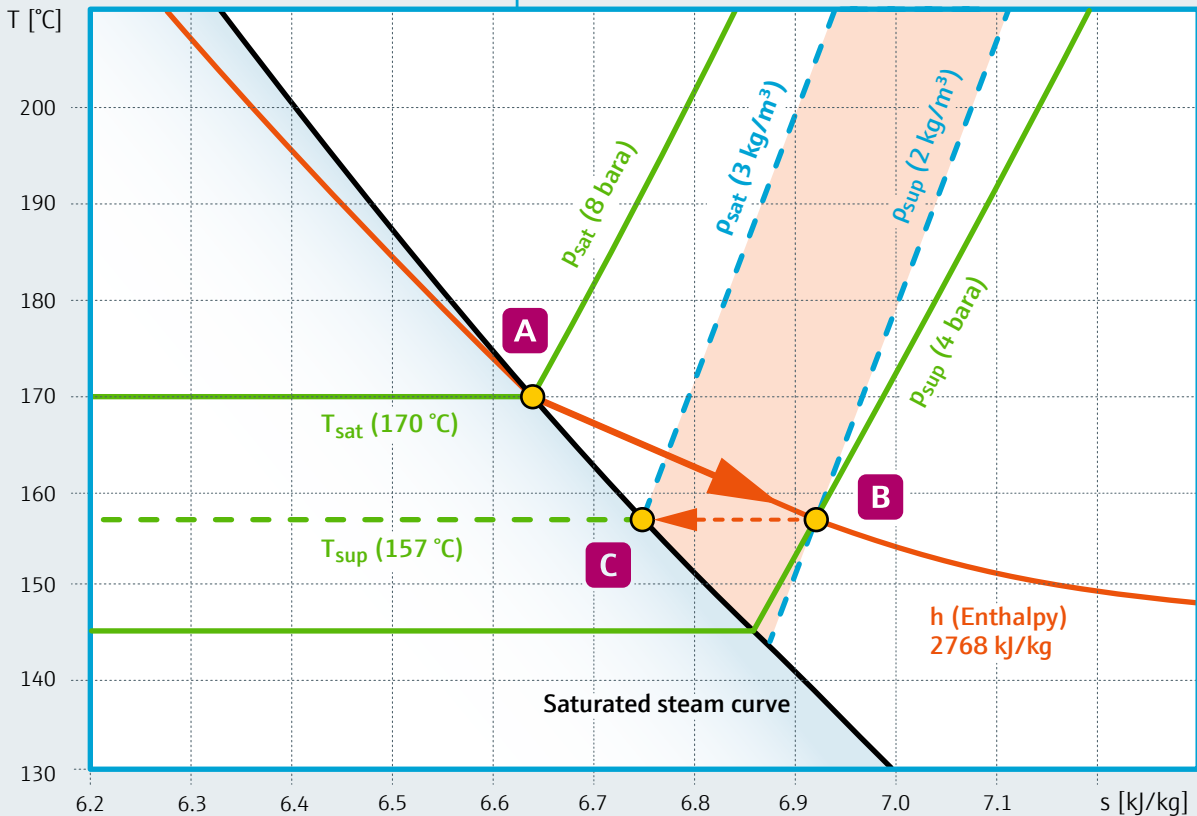
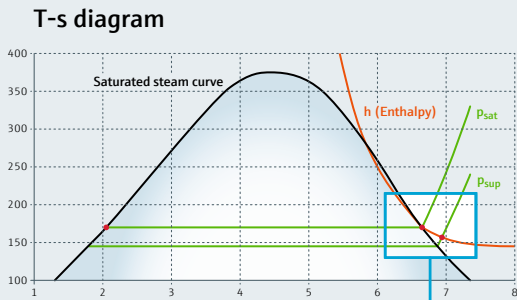
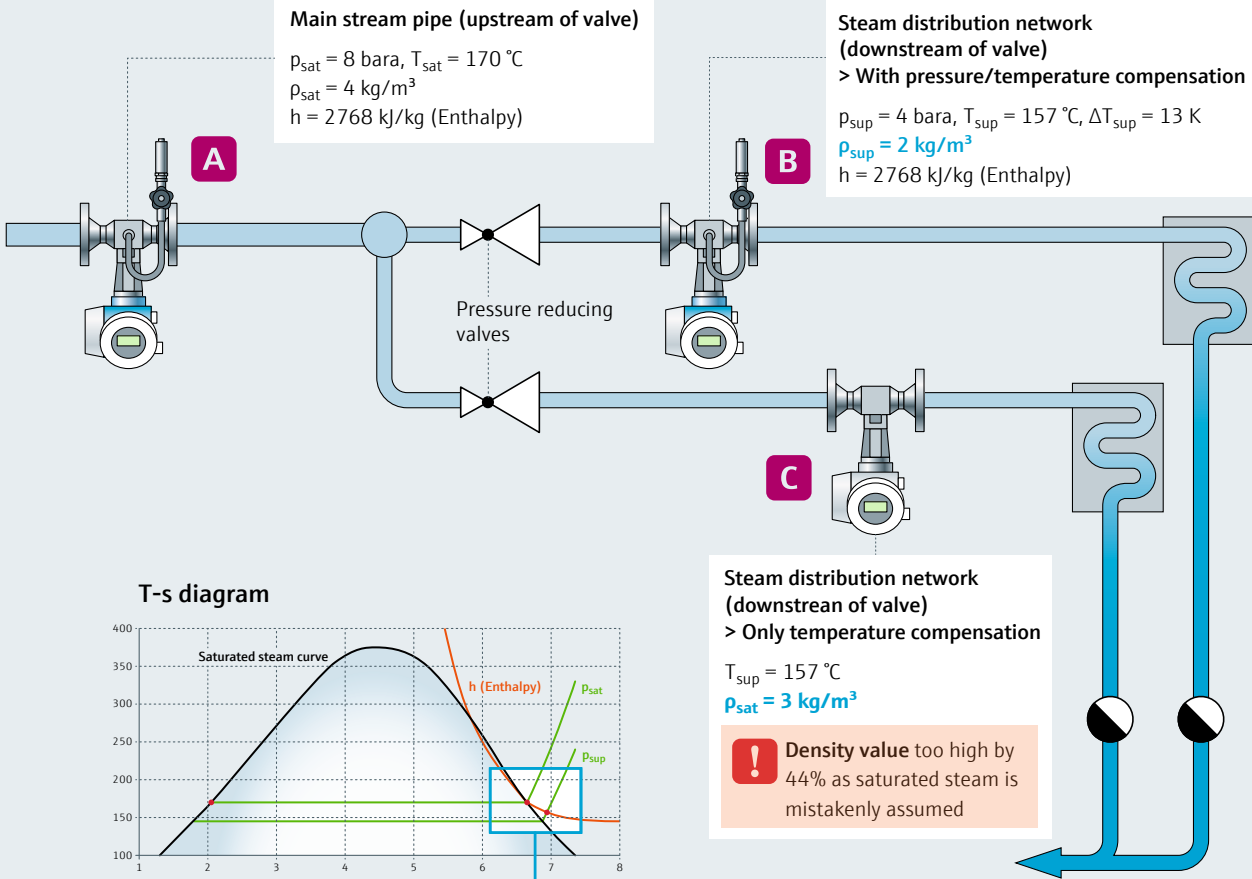
- Available space
- Horizontal or vertical pipings
- Positioning of the transmitter (protection from overheating due to heat thermal radiation upward)



### ! Standard-compliant pressure line (ISO 2186)

Prowirl fulfills the international standard ISO 2186 with respect to the "Connections for pressure signal transmission." This standard recommends an inside diameter of no less than 6 mm and (preferably) at least 10 mm for pressure lines if condensation is probable or if gas bubbles are released in a liquid.

Pressure and temperature compensation with Prowirl F/R/O 200





## A real-world example

### Accurate steam mass and energy measurement downstream of pressure reducing valves


Utilities frequently have various requirements for process pressure and temperature. The different consumers in a plant require steam at a different pressure. The steam density plays a central role in correct cost allocation and steam billing.

Steam generation and distribution **(A)** is usually carried out on a shared, higher pressure level ( $p_{\text{sat}}$ ). Pressure reducing valves between the distribution systems and the end users adjust the steam to the required pressure level ( $p_{\text{sup}}$ ).

Usually, distribution systems are operated using saturated or even slightly superheated steam. The pressure reduction process involves throttling which occurs at constant enthalpy ( $h$ ), meaning that the specific energy content of the steam remains the same. Through isenthalpic relaxation in the pressure reducing valve, the steam behind the valve **(B)** is no longer saturated, but is superheated instead ( $\Delta T_{\text{sup}} = 13 \text{ K}$ ).

In this situation, vortex flowmeters that only feature temperature compensation **(C)** assume that there is saturated steam both at the front and at the rear of the control valve. This explains the steam balancing deviations that frequently occur in branched distribution systems.

To correctly determine steam density ( $\rho_{\text{sup}}$ ) and steam mass when steam is superheated, pressure and temperature must be measured correctly. Therefore, Prowirl 200 with an integrated pressure and temperature measurement, as well as an intelligent steam computer, always ensures reliable steam density values.

 **Globally unique**


Prowirl measures all types of steam right in the pipeline including steam quality and the quantity of condensate.



# Technical data

| Prowirl 200 (transmitter) |   |
|---------------------------|---|
| Display                   | 4-line display with push buttons or with touch control (backlit)  |
| Operation                 | <ul style="list-style-type: none"> <li>Via local display (17 operating languages)</li> <li>Via operating tools, e.g. "FieldCare" from Endress+Hauser</li> </ul> |
| Measured variables        | Volume flow, mass flow, temperature, pressure, dryness fraction (steam quality and quantity)  |
| Power supply              | DC 13 to 35 V (blind version without display)   |
| Ambient temperature       | -40 to +80 °C (-40 to +176 °F)<br>Optional: up to -50 °C (-58 °F)   |
| Degree of protection      | IP66 and IP67 (Type 4X enclosure)   |
| Design Housing material   | <ul style="list-style-type: none"> <li>Compact or remote</li> <li>Aluminum or stainless steel</li> </ul>  |
| Galvanic isolation        | All circuits for outputs and power supply are galvanically isolated from each other   |
| Output/Input              | Current output (4–20 mA, HART); 2 <sup>nd</sup> current output (optional); pulse/frequency/switch output; passive current input (optional)                      |
| Communication             | HART  |
| Ex approvals              | ATEX, IEC, cCSAus, NEPSI, TIIS  |
| Ignition protection type  | Intrinsically safe (Ex ia/IS)<br>Flame-proof (Ex d/XP), Ex n  |

| Prowirl F/R/O (sensors with p/T measurement) |   |
|--|---|
| Nominal diameters                            | <ul style="list-style-type: none"> <li>Prowirl F: DN 25 to 300 (1 to 12")</li> <li>Prowirl R: DN 40 to 250 (1½ to 10")</li> <li>Prowirl O: DN 25 to 300 (1 to 12")</li> </ul>   |
| Process connections                          | <ul style="list-style-type: none"> <li>Prowirl F/R/O: Flange (EN [DIN], ASME, JIS)</li> <li>Prowirl O: Flange (EN [DIN], ASME, JIS), butt-weld version</li> </ul>   |
| Process pressure                             | <ul style="list-style-type: none"> <li>Prowirl F/R: PN 10 to 100, Class 150 to 600, 10 to 40K</li> <li>Prowirl O: PN 160, Class 900</li> </ul>  |
| Process temperature                          | <ul style="list-style-type: none"> <li>Option "Mass steam": -200 to +400 °C (-328 to +752 °F)</li> <li>Option "Mass gas/liquid": -40 to +100 °C (-40 to +212 °F)</li> </ul>   |
| Max. measured error                          | <ul style="list-style-type: none"> <li>Volume flow liquids: ±0.75%; gases/steam: ±1.0%</li> <li>Mass flow liquids: ±1.0%; gases/steam: ±1.5%</li> <li>Temperature: ±1 °C (±1.8 °F) with steam</li> <li>Pressure: ±0.5%</li> </ul> |
| Degree of protection                         | IP66 and IP67 (Type 4X enclosure)   |
| Materials                                    | Stainless steel   |
| Approvals                                    | DGRL  |
| Subject to modification                      |   |

The Prowirl F/R/O 200 measuring systems fulfill the EMC requirements according to IEC/EN 61326 and NAMUR NE21. They also conform to the requirements of the EU and ACMA directives and thus carry the **CE** and  mark.

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