

# Technical data – Proline 300/500

Transmitter	Proline 300 (compact)	Proline 500 (remote)
Display	<ul style="list-style-type: none"> <li>– 4-line backlit display with Touch Control (operation from outside)</li> <li>– Optional: with remote display</li> </ul>	4-line backlit display with Touch Control (operation from outside)
Operation	Configuration via: display, web server, WLAN, WirelessHART, as well as via various operating tools (FieldCare, HART handheld, etc.)	
Housing material	Transmitter: Aluminum, stainless steel die-cast  Remote display: Aluminum, stainless steel die-cast	Proline 500 transmitter “digital”: Aluminum, polycarbonate  Proline 500 transmitter: Aluminum, stainless steel die-cast
Power supply	AC 100 to 230 V, DC 24 V (Zone 1, Div. 1); AC/DC 24 to 230 V (Zone 2, Div. 2, Non-Ex)	
Ambient temperature	Standard: –40 to +60 °C (–40 to +140 °F) Option: –50 to +60 °C (–58 to +140 °F)	Standard: –40 to +60 °C (–40 to +140 °F) Option: –50 to +60 °C (–58 to +140 °F) Option: –60 to +60 °C (–76 to +140 °F)
Degree of protection	IP 66/67 (Type 4X enclosure), Option: IP69 (stainless steel)	
Outputs Inputs Communication	<b>Port 1</b> (communication): HART (4–20 mA), PROFIBUS PA/DP, FOUNDATION Fieldbus, Modbus RS485, EtherNet/IP, PROFINET  <b>Port 2/3</b> (freely selectable): <ul style="list-style-type: none"> <li>– Current outputs (4–20 mA)</li> <li>– Pulse/frequency/switch outputs</li> <li>– Status inputs</li> <li>– Current inputs (4–20 mA)</li> <li>– Relay outputs</li> <li>– Freely configurable in/outputs (I/O)</li> </ul>	<b>Port 1</b> (communication): HART (4–20 mA), PROFIBUS PA/DP, FOUNDATION Fieldbus, Modbus RS485, EtherNet/IP, PROFINET  <b>Port 2/3/4</b> (freely selectable, Proline 500 “digital”): <ul style="list-style-type: none"> <li>– Current outputs (4–20 mA)</li> <li>– Pulse/frequency/switch outputs</li> <li>– Status inputs</li> <li>– Current inputs (4–20 mA)</li> <li>– Relay outputs</li> <li>– Freely configurable in/outputs (I/O)</li> </ul> Proline 500: With up to 3 inputs and outputs
Ex approvals	ATEX, cCSAus, NEPSI, INMETRO, EAC, etc.	
Approvals	SIL: Use for flow monitoring up to SIL 2 (single-channel architecture) or SIL 3 (multi-channel architecture with homogeneous redundancy)	

Subject to modification

[www.addresses.endress.com](http://www.addresses.endress.com)

IND1087D/06/EN/01.16

# Proline Promass Q 300/500

## The top specialist for challenging applications

### With unmatched accuracy for flow and density measurement

- Multivariable high-end Coriolis flow-meter – with the highest measuring accuracy for custody transfer applications and critical density or concentration determinations
- Outstanding metering performance:
  - Superior immunity to fluctuating process pressures and temperatures
  - Ability to handle fluids with entrained gas thanks to the patented “Multi-Frequency Technology” (MFT)
  - Exceptional density measuring accuracy under changing process and ambient conditions
- Maximum operational safety:
  - Developed in accordance with SIL (IEC 61508)
  - “Heartbeat Technology” for device verification during operation
  - Permanent self-diagnostics
- Energy-saving flow measurement – lowest pressure drops across the widest flow ranges
- Full access to process and diagnostic information – numerous, freely combinable I/Os and fieldbuses; WLAN access
- Space-saving installation – no inlet and outlet runs



# 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.

**Perfect integration** Proline can be integrated seamlessly into your plant asset management, providing reliable information for optimizing production and business processes.

**Innovative and proven in use** Proline is based on a versatile, continually updated technology concept, guaranteeing that you are always implementing state-of-the-art technology.

**Optimal application solutions** Proline incorporates all modern flow measuring technologies, and thus optimizing plant up-time – true to our motto: “The industry-optimized flowmeter for your application.”

## Added value in every respect



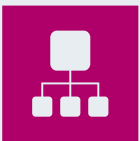
### HistoROM

- Automatic data storage ensures maximum plant safety
- Simple data restoration enables quick exchange of components
- Event logbook and data logger for quick failure analysis



### Heartbeat Technology

- Permanent self-monitoring for all Proline measuring technologies
- Diagnostics for reduced maintenance and quick remedy
- Verification of measuring point, e.g. printing documents for quality reporting (e.g. ISO 9001)



### Seamless system integration

- Direct and transparent due to a wide range of fieldbuses
- Risk-free through extended host testing and certification
- Compatibility over the entire product life cycle enables device replacement without expert know-how



### W@M Life Cycle Management

- Open information system for device documentation and management
- Device-specific information for everyday work
- Quality of information unparalleled in scope and depth



### Web server

- Time-saving local operation without additional software
- Comprehensive access to device, diagnostics and process information
- Fast data upload/download for maintenance and service



### Simple operation

- Time-saving Endress+Hauser operating concept
- Optimal usability through guided parameterization
- User-specific menu structures and device access

# Promass Q 300/500

## Superior accuracy for the real world

Whether in custody transfer applications or when meeting stringent product quality requirements – superior measuring accuracy is essential in many industrial applications. Historically, high accuracy levels were only achievable under ideal circumstances, meaning stable process conditions and true single-phase homogeneous fluids. In the real world, as we know, these ideal conditions don't often exist within the applications that flowmeters are being tasked to perform.

With this in mind, the Promass Q has been developed specifically for these kinds of challenging and often critical applications. It guarantees unmatched accuracy for mass flow, volume flow, and density determination:

- Error-free measurement in custody transfer applications in mass or volume units, such as is required within the oil and gas industry
- Highly accurate fluid density measurement and concentration determination serving as a final product quality indicator, such as in the food industry

In addition, with the innovative and worldwide unique Multi-Frequency Technology (MFT), superior measurement performance is realised in many process control applications with fluids containing entrained gas.



### Did you know...

- that mass flow errors are often due to the presence of very small bubbles or microbubbles trapped within a fluid, which are difficult to physically remove?
- that density measuring accuracy is greatly affected by fluid viscosity and temperature if not adequately compensated for?
- that achieving low zero points through the utilization of small measuring tubes increases pressure drop, reduces flow capacity, and adds significant operating costs for extra pumping power?



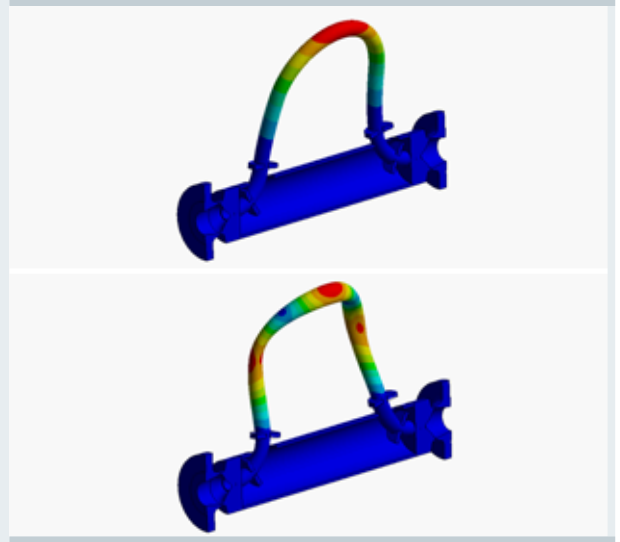
# Three innovations – eight benefits

For more safety, product quality and transparency

## 1 Unique “Multi-Frequency Technology” (MFT)

With Promass Q, Endress+Hauser takes an innovative new approach to providing active compensation for overcoming the problem of measuring fluids with entrained gas accurately. This real-time compensation is achieved through the use of a revolutionary and patented new technique in Coriolis metering – called “Multi-Frequency Technology” (MFT).

With MFT the same set of dual tubes are excited at two different resonant frequencies (modes) simultaneously. The way these two modes react – when exposed to fluid with the same amount of entrained gas – is significantly different. It is through analyzing the unique resonance properties of the two oscillation modes that makes it possible to effectively and actively compensate for the associated measurement error.



## 2 Outstanding density measurement

Everything about Promass Q – from its initial product design to the final line production – was designed and developed to not only promise a top density specification, but also to keep that promise under changing process and environmental conditions.

Unprecedented temperature immunity has been achieved through multiple high-accuracy sensors placed at optimal locations based on thousands of FEA (Finite Element Analysis) and CFD (Computational Fluid Dynamics) simulations and backed by rigorous testing.

Pressure effects are mitigated to new lows through specialized tube forming and a patented bracing technique. An optimized tube shape along with advanced compensation techniques are implemented to reduce sensitivities associated with fluids of different viscosities, densities, and velocities.

With Promass Q, assurance can be granted that regardless of the fluid or severity of the field conditions, a superior and reliable density measurement is provided: a statement that has been verified repeatedly through rigorous type testing.



## 3 Innovative design – through and through

With the help of modern design techniques – aided by CFD/FEA simulations and demanding field testing – every aspect of Promass Q has focused on providing real improvement and real benefit for our customers. The optimized tube shape and flow splitter allows for maximum flow rates at the lowest pressure drops, all without having to sacrifice low-end performance. Extremely low zero point combined with a low pressure drop provides some of the largest useable turndowns available in Coriolis flow measurement today.

Promass Q is able to provide all of these features in a compact and light-weight design all without sacrificing safety which is a cornerstone of our Coriolis flowmeter portfolio.





1

### Density

Promass Q standardly comes with the best available density measurement performance under “real-world” process conditions.

2

### Repeatability

Promass Q provides exceptional repeatability – a true testimonial to the superior overall meter design.

3

### Turndown

Promass Q has the widest “useable” turndown bandwidth of competing Coriolis meters.

4

### Process sensitivity

Promass Q maintains its high performance specification and low uncertainty even under changing process, environmental and fluid conditions.

5

### Entrained gas

Promass Q is standardly equipped with the unique and innovative Multi-Frequency Technology (MFT) for tackling liquids with entrained gas.

6

### Safety

Promass Q offers full flange pressure rating to ASME B16.5 Material Group 1.1 along with high secondary containment burst pressures.

7

### Pressure drop

Promass Q has the lowest pressure drop over the widest flow range, superior to competing Coriolis meters.

8

### Size and weight

Promass Q is lightweight and compact without sacrificing performance or robustness.





## Promass Q in the food and beverage industry

### When product quality is key

In the food industry, one goal stands above all else: absolute cleanliness and hygiene. However, final product quality can be just as critical, such as the right consistency of liquid food products or the correct concentration of added ingredients. Providing a high-precision measurement of fluid density results in superior concentration determination, e.g. °Brix, °Plato, alcohol content (%), etc. The Promass Q ensures that these quality characteristics can be monitored and maintained around the clock.

In addition with the application of Multi-Frequency Technology (MFT), measurement errors associated with entrained gas are reduced to new lows for many applications commonly found in the food industry. Here gases are often purposefully injected into food products – such as ice cream and cream cheese – to form a desired product quality. Conversely, as is the case with milk delivery systems, air becomes unintentionally introduced through transport and unloading processes. Measurement errors, no matter whether they are due to desired or unintentional air entrainment are now a thing of the past.



#### **i** What you can measure (examples)

- Milk ■ Cream cheese ■ Ice cream ■ Pastes ■ Sauces
- Ketchup ■ Honey ■ Jam

## Milk delivery and receiving

### Measuring task

Accurate flow measurement of milk unloading from tanker trucks into processing plants.

### Challenges

Milk's protein and fat structure tends to entrap air easily, causing errors in batch unloading. This air is introduced into the process in different ways:

- Agitation from within the traveling tanker trucks.
- Being drawn into the process from loose process connections or leaking seals.
- Pump unloading when gravity drainage isn't possible.
- Insufficient settling time in tanks or improperly or undersized air eliminators.

### Your benefits

5 Entrained gas

8 Size and weight



## Concentration measurement (°Brix)

### Measuring task

Accurate real-time Brix measurement to ensure optimal product quality and consistency.

### Challenges

- Incorrect Brix measurement due to improper density determination results in suboptimal product quality.
- Poor repeatability can lead to highly inconsistent products.
- Providing stable and accurate density measurement under changing process conditions.
- Keeping overall footprint small and relatively lightweight.

### Your benefits

1 Density

2 Repeatability

4 Process sensitivity

8 Size and weight



## Ice cream measurement

### Measuring task

Precise measurement of the final ice cream product which has been frozen and aerated.

### Challenges

- Ice cream, before its final delivery into packaging, is intentionally highly aerated. The large amounts of entrained air can cause significantly incorrect readings of mass flow and density measurement. This can result in suboptimal overall product quality and over/under filling.
- High pressure drops through metering technology can negatively affect the product quality as well as increase the associated pumping power required.

### Your benefits

1 Density

5 Entrained gas

7 Pressure drop

8 Size and weight







## Promass Q in the oil and gas industry

When rugged and precise measuring technology is key

Within the oil and gas industry, hydrocarbons are typically traded in volume units. For mass flowmeters this means that density determination has to be highly precise in order to accurately determine volume flow. Promass Q, which offers the best density measurement under real-world process and ambient conditions, volume flow can be directly determined and output with unparalleled accuracy. In addition, thanks to the high repeatability Promass Q is:

- the meter of choice for measuring points that are regularly proved in accordance with API MPMS 4.8.
- ideally suited as a traceable reference device for high-precision onsite calibrations.

Also in the oil industry Promass Q with MFT adds significant value to tackling the accurate measurement of liquids with entrapped gas. These are, but not limited to:

- Gas-saturated fluids that will outgas when exposed to pressure changes
- Light hydrocarbons and cryogenics that are highly prone to flashing
- Viscous heavy crudes and emulsions that will tightly hold gases in suspension



### **i** What you can measure (examples)

- Light hydrocarbons
- Heavy crudes
- Well cement
- LNG
- Ethylene
- Oils

## Custody transfer / Volume proving

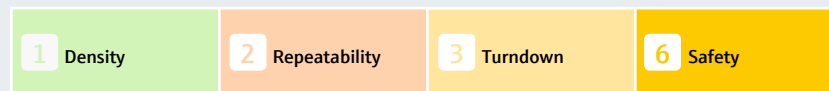
### Measuring task

Highly accurate and repeatable determination of volumetric flow for custody transfer applications.

### Challenges

- Incorrect volumetric flow due to improper density measurement which can lead to line imbalances, lost and unaccounted for product, as well as over/under billing of the receiving party.
- Poor repeatability in meter proving, resulting in increased proving runs and lost time troubleshooting.
- Maintaining accuracy and repeatability under field conditions where there is a high variance in process conditions, products and flow rates.

### Your benefits



## Well cement

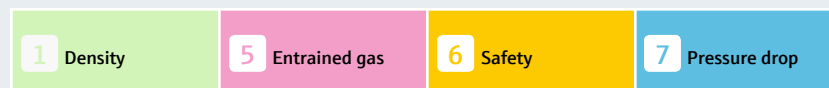
### Measuring task

Accurate measuring and monitoring the density of well cement to ensure optimal product quality as different additives are introduced to change the overall mixture properties.

### Challenges

- Entrained air within the cement, due to the mixing and agitation process, that can cause wrong cement density determination, which can not only be costly, but also a safety concern.
- Inaccurate, arbitrary, and time-consuming measurements using traditional "mud cup" methods.
- Large pressure drops due to high fluid viscosity which requires more pumping power.

### Your benefits



## Two- and three-phase separators

### Measuring task

Accurate allocation and reporting of oil volume measurements from the liquid leg of two- and three-phase separators.

### Challenges

- Inaccurate measurement from entrained gas caused by inadequately sized separators, process upsets, insufficient holding times and product outgassing, which occurs as a result of pressure changes.
- Maintaining accuracy due to a wide range of changing flow rates and process conditions.

### Your benefits








## Technical data – Promass Q sensor

Nominal diameter	DN 25 to 100 (1 to 4")
Materials (wetted parts)	<ul style="list-style-type: none"> <li>▪ Measuring tube, manifold: stainless steel, 1.4404 (316/316L)</li> <li>▪ Process connection: stainless steel, 1.4404 (316/316L)</li> </ul>
Process connections	Flanges: EN (DIN), ASME, JIS
Medium temperature	Standard: -50 to +205 °C (-58 to +401 °F) Optional (low-temperature version): -196 to +150 °C (-321 to +302 °F)
Pressure	Process: EN flanges up to 100 bar (1450 psi), ASME flanges up to 102 bar (1480 psi) Secondary containment: up to 40 bar (580 psi)
Ambient temperature	-20 to +60 °C (-4 to +140 °F)
Degree of protection	IP66/67 (Type 4X enclosure)
Max. measured error	<ul style="list-style-type: none"> <li>▪ Mass flow, volume flow (liquids): <math>\pm 0.10\%</math> o.r., <math>\pm 0.05\%</math> (with PremiumCal)</li> <li>▪ Mass flow (gases): <math>\pm 0.35\%</math> o.r.</li> <li>▪ Density (liquids): <math>\pm 0.2</math> kg/m<sup>3</sup></li> </ul>
Repeatability	<ul style="list-style-type: none"> <li>▪ Mass flow, volume flow (liquids): <math>\pm 0.025\%</math> o.r.</li> <li>▪ Mass flow (gases): <math>\pm 0.25\%</math> o.r.</li> <li>▪ Density (liquids): <math>\pm 0.1</math> kg/m<sup>3</sup></li> </ul>
Certificates Approvals	Custody transfer: MI-005, OIML R81/R117; SIL 2/3; PED, CRN; NACE MR0175/MR0103; 3-A, EHEDG, etc.
Ex Approvals	ATEX, IECEx, cCSA <sub>US</sub> , NEPSI, INMETRO, EAC, etc.

Subject to modification

The Proline Promass Q 300/500 measuring system fulfills the EMC requirements according to IEC/EN 61326 and NAMUR NE21. It also conforms to the requirements of the EU and ACMA directives and thus carries the **CE** and the  mark.

