



## Application Brief

# Sentinel LNG: Measuring cryogenic applications for liquefied natural gas

### Solving measuring disparity with ultrasonic technology

- Measuring LNG comes with multiple challenges
- Varying measurement approaches create friction between buyer and seller
- Sentinel LNG Flow Meter uses ultrasound technology to measure liquefied natural gas with unbeatable performance

### Summary

The challenges in measuring liquefied natural gas center on the available technology for gauging volume, rate, and pressure. When buyer and seller disagree, disparate measurement systems are usually to blame. Panametrics' Sentinel LNG uses ultrasonic technology to deliver high-accuracy measurements and peace of mind.

### Application

The nature of the natural gas process chain is that gas almost always flows. Along the way, it is measured in terms of volume, rate, and pressure. Understanding these units is critical as the fossil fuel moves from the field to the processing facilities, and ultimately to distribution terminals. These are crucial steps in its journey to the end-user. For practical reasons, along the way, its state is changed. When compressed nearly 600 times and cooled down, it transforms from natural gas to liquefied natural gas, the form in which it is most easily transported. Throughout this journey, the goal is to ensure that not a single cubic meter goes unaccounted for.

Measuring LNG has its challenges. Cryogenic conditions, changes in flow rates, and unexpected pressure drops impede speedy and accurate measurements. Moving parts within traditional flow meters wear and lose calibration, creating additional concerns for instrument readers. Other versions can restrict flow, causing pressure drops that may lead to local flashing.



One particularly contentious piece of the natural gas process chain occurs when LNG is moved between a transporter (vessel, rail car, tank truck) and a processing plant or terminal. The problem arises in both the loading and unloading of the product—the exchange between seller and buyer. Varying measurement systems are at the crux. Land-based facilities use flow meters that record the volumetric flow rate of LNG. Vessels use tank gauges that derive volume through a calculus of physical level, temperature gradients, and pressure measurements. Factors such as tank shape, tank expansion, and the pitch and yaw of vessels make the use of tank gauges more complex.

The different measurement approaches often lead to disparity in understanding of volume between buyer and seller. To settle the discord, costly and time-consuming arbitration or legal settlements can be required.

## Solution

Panametrics uses a novel approach to measurement with its Sentinel LNG product line. Unlike traditional flow meters, Panametrics' ultrasonic flow meter is a fully welded construction with no moving parts and no pressure drop, eliminating the typical challenges seen with conventional meters.

At the heart of the Sentinel LNG unit is ultrasonic technology, which measures cryogenic applications for liquefied natural gas with unbeatable performance, reliability, and safety. Inside the unit, acoustic transducers are placed outside the cryogenic liquid to avoid any long-term degradation due to temperature. This ensures ease of replacement if the need arises. The design is full bore, so pressure drop over the meter equates to a section of pipe of the same length. State-of-the-art electronics and advanced algorithms enable the Sentinel LNG flow meter to measure flow with exceptional speed.

To ensure accuracy, Panametrics extensively tested Sentinel LNG using computational fluid dynamics (CFD). By simulating different path configurations under different flow scenarios, including highly turbulent flow regimes typically seen with liquefied natural gas, CFD ensured that the unit provides accurate measurement at all times and, in particular, during custody transfer. To be thorough, Panametrics also rigorously tested the unit under actual flowing conditions.

In an application where a discrepancy of just 1% translates into millions of dollars, Sentinel LNG provides a robust solution for transferring assets. Even in the most unstable conditions, the unit delivers high-accuracy measurements and peace of mind.

