



APPLICATION NOTE Chemical

Measuring the flow of nitrogen in an on-site gas system

- Consumption measurement of highly fluctuating gas volumes from on-site gas generation
- Vortex flow measurement with integrated pressure and temperature compensation
- High reliability and accuracy over a wide turndown ratio (200...3,000 Nm³/h / 7,063...105,944 ft³/h)

1. Background

In addition to conventional gas delivery, a leading European supplier of industrial gases specialises in the construction and operation of on-site gas systems. These systems make it possible to generate gas quickly and reliably on site at the end customer's location. This way, gas production can be tailored to customer requirements, ensuring high availability. The industrial gas manufacturer generates nitrogen for a manufacturing company in Germany in just such an on-site system. The gas is then used in the end customer's manufacturing process.

2. Measurement requirements

In normal operation the nitrogen produced in this system was transported to the destination via a DN40 pipeline. In this case the nominal flow rates are between 200 and 1,500 Nm³/h / 7,063 and 52,972 ft³/h. In exceptional cases far greater nitrogen requirements of up to 3,000 Nm³/h / 105,944 may occur. In such cases supply took place via an additional tank connected to a DN100 bypass pipeline. In order to seamlessly determine the end customer's actual consumption rates, the nitrogen transport must be monitored by flow measurement that covers this entire turndown ratio. Up until now flow volumes had only been measured in the smaller DN40 pipeline. However, the competitor's thermal mass flowmeter used could only provide measuring results for the system during normal operation. It was not possible to measure gas supplied via the larger DN100 pipeline.

Medium:	Nitrogen (gaseous)
Volume flow:	3,000 Nm ³ /h or 105,944 ft ³ /h (max.)
Pressure:	3.5 bar / 50.7 psi
Density:	4 kg/m ³ / 0.25 lb/ft ³

The gas manufacturer wanted to be able to reliably measure the small flow rates in normal operation and extremely large flow rates in exceptional cases. For this reason they were looking for cost-effective instrumentation for all operating conditions. The instrumentation was to enable measurement with as little pressure loss as possible. There was no custody transfer.

KROHNE

3. KROHNE solution

The plant operator decided on the use of the OPTISWIRL 4200 F1R Vortex flowmeter. The 2-wire device was installed directly into the existing large DN100 bypass pipeline. It features integrated nominal diameter reduction to reach a nominal size of DN80. This makes it possible to measure and output small flow rates and to shorten the inlet and outlet sections. Due to the crowded installation conditions and the short piece of pipe, KROHNE also provided a suitable flow straightener which was installed in advance.

The Vortex device is designed as an "all-in-one" solution with integrated pressure and temperature compensation. This ensures reliable and accurate flow measurement, even with fluctuating process conditions. The measured value is converted to standard conditions in the device and output as standard volume. There was no need to install or connect external pressure and temperature sensors.



OPTISWIRL 4200 with integrated pressure and temperature compensation



Nitrogen measurement behind built-in flow straightener

4. Customer benefits

The compact OPTISWIRL 4200 helped measure the nitrogen over the entire measuring range. Now there is transparency when it comes to both the nitrogen consumed during normal operation and the exact requirement during short-term peaks in consumption. Thanks to the Vortex device's integrated pressure and temperature compensation, an unadulterated mA output signal is now available to the plant operator. The signal is transmitted to the end customer's control system in parallel to trend acquisition and monitoring. As the OPTISWIRL 4200 only measures all measuring parameters (F/P/T) at one point, the overall measurement error can be reduced to a minimum of $\pm 1.5\%$, increasing system accuracy. In addition, there are no costs for the procurement and installation of the otherwise necessary temperature and pressure sensors.

The performance of the KROHNE device and its attractive price convinced both plant operator and end customer. The gas manufacturer intends to use the OPTISWIRL 4200 in the future for this type of on-site system.

5. Product used

OPTISWIRL 4200 F1R

- Vortex flowmeter for the measurement of industrial gases
- Integrated pressure and temperature compensation
- Flange or sandwich version
- Up to two times the integrated nominal diameter reduction
- SIL2/3: Developed in accordance with IEC 61508, Edition 2
- Approved for hazardous areas (ATEX, IECEx, QPS etc.)
- 2-wire technology; 4...20 mA, HART®



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