

# Multivariable **vortex** meter simplifies **mass flow** measurement

Many of the recent developments in flowmeter technology are related to mass measurement. This trend results from a growing awareness of the need to measure mass flow, and a critical understanding of the variables in a process or flow metering system that can affect instrument accuracy. The next generation of mass flowmeters will provide improved accuracy, lower installed cost, and enhanced functionality - including multiple outputs of process conditions.

The multivariable vortex mass flowmeter, the first of this new generation of flowmeters, was developed to reduce instrument cost-of-ownership and provide a reliable and accurate device for monitoring mass flow. The meter's distinguishing feature - its ability to measure five process variables in a single location - is the key to improved measurement accuracy and reduced installation costs.

The multivariable vortex mass flowmeter monitors mass flow rate by directly measuring three process variables: fluid velocity, temperature and pressure. The instrument's built-in flow computer then calculates mass flow rate

based on these direct measurements.

The benefits of the multivariable vortex mass flowmeter include:

- \* Improved measurement accuracy and reliability
- \* Improved process and system diagnostics
- \* Lower installed cost due to fewer penetrations and less hardware
- \* Reduced instrument audit trails
- \* Reduced inventory and spare parts requirements
- \* Improved configuration flexibility

This technology is unique in that it provides a reading of mass flow rate from a single entry point in the process line. The process parameter that has the greatest effect on flowmeter accuracy is variation in fluid density. A system that measures velocity in one location, pressure in another and temperature in a third is more vulnerable to this effect than a device that measures all of these variables in a single location. This is particularly relevant when monitoring steam, gas or combustion air flows.

The multivariable vortex mass flowmeter also reduces the cost of hardware, materials and labor required for

installation and commissioning, as well as maintenance costs and spare parts inventory.

The major disadvantage of "traditional" compensated vortex metering systems is the high cost of installation. A typical system requires four man-days to install and commission. The complex electrical and mechanical system requires power and signal wiring between the flowmeter, the pressure transmitter, the temperature transmitter and the flow computer. Three process penetrations and mounting adapters for mechanical connection to the pipe are also necessary. Because the multivariable vortex meter can be installed with a single process penetration and only one set of power and signal wires, it can save two man-days of installation time.

(See Figure 1)

## Three Primary Sensing Elements Provide One Integrated Solution

One of the perceived weaknesses of vortex flowmeters is their sensitivity to vibration. Most industrial pipelines experience vibration caused by pumps,

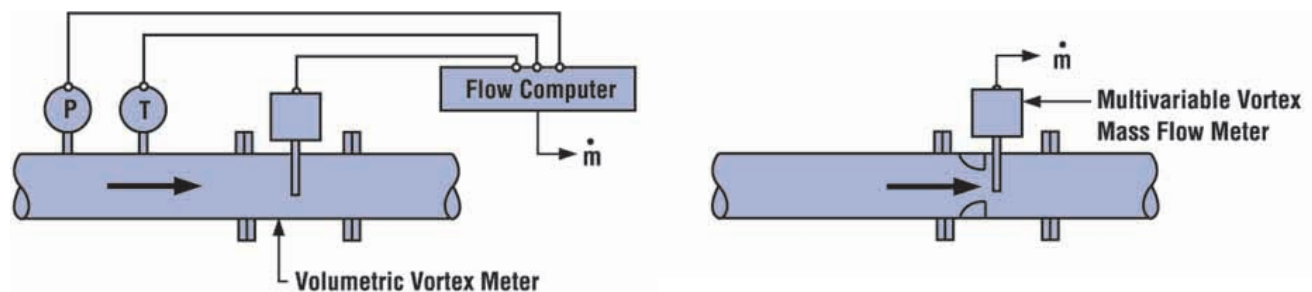


Figure 1 The multivariable vortex mass flowmeter reduces hardware costs and installation labor with a single process penetration.

machinery and flow-induced oscillations. These vibrations can create erroneous vortex frequency signals and affect measurement accuracy. The multivariable vortex meter incorporates a unique shedder design, which minimizes this effect and provides maximum signal integrity across a broad range of flow conditions.

Another problem that plagues many flow metering systems is temperature measurement. The multivariable vortex meter utilizes a platinum resistance temperature detector that measures and corrects for stem conduction effects. This eliminates a common cause of measurement error - ambient temperature changes - by identifying and compensating for variations between process and ambient conditions.

A solid-state pressure transducer is the third element in the meter's sensor module. The three sensors are located adjacent to one another in a single, removable sensing head to simplify maintenance operations. If diagnostic routines detect a fault, the sensor assembly can be easily replaced without compromising instrument accuracy. (See Figure 2)

### Ideal for Steam Flow Measurement

The multivariable vortex meter offers a simple solution to boiler control and energy management problems. It provides the inherent reliability, turn-down, high temperature and high pressure capabilities required for steam flow monitoring, and also delivers these enhanced readings:

- \* Steam mass flow rate and totalized mass
- \* Steam temperature measurement
- \* Steam pressure measurement

In applications such as steam header monitoring, point-of-use monitoring and condensate return measurement, the meter helps improve combustion efficiency and reduce waste. It can also help users calculate boiler efficiency and reduce pumping costs.

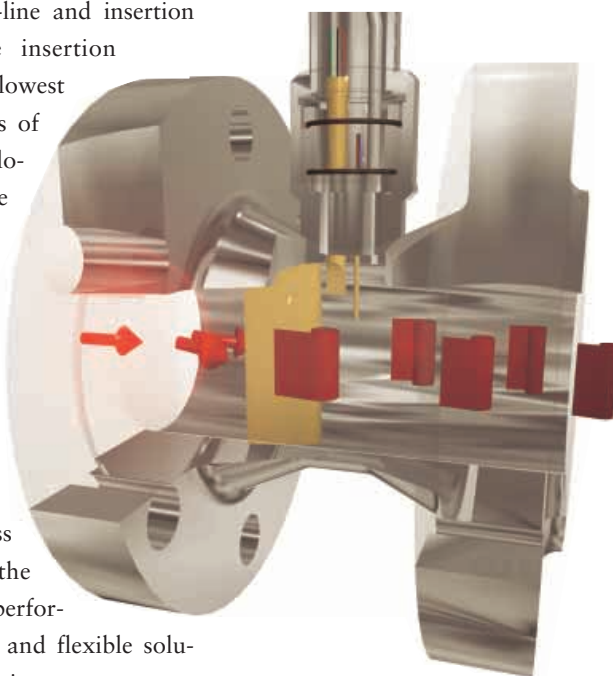
The totalized rate is frequently used for custody transfer and billing operations. The mass flow rate measurement can be used to provide information on peak demand usage to ensure consistent steam service. The instrument's pressure reading is useful as a diagnostic tool to help control the available steam flow capacity. These three measurements are available simultaneously, via 4-20 mA outputs, from the single transmitter.

The multivariable vortex meter is available in both in-line and insertion configurations. The insertion meter provides the lowest possible pressure loss of any metering technology and can also be "hot-tapped" into steam lines to avoid process shutdown.

In today's lean-and-mean industrial environment, engineering time is at a premium. The multivariable vortex mass flowmeter meets the demand for a high-performance, cost-effective and flexible solution, and it is changing the way we think about flow measurement.

*Thanks to Andy Dieball, Director of Marketing Sierra Instruments, Inc. for this article. Further information on the multivariable vortex meter is offered by Sierra Instruments.*

**"The multivariable vortex mass flowmeter... is changing the way we think about flow measurement"**



**Figure 2** Multivariable vortex meter integrates flow, temperature and pressure sensors in a single head.