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Industry's First
Multivariable Vortex
Mass Flow Meter

Series 200 Innova-Mass[®]

SIERRA
INSTRUMENTS, INC.
THE MASS FLOW COMPANY



Innova-Mass[®] revolutionizes mass flow measurement

Sierras' Innova-Mass[®] will change the way you think about flow measurement. Innova-Mass, the industry's first multivariable vortex mass flow meter, is a high-performance, cost-effective solution for accurate measurement of steam, gas and most liquids. It is the only vortex flow meter in the world that provides outputs for five process variables:

- **Mass flow rate**
- **Volumetric flow rate**
- **Temperature**
- **Pressure**
- **Fluid density**

Beyond reducing initial cost, installation cost, and cost-of-ownership over the lifetime of the instrument, this revolutionary multivariable approach to mass flow monitoring simplifies process measurement.

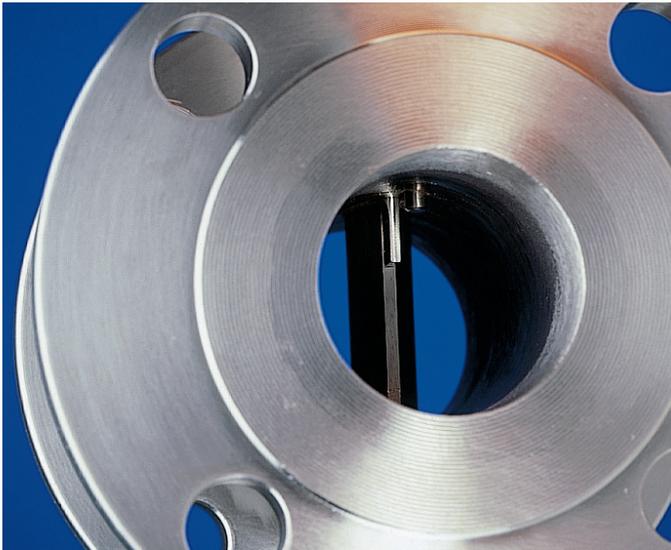
Reduce your engineering design headaches

Sierra's Innova-Mass was developed specifically to save valuable engineering time. It is unique in that it provides a reading of mass flow rate from a single entry point in the process line. Contrast this with the engineering

time required to develop a traditional mass flow measurement system—time spent selecting all the hardware elements of the system; designing the system; specifying, purchasing and installing individual components; and then checking to see if the system functions as designed.

With Innova-Mass you install only one instrument, dramatically reducing both initial cost and installation costs. Other benefits of this single-device approach include:

- **Less maintenance**
- **Easier installation**
- **Shorter instrument audit trails**
- **Fewer inventory and spare parts requirements**
- **Greater configuration flexibility**



Only Innova-Mass measures five process variables in a single location.

Single-point monitoring improves accuracy

In contrast to traditional vortex flow meters, which measure only volumetric flow rate, Innova-Mass measures five process variables with one integrated instrument. Using three primary sensing elements—a vortex shedding velocity sensor, an RTD temperature sensor, and a solid-state pressure transducer—Innova-Mass measures the mass flow rate of gases, liquids and steam. The meter's distinguishing feature, its ability to monitor all process variables in a single location, vastly improves measurement accuracy. This is because systems that use external process measurements to calculate mass flow do not compensate for conditions that may change radically between the point of velocity measurement and the point where upstream or downstream pressure and temperature measurements are made.

The ideal solution for steam and custody transfer applications

Read all your process variables on a single device

Three analog 4-20 mA output signals are available for your selection of any three of the five measurements, mass flow, volumetric flow, temperature, pressure and fluid density. The instrument also provides a reading of totalized mass and alarm settings.

The Innova-Mass diagnostics module allows you to test the flow meter by interrogating the electronics or by directing them to simulate alarm conditions or any desired signal in the analog or frequency output range of the flow meter. A real-time clock and calendar and a time-stamped fault log allow you to view the last ten alarmed events on the meter's display.

Reconfigure your system locally or remotely

Innova-Mass displays all process variables, including mass flow rate and totalized mass in your choice of engineering units, and features an intuitive and easy-to-use menu for configuration and diagnostics. Changing ranges, fluids, alarms, outputs, totalizers and engineering units can be done from your control panel or workstation, or locally, with a hand-held magnet key.

Full implementation of HART protocol also lets you access all measured variables and programming menus, as well as field-configure the instrument without disrupting the existing measurement signal. Meter configuration can be accomplished directly from your control panel, via RS485 or with the HART 275 Communicator.

Innova-Mass Model SCT takes steam flow monitoring to a whole new level

Rising energy costs and increased scrutiny of steam custody transfer have created a demand for steam flow meters that provide a high-accuracy measurement at a low installed cost. Compared to traditional volumetric flow monitoring systems that require additional instrumentation to calculate steam density and communicate remotely, the Innova-Mass Model SCT offers you a simple and cost-effective solution.

In addition to providing a direct reading of steam mass flow rate, temperature, and pressure, the instrument lets you validate instrument accuracy. The meter's integrated flow computer provides an accurate and verifiable measurement of steam usage, reduces billing and contract disputes, and helps energy managers understand consumption trends and control production costs.

An integrated flow computer provides a simple solution to steam custody transfer.



Configure your meter locally, remotely via RS485 or with HART communicator.



The Innova-Mass principle of operation

Innova-Mass integrates three primary sensing elements in a single interchangeable sensor head.

Von Karman demonstrated that, when a fluid flows past a bluff body, an alternating series of vortices is shed from each side, creating areas of fluctuating pressure. The frequency of the vortices is directly proportional to fluid velocity.

In commercial vortex flow meters, the bluff body is called a "shedder bar". The common trait of all shedder bars is sharp corners, which enhance the energy of the vortices and ensures boundary-layer separation at two defined points. This characteristic is responsible for the extraordinary linearity of the frequency of vortex shedding over a wide velocity range.

Innova-Mass uses a piezoelectric sensor to measure the frequency of the Von Karman vortices. This results in an intrinsically linear measurement of fluid velocity over a wide range of Reynolds numbers. The meter's smart electronics automatically calculates the Reynolds number based on the actual measured density and viscosity, and then corrects for any non-linearity at lower Reynolds numbers.

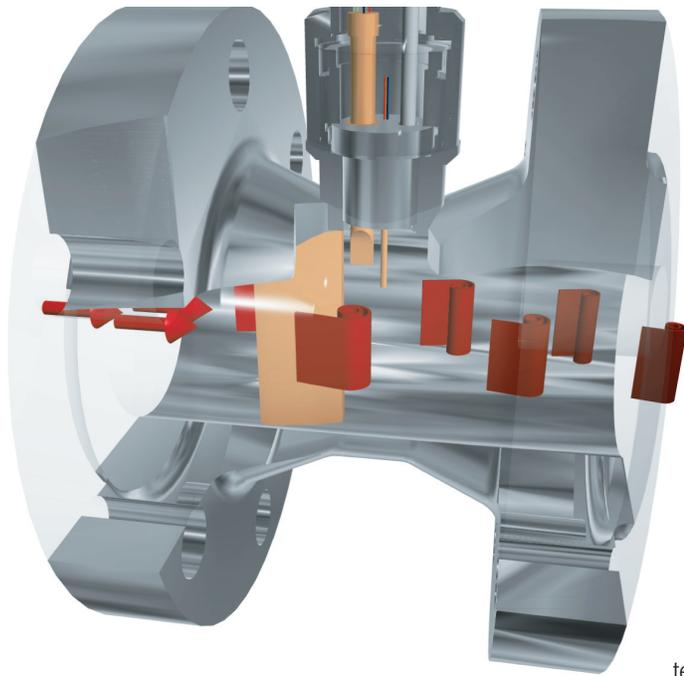
Innova-Mass incorporates temperature and pressure sensing to calculate fluid density at a single point. The solid-state micro-machined silicon pressure transducer and platinum resistance temperature detector provide exceptional accuracy and stability.

Accurate, reliable and cost-effective mass flow measurement

Conventional vortex flow metering systems utilize inputs from external temperature and pressure transmitters to supply an inferred mass flow rate output. In these inferential mass flow devices, temperature and pressure sensors are located somewhere in the pipeline either upstream or downstream of the vortex flow meter, but typically not at the same location in the pipeline. This causes errors in calculating fluid density, resulting in mass flow accuracy in the ± 3 to 5% range.

Because Innova-Mass measures all process variables in a single location, it offers mass flow accuracy in the ± 1 to 2% range, and significantly reduces the complexity and cost of installation.

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Series 240/241 Mass Flow Meter Accuracy Specifications

Process Variables	240 Series In-Line Meters		241 Series Insertion Meters ⁽¹⁾	
	Liquids	Gas and Steam	Liquids	Gas and Steam
Mass Flow Rate	1% of rate over a 30:1 range ⁽³⁾	1.5% of rate ⁽²⁾ over a 30:1 range ⁽³⁾	1.5% of rate over a 30:1 range ⁽³⁾	2% of rate ⁽²⁾ over a 30:1 range ⁽³⁾
Volumetric Flow Rate	0.7% of rate over a 30:1 range ⁽³⁾	1% of rate over a 30:1 range ⁽³⁾	1.2% of rate over a 30:1 range ⁽³⁾	1.5% of rate over a 30:1 range ⁽³⁾
Temperature	$\pm 2^\circ \text{F}$ ($\pm 1^\circ \text{C}$)	$\pm 2^\circ \text{F}$ ($\pm 1^\circ \text{C}$)	$\pm 2^\circ \text{F}$ ($\pm 1^\circ \text{C}$)	$\pm 2^\circ \text{F}$ ($\pm 1^\circ \text{C}$)
Pressure	0.4% of transducer full scale	0.4% of transducer full scale	0.4% of transducer full scale	0.4% of transducer full scale
Density	0.3% of	0.5% of	0.3% of	0.5% of

Notes: (1) Accuracies stated are for the total mass flow through the pipe.

(2) Over 50 to 100% of the pressure transducer's full scale.

(3) Nominal rangeability is stated. Precise rangeability depends on fluid and pipe size.

Smart electronics monitor, calculate and output five process variables
Innova-Mass provides the ultimate flow computer functionality in a single compact package. Configuration data is stored in nonvolatile EEPROM memory and is retained in the electronics when power is interrupted.

Steam Custody Transfer
An integrated flow computer provides a simple solution to steam custody transfer

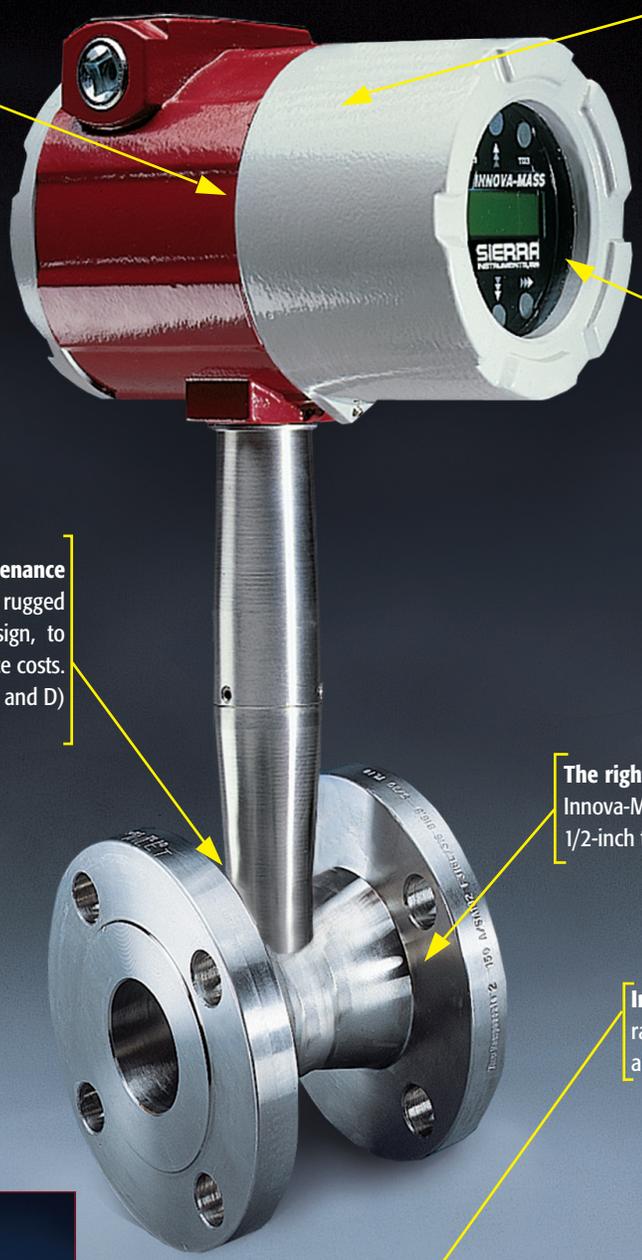
AGA-8 natural gas monitor
The Innova-Mass flow computer incorporates algorithms for monitoring natural gases as specified by AGA Report No. 8 to improve billing accuracy and provide a mass flow reading with a turndown of up to 30 to 1.

Tough, reliable, low-maintenance
The FM-approved Innova-Mass features rugged construction and a no-moving parts design, to improve reliability and reduce maintenance costs. FM approval (Class 1, Div 2, Groups B, C, and D)

The right flow body for your application
Innova-Mass in-line meters are available in 1/2-inch through 8-inch pipe sizes.

Simplified set-up and diagnostics
Innova-Mass lets you monitor performance and configure the meter remotely via HART or RS485 protocol, or locally via six magnet-actuated buttons.

Insertion Meters are available for pipe sizes ranging from 2 inches to 72 inches and greater.



Innova-Flo® for cost-effective volumetric flow measurement

Outstanding rangeability

The Series 220 Innova-Flo® Smart Vortex Flow Meter measures the volumetric flow rate and totalized flow of most gases, liquids and steam in either in-line or insertion-style configurations. By using constant values for the fluid's density and viscosity, Innova-Flo automatically corrects for Reynolds numbers down to 5000, extending the rangeability of the device up to 30:1. Innova-Flo can also be configured to monitor mass flow rate, based on a constant density input.

Innova-Flo is a 4-20 mA loop-powered device and outputs a linear analog 4-20 mA signal proportional to volumetric flow rate or mass flow rate. A pulse output for totalization is also available in your choice of engineering units.

Smart electronics for simplified set-ups

Innova-Flo's smart electronics enhance field-configurability by providing an intuitive and easy-to-use method for changing fluids, outputs, ranges, engineering units and totalization. The electronics are accessed locally via six buttons, activated either directly on the display panel or by a hand-held magnet key operating through the enclosure's window. Magnet access ensures that the meter's hazardous-location integrity is not compromised.

Innova-Flo's comprehensive menu provides complete configuration capability as well as system diagnostics, and a simulation function to test outputs.

The meter is available in-1/2 inch through 8-inch pipe sizes, and as insertion-type meters with 2-inch NPT or flanged process connections. Optional retractor or "hot tap" hardware facilitates installation and maintenance.



Insertion meters are available with retractor assemblies.

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Innova-A 5M 09/03

Series 220/221 Volumetric Flow Meter Accuracy Specifications

Process Variable	220 Series In-Line Meters		221 Series Insertion Meters ⁽¹⁾	
	Liquids	Gas and Steam	Liquids	Gas and Steam
Volumetric Flow Rate	0.7% of rate over a	1% of rate over a	1.2% of rate over a	1.5% of rate over a

Notes: (1) Accuracies stated are for the total volumetric flow through the pipe.

(2) Nominal rangeability is stated. Precise rangeability depends on fluid and pipe size.

Download Innova-Mass datasheets, specifications, and access our sizing and selection program at:

www.innovamass.com