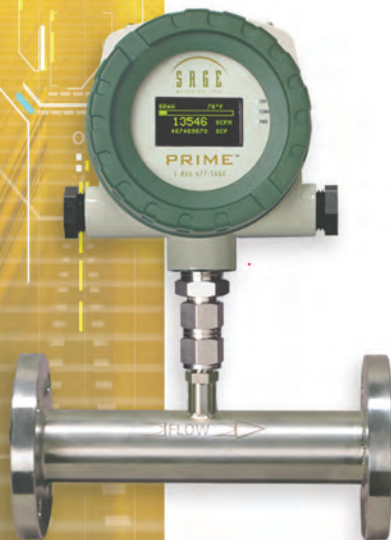
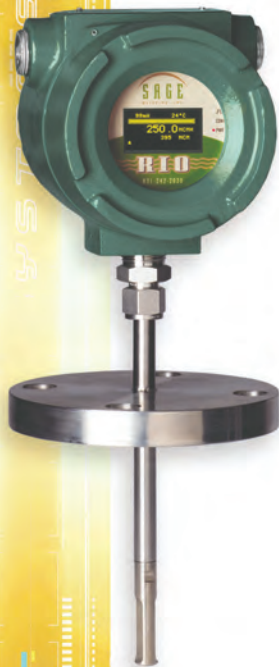




THERMAL MASS FLOW MEASUREMENT FOR GASES



*Make the Wise Choice.
Choose Sage Flow Meters.*



A Commitment to Higher Performance

SAGE METERING is a manufacturer of high performance Thermal Mass Flow Meters which measure the flow rate and consumption of gases for multiple industrial and commercial applications. Frequently used for energy management systems to monitor and improve energy efficiency as well as for regulatory compliance in environmental systems including reporting of Greenhouse Gas Emissions.

TYPICAL APPLICATIONS include measurement and sub-metering of natural gas and compressed air for energy utilization and cost accounting within a facility. Measurement of combustion air flow can be used for improving efficiency in boilers and furnaces. Environmental reporting of Greenhouse Gases from combustion sources as well as measurement for carbon credits are frequently encountered.

OTHER KEY environmental applications include flare gas flow measurement in the Oil and Gas Industry, as well as leak detection, where thermal technology offers economic advantages over traditional flow measurement technology. To meet the regulatory requirements of periodic re-calibration or calibration verification, Sage Metering has developed a unique in-situ accuracy verification process to ensure the meter is performing within the original NIST traceable gas calibration while the process remains in operation.

Sage Meters are used for all types of applications:

ENERGY MANAGEMENT

- ☐ Natural Gas Measurement
- ☐ Compressed Air Flows

ENVIRONMENTAL

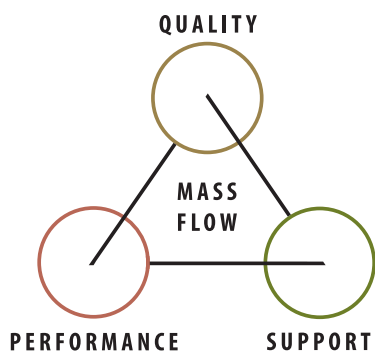
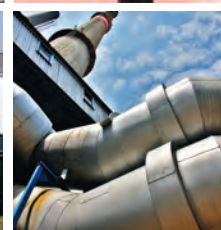
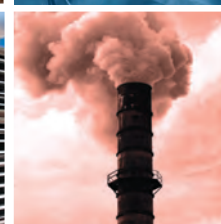
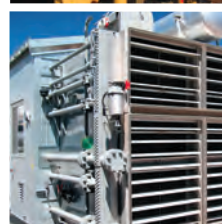
- ☐ Greenhouse Gas Emissions
- ☐ Carbon Credits

PROCESS

- ☐ Flare Gas
- ☐ Biogas / Landfill Gas
- ☐ Combustion Air
- ☐ Vent Air

FACILITIES MANAGEMENT

- ☐ Natural Gas Sub-metering
- ☐ Department Cost Allocation



Experience and Expertise

SAGE METERING, INC. is the fastest growing thermal mass flow meter manufacturer in the industry. Founded in 2002, Sage brings together individuals with many years of combined experience in the design, operation, and application of thermal mass flow meters. This vast knowledge has enabled Sage to identify and improve on the overall design and performance of Thermal Mass Flow instrumentation. Sage's philosophy is inherent throughout its product line and services.

- ❑ **Innovative Products**
- ❑ **On Time Delivery**
- ❑ **Extraordinary Customer Service**
- ❑ **Strong Commitment to Quality**
- ❑ **Excellent Responsiveness to Customers**

Make the Wise Choice. Choose Sage Flow Meters.

A Pioneer in Technology Development

SAGE METERING has brought to market the first hybrid digitally-driven circuit design, eliminating the traditional analog Wheatstone bridge. This feature has provided Sage products with the ability to:

- ❑ Eliminate analog drift, improving stability and long term reproducibility
- ❑ Show a reproducible zero flow point, permitting simple and reliable calibration verification
- ❑ Maintain higher resolution providing greater rangeability
- ❑ Digitally-driven temperature sensor eliminates self-heating errors
- ❑ Match overheat to application for greater signal resolution
- ❑ Remote Style: up to 1000 ft. from probe, and lead-length compensated (junction box has no circuitry – suitable for harsh environments)

IN-SITU CALIBRATION VERIFICATION

- ❑ User can easily verify that flow meter remains in calibration with simple field test while process is in operation
- ❑ Checks overall instrument performance – both sensor and electronics
- ❑ Eliminates the need for periodic factory re-calibration
- ❑ Meets regulatory requirements for calibration check

FIRST GRAPHIC DISPLAY IN THERMAL FLOW INDUSTRY

- ❑ Provides flow rate, temperature, totalized flow, diagnostics, and signal at a single glance
- ❑ High contrast display adjusts to ambient lighting, making it easy to read

IMPROVED TEMPERATURE COMPENSATION

- ❑ Ensure accurate flow measurement over wide range of process temperatures

ATTENTION TO ACCURACY

- ❑ Calibrations performed on actual gas
- ❑ NIST traceable calibration facility provides accuracy flexibility

NIST Traceable Calibration



Compact Design



Durable Construction



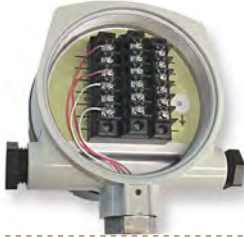
High Velocity NIST Calibration Facility



Sage Prime Thermal Mass Flow Meter (SIP Series)

The Prime™ is Sage's premier Thermal Mass Flow Meter for all rugged industrial applications. The Prime has been approved for use in hazardous areas by many agencies, plus CE rated for Electromagnetic compatibility. Available in both 24 VDC (12 VDC optional) and 115/230 VAC input power. The 2.5 watts power is the lowest consumption in the industry.

Easy access to wiring connections



Available with Integral (SIP) or Remote (SRP) electronics (cable lengths to 1000 ft.)



1/4" to 4" flow body with flow conditioner (NPT standard, flange optional)



Easy-to-read graphic display gives flow rate, totalized flow, temperature and diagnostics information



Compact design simplifies installation

Process temperatures to 450° F (232° C) with standard sensor

Outputs:

- 4–20 mA
- Optional HART™ communication
- Pulse
- Modbus

Insertion Probe Shown with SVA05 Mounting Hardware



Hazardous area approvals

In-situ calibration check verifies proper operation of flow meter

Sage Prime HVAC Series Thermal Mass Flow Meter

Measure Natural Gas flow rate in consumption in commercial, municipal, and industrial buildings, as well as colleges, government facilities, hospitals, shopping centers, office buildings, and complexes

**Accuracy of $\pm 0.5\%$ of Full Scale
 $\pm 1\%$ of Reading over a 100:1 turndown**

For more information on the Sage Prime (above) or Prime HVAC, view the Products Tab on the Sage website by visiting www.sagemetering.com/prime. Or contact Sage at 866-677-SAGE (7243).

Sage 200 / 300 Thermal Mass Flow Meters

The Sage 200/300 Series Flow Meters provide the same high level of performance as the Sage Prime only with a more economical offering.

For more information on the Sage 200/300 Thermal Mass Flow Meters, view the Products Tab on the Sage website by visiting: www.sagemetering.com



Sage 300 Meter Shown with Insertion Probe

Agency approved for Class 1 Division 2 service

4–20 mA and pulse output

Optional Modbus output

Optional display of flow rate, total flow and temperature

Integral or Remote electronics

Sage Insight Software for Use with Sage Prime

Sage INSIGHT is a new, powerful, intuitive software that provides information on the operation and configuration of the Sage Prime thermal mass flow meter. INSIGHT is the ideal multi-purpose tool to get the assurance that the meter is performing according to the original specifications, is in calibration and the sensors are clean.

Determine that the flow meter is accurate and in calibration

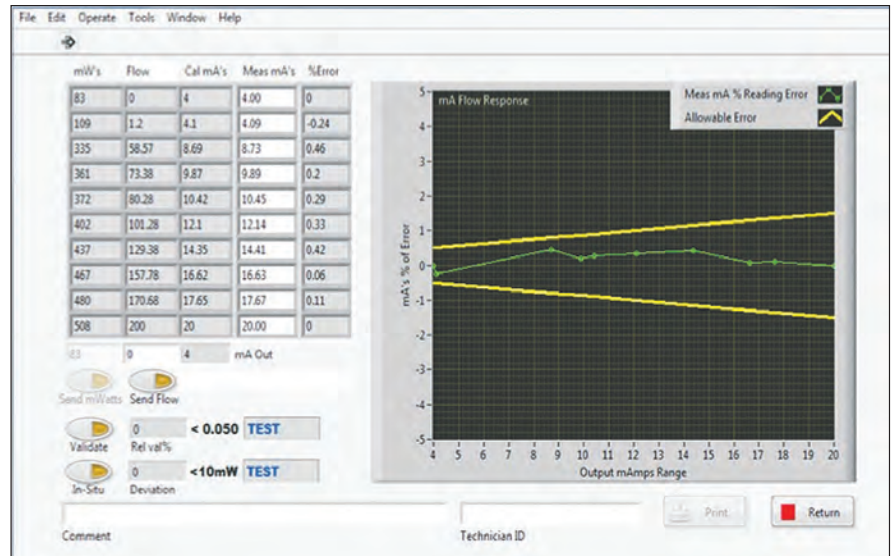
Provide a 10 point loop evaluation which verifies the output signal matches the original calibration data

Review and modify the configuration of the Prime

Verifies the sensors are clean and performing to specifications

Automates the well accepted In-Situ calibration verification test

Creates reports for maintenance records or regulatory agencies



For more information on the Sage Insight (top), view the Products Tab by visiting www.sagemetering.com/insight. Or contact Sage at 866-677-SAGE (7243).

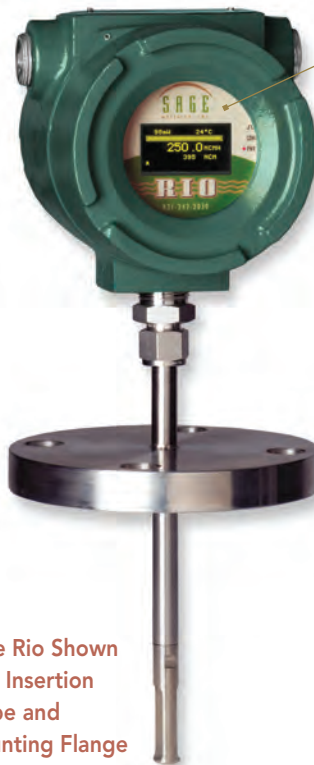
Sage Rio Thermal Mass Flow Meter (SIX Series)

The Sage Rio Thermal Mass Flow Meter provides the same levels of performance found in the Sage Prime with additional agency approvals.

ATEX Flameproof approval –
 Ex II 2G Ex d IIB+H2 T6 Gb*
 UL, cUL for Class I, Div. 1, Groups B, C, D

Available with Integral (SIX) electronics.
 Remote style (SRX) optionally available

1/4" to 4" flow body with flow conditioner (NPT standard, flange optional)



Sage Rio Shown with Insertion Probe and Mounting Flange

Rotatable graphic display gives flow rate, totalized flow, temperature and diagnostics information

Outputs:

- 4–20 mA
- Optional HART™ communication
- Pulse
- Modbus

In-situ calibration check verifies proper operation of flow meter

*T6 Rating is suitable for gases with ignition temperature as low as 185°F (85°C)



For more information on the Sage SIX (above), view the Products Tab by visiting www.sagemetering.com/rio. Or contact Sage at 866-677-SAGE (7243).

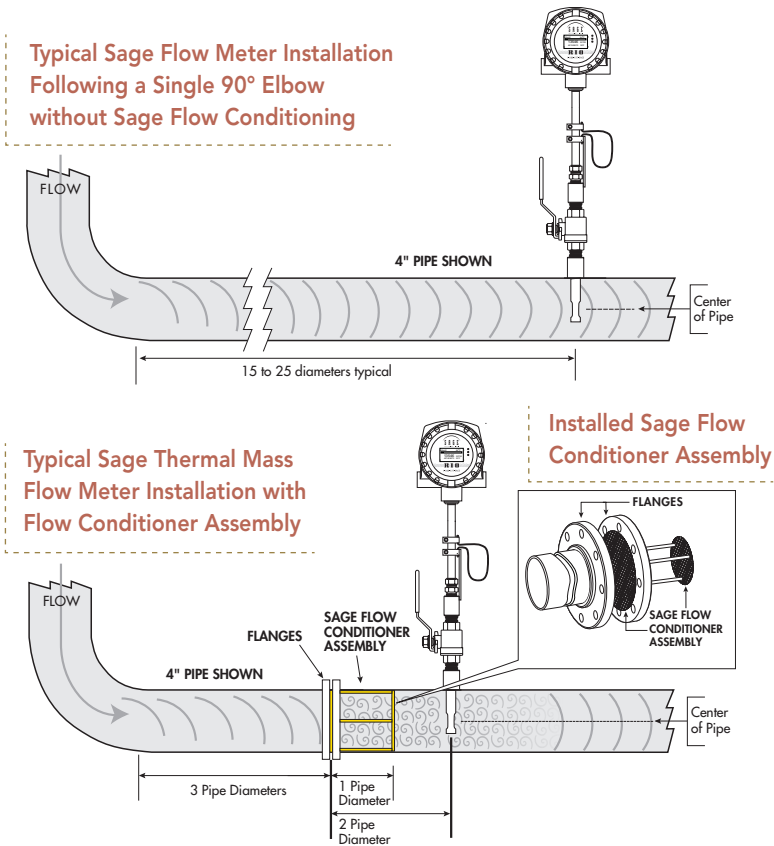
Flow Conditioning

Any insertion flow meter measures the flow at the location of the sensor. Therefore the overall accuracy of the flow measurement is dependent on the flow profile in the pipe.

With sufficient amount of straight pipe run, the desired flow profile naturally occurs. Sage recommends straight run distances which are dependent upon upstream and downstream pipe configuration. These recommended distances provide the expected flow profile at the sensor.

Often the desired amount of straight run is not available. In these situations, Sage Metering offers flow conditioning assemblies. They are easily installed between two flanges as shown to the right. When using a flow conditioning assembly, the recommended upstream straight run is greatly reduced. The use of a flow conditioner is a very simple method for obtaining the best possible overall accuracy.

Note, Sage in-line flow meters (1/2" and up) include built-in flow conditioners, thus minimizing the amount of upstream straight run that is required.



Sage Sensor Design

Sage offers the sensor in two different designs. The standard 1/2" diameter probe for general purpose use and the new 3/4" all welded design for heavy duty industrial applications, as well as ultra high velocity applications.

Installation Hardware

The Sage Flow Meter with insertion probe can easily be installed into a pipe or duct by using a 1/2" or 3/4" NPT connection for the 1/2" probe or a 1" NPT for the 3/4" probe. The two most common methods of installation are the SVA isolation valve with a compression fitting or the simple STCF compression fitting. The compression fittings have Teflon ferrules which provide ease in installation and positioning the sensor. The use of the isolation valve permits the probe to be removed while the process is in operation. Flange connections can also be provided to meet user's piping requirements.

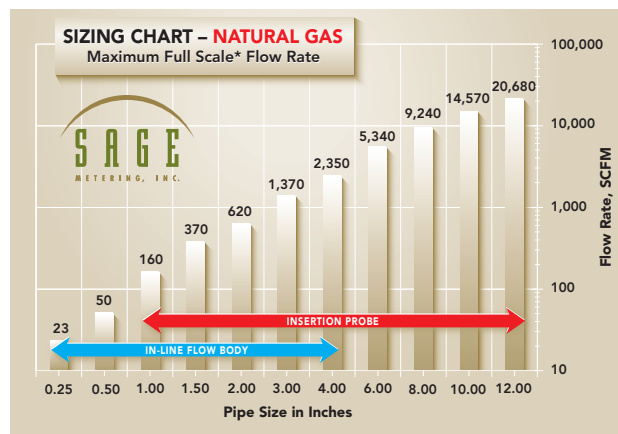
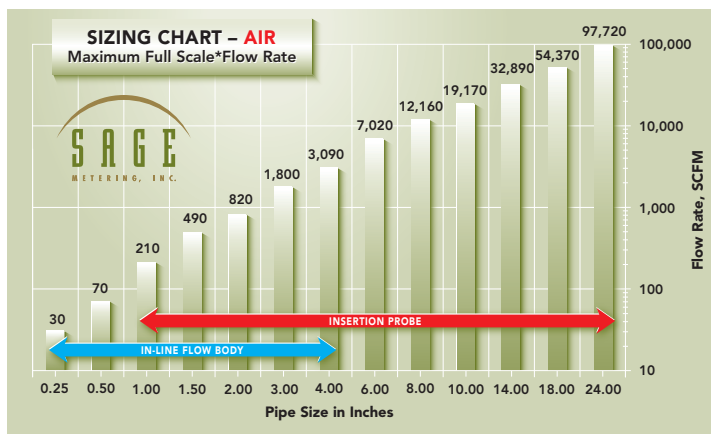
PROBE LENGTH OF INSERTION PROBES

	STCF05/STCF07* Compression Fitting	SVA05LP Isolation Valve Low Pressure	SVA05/SVA07* Isolation Valve High Pressure
PIPE SIZE	<125 PSIG	<50 PSIG	<250 PSIG
1" – 3.5"	6"	12"	15"
4" – 12"	12"	15"	18"
14" – 24"	15"	24"	24"
30"	18"	24"	30"
36"	24"	30"	30"

*Use SVA05 for 1/2" diameter probe and SVA07 for 3/4" diameter probe and sensor

Flow Sizing

The two most common applications for Sage Flow Meters is for measurement of air and natural gas. The following charts indicate the Maximum Full Scale Flow Rates for these gases in different pipe sizes (see below for Minimum Full Scale Flow Rates).



Full Scale Flow Rates of Common Gases Based on Pipe Size in Inches. Minimum Full Scale Flow Rate can be as low as 5% of Maximum Full Scale Flow Rate and will still maintain a 100:1 turndown. The accuracy of $\pm 0.5\%$ of Full Scale $\pm 1\%$ of Reading applies over the full turndown. All calibrations begin at no flow (0 SCFM).

Principle of Operation

Sage Thermal Mass Flow Meters measure heat transfer as the gas flows past a heated surface. Two platinum RTD sensors are clad in a protective sheath. The flow sensor is self-heated while the second sensor measures the temperature of

Sage Thermal Mass Flow Technology Uses Dual Temperature Sensors to Measure Flow Rate

the gas. As gas flows past the heated flow sensor the gas molecules carry heat away from the surface. The

Sage proprietary sensor drive circuit replenishes the lost energy by heating the flow sensor to maintain the desired temperature difference over the entire temperature range of the instrument. The power required to maintain this temperature differential is proportional to the mass flow rate. The inherently non-linear signal provides excellent low flow sensitivity and high turndown capabilities. The signal



is linearized to provide the output signal from the flow meter.

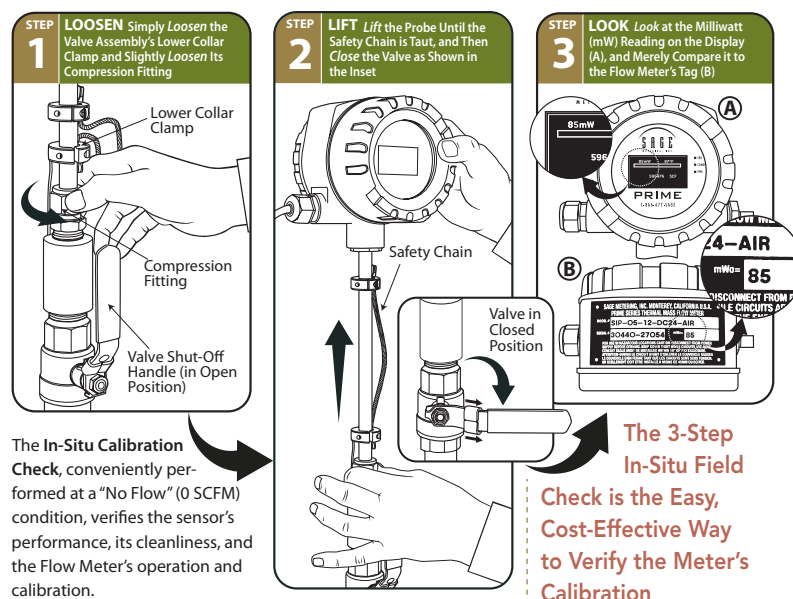
Calibration

Calibration is an essential portion of any thermal mass flow meter. The calibration establishes the

relationship between mass flow and the power required to maintain the specified temperature difference. For best accuracy, calibrations are performed on the actual gas in Sage's NIST traceable calibration facility.

In-Situ Calibration Verification

One of the challenges with any thermal mass flow meter is to verify the instrument's calibration. This is possible on the Sage Prime and Rio if just one of the calibration data points can be checked during normal operation. Sage has developed a unique method which permits the user to verify the calibration without having to shut down or remove the sensor from the process. This "in-situ" process is accomplished in three easy steps – **Loosen, Lift, and Look** (see below). This permits the user



to obtain a "no flow" data point which can be compared against the original factory calibration listed on the name plate and on the calibration certificate. When the measured signal matches the original NIST traceable calibration data, the accuracy of the entire range of the meter is verified. For more information visit www.sagemetering.com



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