

# SAGE NIST TRACEABLE CALIBRATION PROCEDURE

Sage has one of the finest Thermal Mass Flow Meter calibration facilities in the U.S. All of the Sage calibration standards are NIST traceable (National Institutes of Standards and Technology).

As can be seen from the table at the bottom of our Calibration Facility Flyer [[Click here](#)], we have five standards that have an NIST proven accuracy of 0.50% or better, and we have one flow meter simply used for diagnostic reasons (the 4" Vortex). Generally, we use the 2" and 4" Positive Displacement Meters (Roots Meters) as our primary standards. For very high flow rates (high velocity) applications, we also use our 8" Positive Displacement Roots Blower/ Flow Meter. We can take data points up to 30,000 SFPM (~150 NMPS) and can extrapolate to at least 20% above that to maintain published accuracy of 0.5% of Full Scale and +/- 1.0% of Reading over a 100 to 1 turndown. For extremely low flow rates, we can use our Bell Prover, or if necessary, Piston Provers.

As for calibration procedures: We temperature-calibrate every single flow meter in a proprietary facility that eliminates any errors from changes in the process temperature. The data generated from this multi-temperature procedure is then loaded into the Flow Meter's Modbus registers to eliminate any flow errors associated with temperature. This facility also involves a process that sets the sensitivity for our customer's application: Low flow rate application have high sensitivity (more heat applied to the flow sensor); and high flow rate applications have much lower sensitivity (less heat applied to the flow sensor) to deal with the very high heat transfer of Flare Gas, Compressed Air, etc.).

Please note the photos of our calibration facility, particularly the two photos on the right of the Flyer. The 8" Roots Blower/ Meter was instituted in 2017, and you can see the large 8" pipes that go through valves to connect to the 4" flow section where the customer Flow Meter is inserted for calibration. For lower flow rates or smaller in-line Flow Meters, we set up smaller test sections for calibration. However, in all cases, we use the actual process gas or gas mix specified by the customer. In other words, this is a closed loop calibration facility, and unlike some of our competitors such as Endress+Hauser (who only calibrates with Air), we take the flow data with the actual gas or gas mix required (you can see one of the gas tanks in our Calibration Flyer).

Finally, we typically take at least 15 data points (see the 2<sup>nd</sup> attachment). However, and importantly, we take 11 samples for each of those data points (e.g., at least 165

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points). The multiple samples per data point assures that each of the flow points have settled, and thus we get absolutely perfect calibration results. Finally, we use a curve plotting program to linearize the data on the curve, and then enter six unique coefficients into the Modbus registers of the Flow Meter.

Note, Sage is the pioneer of the In-Situ Calibration procedure (see attached Flyer or the following Video), where a customer can verify at any time that the flow meter retains its original NIST calibration with a simple 5-minute verification: <https://sagemetering.com/in-situ-calibration-check/>.

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