Microbridge Airflow Sensors

Gas Correction Factors – Note #3

Microbridge mass airflow sensors operate by measuring the rate of relative heat transfer from a heater resistor to a temperature sensing resistor located on either side of the heater. The heat transfer is proportional to the mass flow. Offsets in the sensor sensitivity (thermal efficiency) will occur if the thermal properties of the medium change. The dominate factor is the thermal conductivity of the gas being measured. Additionally, heat capacity and gas viscosity cause lesser effects.

Heat capacity and gas viscosity are constants for a given gas. However, if the gas composition changes, these properties may also change. Fortunately, air, nitrogen, and oxygen have nearly identical properties.

The 0.5% Argon (Ar) in air is not significant, nor is the relative humidity from 0 to 99% at temperatures less than 40°C (104°F). Humidity levels of 100%, with temperatures greater than 40°C (104°F), indicate that more than 1% of the atmosphere is water. This may cause a measurable increase in sensor output. The actual offsets from Argon and 100% humidity are in opposite directions and may partially cancel each other at temperatures less than 40°C (104°F).

Approximate Gas Correction Factors

Gas Type	Approximate Correction Factor
Helium (He)	0.5*
Hydrogen (H_2)	0.7*
Argon (Ar)	0.95
Nitrogen (N_2)	1.0
Oxygen (O_2)	1.0
Air	1.0
Nitric oxide (NO)	1.0
Carbon monoxide (CO)	1.0
Methane (CH_4)	1.1
Ammonia (NH_3)	1.1
Nitrous oxide (N_2O)	1.35
Nitrogen dioxide (NO_2)	1.35
Carbon dioxide (CO_2)	1.35

Note: Gas correction factors are referenced to nitrogen (N_2) as calibration gas type. Approximate gas correction factors are provided as guidelines only. Individual gas types may perform differently at temperature extremes and varying flow rates.

*When sensing Hydrogen (H_2) or Helium (He) it may be necessary to power the mass flow sensors using increased supply voltage: Hydrogen, 12 VDC typical, and Helium, 15 VDC typical.

Carbon monoxide (CO) and nitric oxide (NO) have properties similar to air. Carbon dioxide (CO_2) will have increased sensitivity compared to that of air (roughly 135%, this may vary with flow rate). Gases similar to CO_2 are nitrous oxide (N_2O) and nitrogen dioxide (NO_2).

Helium has such a high thermal conductivity that it will saturate the heater control circuit on the sensor unless supply voltage is increased to 15 VDC*. Helium sensitivity is then reduced to the point where two liters of Helium will produce an output eqivalent to one liter (1,000 sccm) mass flow of air or nitrogen. The correction factor will be dependent upon temperature and actual flow rate.

Hydrogen flow measurement requires the use of a special sensor. These devices provide normal operation when sensing hydrogen flow and are designated with an ''H'' at the end of the catalog listing. Established hydrogen stable listings include AWM2100VH, AWM2300VH and AWM42150VH.