

MASS FLOW TUTORIAL

INTRODUCTION

Like variable area flowmeters, electronic mass flow equipment measures and controls the flow of gases. Unlike variable area flowmeters mass flow equipment measurement is not compromised by the variation of pressure or temperature within stated limits of each unit. The technology of mass flow measurement offers a host of solutions to gas control and the possibility of preparing gas mixtures on site in the laboratory or in the manufacturing process. Accuracy is generally + 1% FS compared to + 5% fS for a variable area meter.

MASS FLOW PRINCIPLE OF OPERATION

Metered gases are divided into two laminar flow paths, one through the primary flow conduit, and the other through a capillary sensor tube. Both flow conduits are designed to ensure laminar flows and therefore the ratio of their flow rates is constant.

Two precision temperature sensing windings on the sensor tube are heated, and when flow takes place, gas carries heat from the upstream to the downstream windings. The resultant temperature differential is proportional to the change in resistance of the sensor windings.

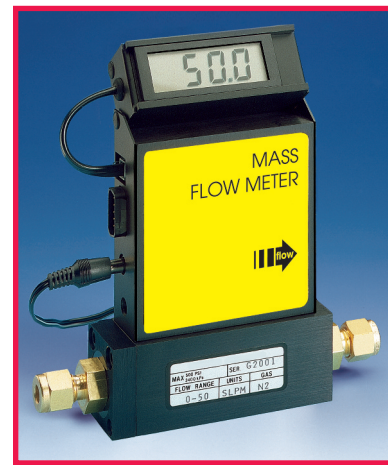
A Wheatstone bridge design is used to monitor the temperature dependent resistance gradient on the sensor windings which is linearly proportional to the instantaneous rate of flow.

Output signals of 0 to 5Vdc and 4 to 20mA are generated indicating mass molecular based flow rates of the metered gas.

Flow rates are unaffected by temperature and pressure variations within stated limitations.

MASS FLOWMETERS

A mass flowmeter consists of a transducer and a readout like the unit picture here. Mass flow units are factory calibrated with an NIST traceable certified systems, have a high level of leak integrity (normally 10⁻⁹sccs helium) and can be fitted with a totalizer that provides the current flow rate and the total volume of gas passed over time.



MASS FLOW CONTROLLERS

A mass flow controller is a mass flow transducer combined with an electronic control valve. A typical mass flow controller is pictured here. With the control valve the user is able to set and maintain a specified flow rate regardless of pressure and temperature variations within the designated limitations of the device. The mass flow controller has all the features of a mass flowmeter with regard to calibration, leak integrity, and totalizing.

