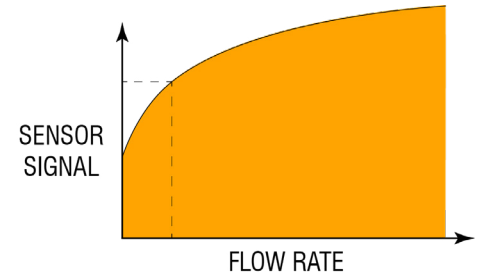# FOX TECH TIP

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Theory of Operation: Thermal Gas Mass Flow Meters

REPEATABLE GAS MASS FLOW MEASUREMENT

Fox Thermal flow meters use a constant temperature differential (ΔT) technology to measure mass flow rate of air and gases. The thermal mass flow sensor consists of two Resistance Temperature Detectors (RTDs). The sensor elements are constructed of a reference grade platinum wire wound around ceramic mandrels that are inserted into stainless steel or Hastelloy tubes.

The *reference RTD* measures the gas temperature. The *heated element* is kept at a constant temperature and the instrument electronics measure the cooling effect of the gas flow. The electrical power required to maintain a constant temperature differential is directly proportional to the mass flow rate of the process gas. The microprocessor then linearizes this data to deliver a 4-20mA output signal.
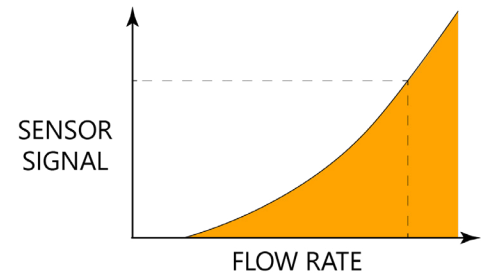
THERMAL MASS FLOW BY FOX THERMAL

- Direct mass flow measurement of air and gases in standard volumetric units (i.e. SCFM or NM3/H) or mass units (i.e. lbs/m or kg/h)
- No additional pressure or temperature compensation required
- Exceptionally broad measurement range, (up to 1000:1; 100:1 typical) including very low velocity flow rates
- Linear 4-20mA output proportional to mass flow rate
- Linear 4-20mA output for process temperature
- Low pressure drop
- No moving parts
- Insertion, inline, and remote sensor configurations (remote only available for the FT2A, FT3, and FT4X models)
- Microprocessor based, field programmable electronics
- Proprietary DDC-Sensor™ or PowerPro™ Sensor
- Mesaures flow rate and flow total

FOX THERMAL FLOW METERS

SENSOR SIGNAL

FLOW RATE

DP FLOW METERS

SENSOR SIGNAL

FLOW RATE

Figure 1: Comparison of Fox Thermal mass flow meters to DP meters

DDC-SENSOR™ TECHNOLOGY

The Fox Thermal DDC-Sensor™ is a new state-of-the-art sensor technology used in the FT1, FT4A, and FT4X flow meters. The DDC-Sensor™ is a Direct Digitally Controlled sensor that is interfaced directly to the microprocessor for more accuracy, speed, and programmability. The DDC-Sensor™ accurately responds to changes in process variables (gas flow rate, pressure, and temperature) which are used by the microprocessor to determine mass flow rate, totalized flow, and temperature.

DDC-Sensor™ shown in closeup with weld mark detail on the bottom of the RTD window highlights non-cantilevered design.