Eldridge Products, Inc.

Thermal Gas Mass Flow Measurement and Control Instrumentation

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EPI produces a wide variety of thermal instrumentation for gas mass flow measurement and control. Built with over twenty years experience in thermal mass flow metering design and production, our thermal flowmeters and flow switches are known for superior quality, dependability, ease of use, and durability in real world applications.

Our Master-Touch™ Family of thermal gas mass flowmeters greatly expanded this legacy by adding a powerful microprocessor to our proven thermal technology for an unparalleled degree of flexibility, accuracy, and control. Upon its introduction, the Master-Touch raised the standard for "smart" technology and it remains at the forefront of thermal gas mass flow instrumentation.

Sensor Theory and Operation

Master-Touch products include a rugged, cleanable, thermal mass flow sensor. These units consist of a sensor assembly which utilizes two RTD (Resistance Temperature Detector) sensing elements. The sensors are constructed of reference grade platinum, ceramic, glass, and stainless steel. Two platinum resistance sensors are built up upon the ceramic substrate and then given a thin glass coating. The assembly is then slipped into a stainless steel sheath for corrosion and abrasion resistance. The sensor assembly is large, rugged, insensitive to dirt buildup, and easily cleaned.

During operation, the temperature sensor constantly measures the ambient temperature of the gas and maintains a reference resistance on one side of a Wheatstone bridge. The second sensor is forced through self-heating to a constant temperature above that of the gas stream and is controlled by the temperature sensor and our forced null Wheatstone bridge amplifier. Our bridge circuit is set up with precise resistance values to maintain the overheat temperature and to counterbalance the process gas temperature effects.

Since the sensor compensates for temperature changes and pressure effects are negligible, the heated sensor becomes a mass flow sensor. Gas mass flow across the heated sensor is measured by the thermal heat transfer (loss) of the sensor. As the velocity of the gas is increased, more heat is transferred from the sensor to the gas stream. Gas molecules absorb heat while passing the heated sensor surface and thus more power is required of the sensor's drive circuit to maintain a constant sensor overheat temperature. This heat transfer is directly proportional to the mass velocity of the gas (density x velocity). The power demand of the flow transmitter is what we use as our non-linear mass flow or mass velocity transmitter signal.

Inline & Insertion Styles

The inline style flowmeter assembly includes the flow sensing element, temperature sensing element, bridge amplifier/signal output board, linearizer circuit board, transmitter enclosure, and flow section. The flow section is typically specified to match the user's flow conduit and is plumbed directly in the flow line. This design has the sensing elements mounted directly in the flow section for exposure to the process gas.

Our inline style flowmeters are available in sizes from 1/4" pipe through 4" pipe and are provided with threaded male NPT ends as the standard mounting style for sizes as large as 2 1/2". For sizes 3" and larger, ANSI 150# flanges are standard. Optional end mounting styles may be specified, such as tube ends, tube end fittings, butt weld ends, flanged ends, etc. as required for any size. Pipe sizes in excess of 4" require insertion style thermal mass flow meters.

The insertion style flowmeter assembly includes the flow sensing element, temperature sensing element, bridge amplifier/signal output board, linearizer circuit board, transmitter enclosure, and probe assembly which supports the sensing elements. This design requires the probe assembly to be inserted into the process gas flow conduit to allow the process gas to flow across the sensor assembly. The insertion style thermal mass flow meter probe assemblies may be inserted into any suitable flow section, pipe, duct, etc.

Our Insertion style thermal mass flowmeters are available with 1/2", 3/4", or 1" OD probes and may be installed with pipe fitting connections or user supplied bored through tube fittings. Tube fittings, with or without mounting flange, are also available from the factory as an option. The tube length must be specified upon ordering. Standard probe lengths are available in 3" increments for lengths from 6" to 24", and in 6" for lengths from 24" to 60".

Integral & Remote Styles

Integral style flowmeters are assembled with all electrical components, digital display and power supply located within one enclosure. This enclosure is mounted directly to the flowbody (inline thermal mass flowmeters) or probe assembly (insertion thermal mass flowmeters).

Remote style flowmeters are assembled with the flow transmitter located in an enclosure that is mounted directly to the flowbody (inline flowmeters) or probe assembly (insertion flowmeters). The linearizing electronics, digital display and power supply are remotely mounted for convenient access. A two-wire, twisted pair cable is typically used to connect the electronics enclosures.

Inlet Flow Conditioners

All inline style flowmeters for line sizes of 3/4" and larger now include a pair of inlet flow conditioners. These conditioners help to improve problematic, uneven flow profiles by disrupting the gas flow and allowing it to assume a more uniform profile, without adding any significant pressure drop in most applications.

NEW LightWIRE™

Our Master-Touch flowmeters now include infrared communications via our *LightWIRE* technology. *LightWIRE*-enabled flowmeters are used with PCs and laptops running EPICommunicator™ software via Communicator I RS232 or USB adapters, or with our handheld Communicator II. The new Communicator II provides the same functionality as the 4-button keypad — without opening the flowmeter enclosure cover.

Master-Touch™ Technology

Our Master-Touch technology adds a powerful "smart" microprocessor to our proven sensor and bridge circuitry for improved performance and user control. The microcomputer performs digital signal processing (DSP) functions utilizing a high speed, high resolution 12-bit analog to digital converter (ADC), a central processing unit (CPU) and a high resolution 12-bit digital to analog converter (DAC). Operations are performed in real time while supporting simultaneous full duplex RS232 communications.

Digital Subsystems

Five digital subsystems control the Master-Touch functions:

1. **Analog-to-Digital Converter** (ADC) to acquire the data generated by the sensors.
2. **Curve Linearizer** to transform nonlinear to linear voltages.
3. **Digital-to-Analog Converter** (DAC) to generate output voltage from sensor data.
4. **Voltage Tracking** to perform real-time processing of input and output signals.
5. **EEPROM** to store and maintain user configurable variables.

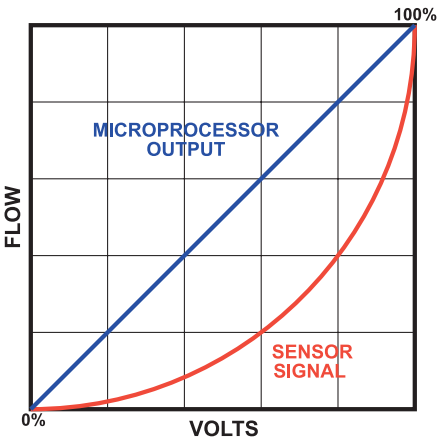
Major Features

Every Master-Touch flowmeter supports up to **Four Separate Meter Ranges** that can include independent calibration data for different gases, flow ranges, pressures, etc. The meter ranges can be selected through the keypad, a PC, your DCS, or by external switching.

The Master-Touch provides **Continuous Curve Fitting** as the microprocessor uses a polynomial curve fit to linearize data into a continuous linear output with 12-bit precision. The flowmeter variables may be viewed or modified without any interruption to the flow signal or elapsed flow totalization.

The Master-Touch also supports **Continuous Tracking** and **Timestamping** of high and low flow rates. These values can be easily reset as needed.

The user can choose from a variety of **Engineering Units** while the flowmeter is in operation. All flow rate, accumulated total, alarm, and timestamp information is automatically converted into the new units.



User input and control of the field-adjustable, smart transmitter is supported by the four-button touch keypad or via RS232 I/O communications using ***EPICommunicator***™ software.

Menuing System

The basic menuing system is accessed via the 4-button keypad and features six operational modes:

1. The **Run Mode** displays the flow rate and total flow, the selected calibration range and the status of the relay contact closures.
2. The **Meter Mode** provides easy access to the engineering units, elapsed flow reset, and output scaling.
3. The **Utility Mode** supports signal filtering, various display options, and locking/unlocking the settings.
4. The **Status Mode** presents information about the current status of the metering operations.
5. The **Alarm Mode** is utilized for flow alarms, batch counting, or timer functions. Two 1-amp relays can be configured for any combination of alarms.
6. The **Factory Mode** is reserved for factory configuration and variables.

Applications & Solutions

For many years EPI's flowmeters have been installed in a wide variety of process control applications, from steel and paper mills to auto manufacturers to pharmaceutical houses, from natural gas submetering and compressed air consumption to water & wastewater treatment plants.

Gas Submetering

For many companies, the use of natural gas is the obvious choice for submetering. The gas is typically delivered through large lines at very high pressure and the gas company supplies the figures for your overall consumption. But beyond this general custody transfer, how much do you know about specific consumption and how are opportunities for cost savings determined? Submetering at selected points will show where the gas is used, how much gas is used at each location or work area, and when each location or work area is using the gas. This is the information needed to analyze ongoing expenses and to refine overall usage.

Compressed Air Monitoring

In many facilities, compressed air is one of the primary components of overall energy use. As energy costs continue to rise, accurately tracking the use of compressed air can produce direct and immediate benefits by providing the information you need to establish a program that:

1) monitors general usage to encourage cost conservation;

2) tracks peak usage to determine the optimum compressor capacity; and

3) simplifies the overall instrumentation needs through the use of thermal gas mass flow technology.

EPI flowmeters are the instrument of choice for compressor distributors and air audit professionals throughout the country.

Water & Wastewater Treatment

The treatment of water and wastewater is a critical element of municipal responsibility. Increased public and private awareness of water quality, availability, and cost is a driving force behind the demands for better efficiency and economy in these processes.

The use of compressed air is necessary to promote optimal bacteria growth in aeration basins. Closely controlling the aeration process can reduce energy consumption by as much as 25%, and accurate measurement is critical to achieving this goal.

Monitoring Digester or Bio Gas is equally important. The primary objective is to achieve an overall system balance. A secondary objective is to monitor the excess gas (waste gas) that is used as a fuel to power onsite generators and pumps, or to create energy for a more widespread power grid. In addition, monitoring is often a requirement of local, state, and Federal environmental guidelines.

Typical Industrial Applications

AUTOMOTIVE INDUSTRY

Compressed air monitoring * Natural gas consumption * Powder paint air flow * Paint booth/paint oven ventilation

UTILITY SERVICES

Stack or flue gas * Waste water aeration * Ventilation systems * Digester gas * Gas flows * Nitrogen purge * Combustion air * Boiler inlet air

FOOD PROCESSING

Drying air * Ventilation systems * Boiler inlet air * Exhaust gas * Process control * Compressor lines

HVAC

Air balancing * Duct flows * Energy conservation * Fume hoods * Clean rooms * Laminar flow benches

LABORATORY AND R & D

Flow research * Biomedical studies * University studies * Toxicology studies * Energy studies * Industrial Hygiene * Occupational Safety * Experimentation

PETROLEUM & GAS INDUSTRIES

Custody transfer * Landfill gas recovery * Flare gas measurement * Gas mixing * Gas quality studies * Leak testing

RAW MATERIALS INDUSTRIES

Pulp & paper mills * Mining * Semiconductor manufacturing * Chemical processing * Primary metals * Plastics & synthetics