

SS FLOW_TMFM

THERMAL MASS FLOWMETER



KEY FEATURES

- **Direct Mass Flow Measurement:** Unlike traditional flowmeters that may measure volumetric flow and require additional density or temperature compensation, thermal mass flowmeters directly measure mass flow rate
- **Wide Rangeability:** They often have a wide turn down ratio of 100: 1
- **High Accuracy:** Thermal mass flow meters can provide high accuracy and repeatability, particularly in applications where stable and laminar flow conditions exist.
- **Low Pressure Drop :** They typically have a low pressure drop compared to other flow measurement technologies, making them suitable for applications where minimizing pressure loss is critical.
- **No Moving Parts :** Since they operate based on thermal principles, they do not have any moving parts, which contributes to their reliability and minimal maintenance requirements.
- **Cost Effective :** Particularly in large line sizes, the Thermal Mass Flowmeter offers a cost-effective solution in terms of both product and installation costs

WORKING PRINCIPLE

The working principle of a thermal mass flow meter is based on the concept of convective heat transfer. The flow meter consists of a heated element (often referred to as a sensor or probe) and temperature sensors. These sensors are usually located upstream and downstream of the heater. The heater continuously maintains a constant temperature difference (ΔT) relative to the fluid. As the fluid flows past the heated element, it absorbs heat due to convective heat transfer. The temperature sensors measure the temperature difference (ΔT) between the heated element and the fluid. This temperature difference is directly proportional to the rate at which heat is carried away by the fluid, which in turn correlates with the mass flow rate of the fluid. By knowing the heat input (power supplied to the heater) and monitoring the temperature difference (ΔT), the mass flow rate of the fluid can be calculated using specific calibration factors and the physical properties of the fluid (such as thermal conductivity and specific heat). The flow meter processes this data to provide an output signal that directly indicates the mass flow rate of the fluid.

TECHNICAL SPECIFICATION

#	Item Name	Parameter Values
1	Measuring Medium	Various gases (Except the acetylene)
2	Pipe Size	DN10~DN4000mm
3	Velocity	0.1~30/60/100 Nm/s
4	Accuracy	$\pm 1 \sim 3\%$
5	Working Temperature	Sensor: $-40^{\circ}\text{C} \sim +80^{\circ}\text{C}/150^{\circ}\text{C}/250^{\circ}\text{C}$ / Transmitter: $-20^{\circ}\text{C} \sim +45^{\circ}\text{C}$
6	Working Pressure	16 bar, Consult factory for high Pressure
7	Power Supply	Compact type: 24VDC or 220VAC, Remote type: 24VDC or 220VAC
8	Response Time	1Sec. / 3 Sec.
9	Output	4-20mA (optoelectronic isolation, maximum load 500 Ω), Pulse, RS485 (optoelectronic isolation) and HART
10	Alarm Output	Relay Output
11	Sensor Type	Standard Insertion, Hot-tapped Insertion and Flanged
12	Construction	Compact and Remote
13	Pipe Material	Carbon steel, stainless steel, plastic, etc
14	Carbon steel, stainless steel, plastic, etc	4 lines LCD, TFT, LED Display Mass flow, Volume flow in standard condition, Flow Totalizator, Date and Time, Working time, and Velocity, etc.
15	Protection Class	IP65 / IP67 / Flameproof
16	Sensor Housing Material	Stainless steel (316) / Platinum / PTFE Coating etc

APPLICATION

▪ Steel & Power

- **Natural Gas Measurement:** Steel and Power plants often rely on natural gas for various processes, including heating furnaces, powering boilers, and as a fuel source for turbines. Thermal Mass Flow meters accurately measure the flow rate of natural gas, ensuring precise consumption monitoring and efficient energy management.
- **Compressed Air Systems:** Compressed air is extensively used in both steel manufacturing and power generation processes for pneumatic tools, control systems, and other operational needs. Thermal Mass Flow meters accurately monitor the flow of compressed air, enabling effective leakage detection, optimizing compressor efficiency, and reducing energy costs.
- **Emissions Monitoring:** Steel and Power plants are subject to stringent environmental regulations regarding emissions of gases such as methane, carbon dioxide, and nitrogen oxides. Thermal Mass Flow meters are employed to measure the flow rates of these gases, enabling plants to monitor and control emissions effectively to comply with regulatory requirements.
- **Process Gas Measurement:** Various gases such as oxygen, nitrogen, and argon are used in steel production processes like blast furnaces, converters, and electric arc furnaces. Thermal Mass Flow meters are utilized to measure the flow rates of these process gases, ensuring precise control over gas injection rates, improving process efficiency, and enhancing product quality.

▪ Food & Pharmaceuticals

- **Sterilization Processes:** Thermal Gas Flowmeters are used to measure the flow sterilizing gases used in autoclaves and sterilization chambers. Accurate flow measurement ensures proper sterilization conditions, crucial for maintaining product integrity and safety in pharmaceutical manufacturing and food processing.
- **Packaging:** In food packaging applications, Thermal Gas Flowmeters are employed to monitor the flow of inert gases such as nitrogen or carbon dioxide used for modified atmosphere packaging (MAP). MAP helps extend the shelf life of perishable foods by controlling the atmosphere inside the packaging. Precise gas flow measurement ensures consistent packaging quality and shelf life extension.
- **Gas Purging and Inerting:** Thermal Gas Flowmeters are utilized for purging and inerting applications where gases like nitrogen or argon are used to displace oxygen from tanks, reactors, or storage vessels. This is crucial in pharmaceutical manufacturing to prevent oxidation and maintain product stability. Accurate flow measurement ensures efficient use of inert gases and compliance with safety standards.
- **Process Control:** In both food and pharmaceutical production, Thermal Gas Flowmeters play a vital role in process control by monitoring the flow of gases used in various stages of production. This includes monitoring the flow of process gases in reactors, drying chambers, and mixing processes to ensure consistent product quality and production efficiency.
- **Environmental Monitoring:** Thermal Gas Flowmeters are employed for monitoring emissions and exhaust gases in pharmaceutical facilities to ensure compliance with environmental regulations. They measure the flow rates of gases released from processes such as incineration or chemical synthesis, aiding in emissions control and environmental impact assessment.
- **Research and Development:** In pharmaceutical research and development laboratories, Thermal Gas Flowmeters are used for precise measurement of gases in experimental setups and pilot plants. This helps researchers accurately control experimental conditions and optimize processes during drug development and formulation studies.

■ Textile Industries:

- **Air Supply for Spinning and Weaving:** Textile manufacturing processes such as spinning and weaving often require a continuous and controlled supply of compressed air. Thermal Mass Flowmeters measure the flow rate of compressed air, ensuring that adequate amounts are delivered to spinning machines, air jet looms, and other equipment. This helps maintain consistent production speeds and quality of textile products.
- **Dyeing and Finishing Processes:** In textile dyeing and finishing operations, various gases such as steam and compressed air are used for heating, drying, and treating fabrics. Thermal Mass Flowmeters monitor the flow rates of these gases, ensuring precise control over process parameters such as temperature and humidity. This contributes to uniform dyeing and finishing results, enhancing product quality and reducing production variability.
- **Boiler and Heating Systems:** Textile plants often rely on boilers for steam generation, which is essential for heating water, dye baths, and providing energy for various processes. Thermal Mass Flowmeters measure the flow of natural gas, fuel oil, or other combustible gases used in boilers, ensuring efficient combustion and optimal energy utilization. Accurate flow measurement helps in managing fuel costs and maintaining environmental compliance.
- **Environmental Control and Emissions Monitoring:** Textile manufacturing can involve emissions of gases such as exhaust from boilers and air handling systems. Thermal Mass Flowmeters are used to monitor these emissions, ensuring compliance with environmental regulations. By accurately measuring flow rates, they help textile plants manage air quality and minimize environmental impact.
- **Process Optimization and Energy Efficiency:** Thermal Mass Flowmeters play a crucial role in optimizing energy use and improving overall efficiency in textile production. By providing real-time data on gas flow rates, these instruments enable plant operators to identify inefficiencies, optimize processes, and reduce energy consumption. This contributes to cost savings and sustainability goals within the textile industry.
- **Maintenance and Safety:** Monitoring gas flow rates using Thermal Mass Flowmeters helps in detecting anomalies or leaks in gas supply systems promptly. This proactive approach supports maintenance efforts, ensuring equipment reliability and safety in textile manufacturing facilities.

■ Automobile

- **Engine Air Intake Measurement:** Thermal Mass Flowmeters accurately measure the intake air flow rate entering the engine. This measurement is critical for engine control systems to adjust fuel injection rates, ensuring optimal air-fuel ratios for combustion efficiency, engine performance, and emissions control.
- **Exhaust Gas Measurement:** In exhaust systems, Thermal Mass Flowmeters measure the flow rate of exhaust gases. This data is used for emission monitoring and compliance with environmental regulations. Monitoring exhaust gas flow helps automotive manufacturers ensure that vehicles meet emission standards and optimize exhaust system design for efficiency.
- **Fuel Consumption Measurement:** Thermal Mass Flowmeters are used to measure the flow rate of fuel gases such as natural gas or hydrogen in alternative fuel vehicles (e.g., natural gas vehicles, hydrogen fuel cell vehicles). Accurate measurement of fuel flow supports efficient fuel management, helping to optimize vehicle range and performance.
- **Climate Control Systems:** In automotive HVAC (Heating, Ventilation, and Air Conditioning) systems, Thermal Mass Flowmeters measure the flow rates of refrigerant gases (such as R134a or R1234yf) used for cooling and heating. This ensures precise control of cabin temperature and humidity levels, enhancing passenger comfort.

- **Tire Inflation Systems:** Thermal Mass Flowmeters are utilized in tire inflation systems, where they measure the flow of compressed air or nitrogen used to inflate and maintain tire pressure. Accurate flow measurement helps ensure proper tire inflation, optimizing vehicle safety, handling, and fuel efficiency.
- **Battery Cooling Systems (Electric Vehicles):** In electric vehicles (EVs), Thermal Mass Flowmeters monitor the flow rates of cooling gases (e.g., refrigerants or coolants) used to regulate the temperature of high-voltage batteries. Proper cooling is crucial for maintaining battery performance, longevity, and safety.
- **Emissions Testing and Development:** During vehicle development and emissions testing, Thermal Mass Flowmeters are used to measure and analyze exhaust gas flow rates. This helps engineers assess engine performance, optimize emission control strategies, and comply with regulatory standards.

▪ Cement

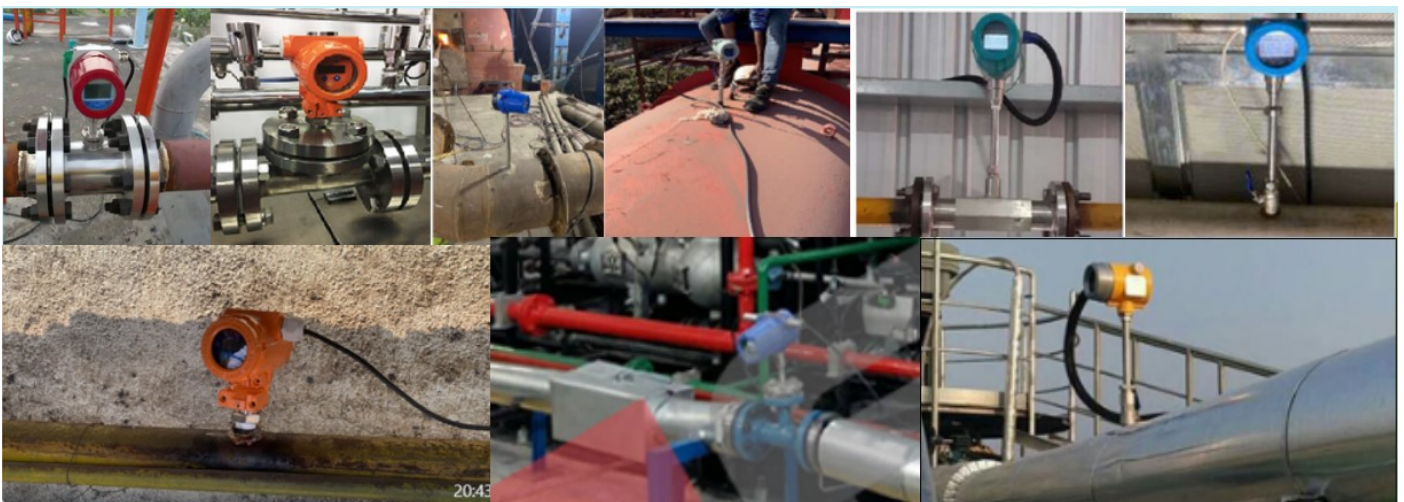
- **Air Supply and Blending:** Cement production processes often require controlled air supply for combustion in kilns and preheaters. Thermal Mass Flowmeters measure the flow rates of combustion air and secondary air, ensuring optimal oxygen levels for efficient fuel combustion. This helps maintain kiln temperature profiles, enhance clinker quality, and optimize energy consumption.
- **Coal and Alternative Fuel Injection:** Thermal Mass Flowmeters are used to measure the flow rates of pulverized coal or alternative fuels such as biomass, waste-derived fuels, or tires injected into kilns or calciners. Accurate fuel flow measurement ensures proper combustion efficiency, thermal energy distribution, and adherence to emission standards.
- **Flue Gas Measurement:** In cement plants, Thermal Mass Flowmeters monitor the flow rates of flue gases emitted from kilns and other combustion processes. This data is crucial for environmental compliance, as it helps in monitoring and controlling emissions of pollutants such as particulate matter, sulfur dioxide (SO₂), and nitrogen oxides (NO_x).
- **Process Gas Measurement:** Thermal Mass Flowmeters measure the flow rates of process gases such as nitrogen, oxygen, and carbon dioxide used in various stages of cement production, including grinding, blending, and packing. Accurate flow measurement aids in optimizing process efficiency, controlling material flow rates, and maintaining product quality.
- **Cooling Air and Ventilation:** Thermal Mass Flowmeters monitor the flow rates of cooling air used to regulate the temperature of equipment and components in cement plants, such as coolers and grinding mills. Proper airflow management helps prevent overheating, extend equipment lifespan, and ensure consistent production operations.
- **Dust Collection and Pneumatic Conveying:** Thermal Mass Flowmeters are utilized in dust collection systems and pneumatic conveying of raw materials, additives, and finished cement. They measure the flow rates of air and gases used in these systems, ensuring efficient material handling, minimizing dust emissions, and maintaining workplace safety.
- **Fuel Gas Measurement:** Thermal Mass Flowmeters measure the flow rates of natural gas, fuel oil, or other combustible gases used in auxiliary equipment such as boilers, heaters, and power generation units. Accurate fuel flow measurement supports efficient energy utilization, reduces operational costs, and ensures reliable supply to essential plant operations.

▪ Oil & Gas

- **Natural Gas Measurement:** Thermal Mass Flowmeters accurately measure the flow rates of natural gas at various points in the distribution and transmission networks. This includes metering natural gas flow from production wells, through pipelines, and at distribution points for billing purposes. The data helps operators manage gas supply, monitor consumption, and ensure compliance with regulatory standards.

- **Flare Gas Measurement:** In oil and gas production facilities, Thermal Mass Flowmeters monitor the flow rates of flare gases that are burned off during operational upsets or routine maintenance. Accurate measurement of flare gas flow helps operators assess environmental impact, optimize combustion efficiency, and comply with regulatory requirements for emissions control.
 - **Fuel Gas Measurement:** Thermal Mass Flowmeters are used to measure the flow rates of fuel gases such as natural gas, propane, or butane used in boilers, heaters, turbines, and other equipment at production facilities. Precise measurement ensures efficient combustion, energy management, and operational safety.
 - **Hydrogen Sulfide (H₂S) Measurement:** Thermal Mass Flowmeters are employed to measure the flow rates of hydrogen sulfide gas in sour gas processing facilities and pipelines. Monitoring H₂S flow is critical for safety, environmental compliance, and optimizing the efficiency of sulfur recovery processes.
 - **Emissions Monitoring:** Thermal Mass Flowmeters are used for emissions monitoring in oil and gas facilities to measure the flow rates of exhaust gases from engines, turbines, and flares. Monitoring emissions helps operators comply with environmental regulations, assess environmental impact, and implement emission reduction strategies.
 - **Pipeline Leak Detection:** Thermal Mass Flowmeters are integrated into pipeline systems for continuous monitoring of gas flow rates. Sudden changes in flow rates can indicate potential leaks or anomalies in the pipeline. Early detection through flow measurement helps operators minimize environmental risks, prevent product loss, and ensure pipeline integrity.
 - **Gas Lift Operations:** In oil production operations, Thermal Mass Flowmeters are used to measure the flow rates of gas injected into wells for artificial lift purposes (gas lift). Accurate measurement of gas flow helps optimize production rates, maintain reservoir pressure, and extend well longevity.
- Well Testing and Production Optimization:** Thermal Mass Flowmeters play a role in well testing operations, where they measure gas flow rates during production testing and reservoir evaluation. Accurate flow measurement helps in optimizing well performance, identifying reservoir characteristics, and maximizing hydrocarbon recovery.

FEW INSTALLATIONS PICTURE



ORDERING INFORMATION

SS FLOW_TMFM_LINE SIZE			
MOC	1 – SS304 2 – SS316 3 – Other	Protection	1 - IP 65 2 – IP67
Pressure	1 – Up to 16 Bar 2 – Other	Explosion Proof	1 - Yes 2 - No
Connection	1 – Flange 2 – Thread 3 – Clamp 4 – Insertion	Output :	1 - 4 to 20mA 2 – RS485 3 – 4 to 20mA + HART 4 – 4 to 20mA + RS485
Temperature	1 – 80 Degree C 2 – 150 Degree C 3 - 250 Degree C 4 – Above 250 Degree C	Relay	1 - Switching 2 – With Addition Output 3 – NA
Power	1 – 24vDC 2 – 230V DC	Test Certificate	1 – Factory Calibration 2 – NABL lab
Display	1 - Without 2 – Integral 3 – Remote Type	Any Other Details	Please specify

WE UNDERSTAND FLOW

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