



MDOT

Thermal Mass Flow Meter

Advanced gas flow monitoring for the water and wastewater treatment process.

The MDot is one of the most technically advanced gas flow meters specifically designed for the water and wastewater market. Extensive engineering effort has been invested to deliver advanced features, accurate measurement performance, and outstanding reliability.

The MDot is an innovative Thermal Mass Flow Meter and Temperature Transmitter. It is microprocessor-based and field-programmable, and operates on the law that gases absorb heat. The MDot features two sensor elements, with one sensor element detecting the gas temperature and the second maintained at a constant temperature above the gas temperature. When gas flows past the sensor, the energy required to maintain the constant differential temperature as heat is siphoned into the gas is proportional to the mass flow rate.

Gas Flow Measurement in the Water and Wastewater Industry

The MDot Thermal Mass Flow Meter has been designed to meet the demands of the water and wastewater industry, where aeration, digestion, and cogeneration play crucial roles.

Optimize your aeration blower systems, and save money on operation costs, by installing the MDot on your main air header and each individual feed line. The MDot is highly accurate and has incredible turndown, perfect for modern systems where blowers are variable speed.

In aerated grit removal systems, installing the MDot will allow you to accurately adjust your air feed process for the varying influent conditions seen at the treatment plant. With incredible turndown, the MDot ensures accurate measurement at minimal to maximum wastewater volumes.



THE RIGHT METER FOR

- Aeration Tanks
- Digester and Biogas Monitoring
- Air Injection
- Cogeneration Systems
- Natural Gas Makeup and Submetering

For your anaerobic digestion or biogas systems, the MDot is the right solution to measure the gas output. With the best low-flow performance compared to other types of gas meters, the MDot ensures you are always making a measurement and able to meet environmental regulations for monitoring output. The built-in MDot GasSelect feature allows you to change your methane and CO2 gas composition, and to adjust for changes in your process, without having to remove the meter to be sent back for recalibration. You'll never have to stop your process or worry about inaccuracies because of gas composition.



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As the world moves over to more renewable and sustainable energy, we often see cogeneration power systems set up within water and wastewater treatment plants. These cogeneration systems supply the wastewater market with standby power, or to create green/bioenergy to reduce energy costs. The digester gas or biogas output is commonly used to fire boilers and hot water heaters, generate electricity to operate pumps and blowers, or to generate electricity to sell back to the grid. MDot provides accurate and reliable flow monitoring of methane and other biogases. If methane is used to feed cogeneration systems when produced digester gas is low, the MDot can be used to accurately measure these systems. Finally, since methane is a significant greenhouse gas compared to CO₂, if cogeneration is not utilized at your facility, you can use the MDot to accurately track how much gas is flared in order to report to regulatory agencies.

Mass Flow

The MDot measures mass flow, an advantage over other flow meters which measure volumetric flow rate. Volumetric flow is incomplete because temperature and pressure are unknown and must be measured separately. The MDot provides a direct measurement of gas flow in Mass units (kg/hr, lb/hr), standard volumetric flow rate units (SCFM, SLPM) or normal units (NM³/hr, NLPM) with no additional temperature or pressure measurements required. Turndown is also significantly better with thermal mass technology, with 100:1 typical and 1000:1 achievable. This means that no matter how much your gas flow process changes, you can have confidence your meter is always able to measure and measure accurately.

Calibration Validation

Validate the calibration of the MDot in the field without removing the meter by using the MDot Cal test. The goal of Calibration Validation is to provide operators with the ability to verify that the meter is capturing accurate data at scheduled verification times - or at any time - instead of sending the meter back to the factory. By initiating the MDot Cal in the field, operators can verify that the meter is running accurately by testing the functionality of the sensor and its associated signal processing circuitry. This test can be done in the pipe under normal process conditions. No system shutdown required.

I/O Description

The MDot features a single isolated 4-20mA analog output, with optional HART communication, an isolated pulse output configurable for volume totalization or alarms, and optional Modbus RTU via RS485. There is also a USB port for interfacing with a laptop or computer.

Use the free MDot View software to interface with the USB port. The PC-based software program displays flow meter readings and permits flow meter configuration and initialization of the MDot Cal validation feature. The software is available for download on the Pulsar Measurement website.

Technical Specification

PERFORMANCE SPECIFICATIONS

Flow Accuracy: Air: $\pm 1\%$ of reading $\pm 0.2\%$ of full scale
Other gases: $\pm 1.5\%$ of reading $\pm 0.5\%$ of full scale
(Accuracy specification applies to customer's selected flow range)

Unobstructed Pipe Requirement: Insertion: 15 diameters upstream, 5 diameters downstream
Inline: 8 diameters upstream, 4 diameters downstream

Flow Repeatability: $\pm 0.2\%$ of full scale

Flow Response Time: 0.8 seconds (one time constant)

Temperature Accuracy: $\pm 0.6^\circ\text{C}$ ($\pm 1^\circ\text{F}$)

Calibration: Factory calibration to NIST-traceable standards

MDot Cal: In-situ, operator-initiated calibration validation

OPERATING SPECIFICATIONS

Gas Selections: Air, Methane, or Methane and CO2 mix (Digester or Bio Gas)

MDot GasSelect: Allows the user to change gas selection and Methane/CO2 mixture percentage in the field

Gas Pressure (max): Insertion: 51 barg (740 psig)
Inline, 316SS w/ NPT ends: 34.5 barg (500 psig)
Inline, 316SS w/ ANSI150 ends: 16 barg (230 psig)
Inline, Carbon Steel w/ NPT ends: 34.5 barg (500 psig)
Inline, Carbon Steel w/ ANSI150 ends: 20 barg (285 psig)
NOTE: If Teflon (PTFE) ferrule option ordered, max gas pressure is 4.1 barg (60 psig)

Operating Temperature: MDot DST Sensor: -40 to 121°C (-40 to 250°F)
Enclosure: -40 to 70°C (-40 to 158°F)
NOTE: Display dims below -20°C (-4°F). Function returned once temperature rises again

Flow Velocity Range: 0.07 to 118 NMPS (15 to 25,000 SFPM)
Turndown: Up to 1000:1, 100:1 typical

Relative Humidity: 90% RH maximum; non-condensing
NOTE: Condensing liquids contacting the sensor can cause erratic flow reading

Units of Measurement (field selectable): SCFM, SCFH, NM3/M, NM3/H, NM3/D, NLPS, NLPM, NLPH, MCFD, MSCFD, SCFD, MMSCFD, MMSCFM, SM3/D, SM3/H, SM3/M, LB/S, LB/M, LB/H, LB/D, KG/S, KG/M, KG/H, SLPM, MT/H

Input Power: 12 to 28 VDC, 6 watts
Full input power range: 10 to 30 VDC
A 20 Watt or greater power supply is recommended
Installation (over-voltage) Category II for transient over-voltages

Outputs: **Channel 1:** Standard isolated 4-20mA output for flow or temperature; fault indication per NAMUR NE43; optional HART communication
Channel 2: Option of pulse output or Serial Communication (Modbus RTU via RS485 Isolated pulse output: 5 to 24VDC, 20mA max., 0 to 100Hz for flow (the pulse output can be used as an isolated solid state output for alarms)

USB Communication: USB for connecting to a laptop or computer is standard
Free PC-based software tool - MDot View - provides complete configuration, remote process monitoring, and data logging functions

4-20mA and Pulse Verification: Simulation mode used to align 4-20mA output and pulse output (if ordered) with the input to customer's PLC/DCS.

PHYSICAL SPECIFICATIONS

Probe Diameter: 3/4-inch

Sensor Material: 316 stainless steel

Enclosure: NEMA 4X, aluminum, dual 3/4-inch FNPT conduit entries.

SOFTWARE

MDot View: For easy field setup, and access to all meter configuration and data logging functions

MDot Cal: To validate meter functions

INLINE METER AVAILABLE SIZES, MATERIALS, AND PROCESS CONNECTIONS

Nominal Size	Flow Body Materials (Schedule 40)		Process Fittings	
	316 Stainless Steel	Carbon Steel	NPT	ANSI 150 Flanges
0.75	✓		✓	✓
1	✓		✓	✓
1.25	✓		✓	✓
1.5	✓		✓	✓
2	✓	✓	✓	✓
2.5	✓	✓	✓	✓
3	✓	✓	✓	✓
4	✓	✓		✓
6	✓	✓		✓

APPROVALS

Relevant directives and standards applied:
 EMC Directive: 2014/30/EU
CE: Electrical Equipment for Measurement, Control and Lab Use: EN61326-1:2013
 Pressure Equipment Directive: 2014/68/EU Article 13
 Weld Testing: EN ISO 15614-1 and EN ISO 9606-1, ASME B31.3

FM (FM222US0064X) & FMc (FM22CA0045X): Class I, Division 1, Groups B, C, D;
 Class II, Division 1, Groups E, F, G;
 Class III, Division 1; T4, Ta = -40 °C to 70 °C;
 Class I, Zone 1, AEx/Ex db IIB + H2 T4; Gb Ta = -40 °C to 70 °C; Type 4X, IP66/67

ATEX (FM16ATE X0013X): II 2 G Ex db IIB + H2 T4; Gb Ta = -40 °C to 70 °C; IP66/67
 II 2 D Ex tb IIIC T135 °C; Db Ta = -40 °C to 70 °C; IP66/67

IECEX (IECEX FMG 16.0010X): Ex db IIB + H2 T4; Gb Ta = -40 °C to 70 °C; IP66/67
 Ex tb IIIC T135 °C; Db Ta = -40 °C to 70 °C; IP66/67

ATEX and IECEX Standards: EN IEC 60079-0, IEC 60079-0
 EN 60079-1, IEC 60079-1
 EN 60079-31, IEC 60079-31
 EN 60529 +A1 +A2, IEC 60529

Delivering the Measure of Possibility



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