

MODEL

FT2A

TEESING

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Fox Thermal Gas Mass Flow Meter

HIGHLIGHTS

- Measures gas flow rate in SCFM, NM3/HR, LBS/HR, KG/HR, & many more
- Wide measurement range; 100:1 turndown typical
- Measures process gas temperature
- 4-20mA for flow rate & temperature; pulse output for flow/total
- USB port to connect to a PC standard; Modbus RTU (RS485), BACnet MS/TP (RS485), Profibus-DP, DeviceNet or Ethernet Modbus TCP
- Insertion and Inline models
- Welded, 316 SS sensor construction; Hastelloy C276 optional
- Microprocessor based, field programmable electronics
- On-board 2 line x 16 character, backlit display with configuration panel to view/set readings and parameters
- Free FT2A View™ Software available
- NIST traceable calibration
- Low-end sensitivity for leak detection
- Negligible pressure drop
- No moving parts design
- FM (U.S.) & FMc (CANADIAN) approved for Class I, II, III, Division 2, Groups A, B, C, D, E, F, G T4A hazardous locations. NEMA 4X and CE approved.
- EMC Certification to: EN 61326-1:2013
- Low Voltage Directive (LVD): 2014/35/EU
- Product Safety Testing: EN 61010-1: 2010
- Weld Testing: EN ISO 15614-1 and EN ISO 9606-1, ASME B31.3



THEORY OF OPERATION

Fox Thermal Flow Meters use a constant temperature differential (constant ΔT) technology to measure mass flow rate of air and gases. The thermal mass flow sensor consists of two Resistance Temperature Detectors (RTD's). 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 instrument electronics heat the mass flow sensor, or heated element, to a constant temperature differential (constant ΔT) above the gas temperature and measures the cooling effect of the gas flow. The electrical power required to maintain a constant temperature differential is directly proportional to the gas mass flow rate. The microprocessor linearizes this signal to deliver a linear 4-20mA signal.

MODEL FT2A

GAS MASS FLOW METER & TEMPERATURE TRANSMITTER

The Fox Model FT2A measures gas flow rate in standard units without the need for temperature or pressure compensation. It provides isolated 4-20mA and pulse outputs for flow rate, and a 4-20mA output for process gas temperature. The pulse output is normally used for totalization.

With an on-board 2 line x 16 character, backlit display, operators can view flow rate, total, elapsed time, process gas temperature, and alarms. The display is also used in conjunction with the Configuration Panel to configure flow meter settings, pulse output frequency scaling, pipe area, zero flow cutoff, flow filtering (damping), display configurations, diagnostics and high or low alarm limits.

The Model FT2A is available in both insertion and inline models. The insertion meter is easily installed by drilling a hole in the pipe and welding on a 3/4" NPT branch outlet.

NIST TRACEABLE FACTORY CALIBRATION

Fox calibrations are performed with NIST traceable flow standards. Whether you require a straightforward air calibration or a complex mixed gas calibration, our goal is to achieve the highest accuracy and the fastest turnaround time.

The Fox Calibration Lab employs a wide range of gases, gas mixtures, temperatures, pressures, and line sizes to simulate actual fluid and process conditions. This real-world approach improves installed accuracy and minimizes measurement uncertainty.

A Fox-supplied compression fitting secures the probe in place. The inline model is available in 1/4-inch to 6-inch sizes and includes built-in flow conditioners that eliminate the need for long, straight pipe runs. The meter can be ordered with flange or NPT end connections.

Both models are supplied with 316 stainless steel wetted materials standard or Hastelloy C-276 as an option (inline flow bodies also available in carbon steel). A USB port to connect to a computer or laptop is standard; interface options include Modbus RTU (RS485), BACnet MS/TP (RS485), Profibus-DP, DeviceNet, or Ethernet Modbus TCP.

Fox has certified cleaning and bagging procedures for flow meters to be used in oxygen applications.

DIMENSIONS

INSERTION STYLES

Assuming there is no insulation or retractor, Fox recommends the following probe lengths:

| Pipe Size | Probe Length |
|----------------------------|--------------|
| 1.5" (40mm) to 6" (150mm) | 6-inch |
| 8" (200mm) to 12" (300mm) | 9-inch |
| 14" (350mm) to 18" (450mm) | 12-inch |

Use the equation below for larger pipe sizes

| Probe Lengths in inches (cm) = | |
|--------------------------------|-------------|
| 6.0 (15.2) | 9.0 (22.9) |
| 12.0 (30.5) | 15.0 (38.1) |
| 18.0 (45.7) | 24.0 (61.0) |
| 30.0 (76.2) | 36.0 (91.4) |

EQUATION

Equation for selecting insertion flow meter probe length:

Probe length = 1/2 pipe ID (in inches) + 3" + thickness of insulation (if any) + 10" (for retractor if supplied). Round up to the next standard probe length available.

Note: Contact Fox for longer probes.

APPROVALS

CE Mark: Approved

EMC Directive: 2014/30/EU

Electrical Equipment for Measurement, Control and Lab Use:
EN61326-1:2013

Low Voltage Directive (LVD): 2014/35/EU

Product Safety Testing: EN 61010-1: 2010

Pressure Equipment Directive: 2014/68/EU Article 13

Weld Testing: EN ISO 15614-1 and EN ISO 9606-1, ASME B31.3

INLINE STYLES

Inline pipe sizes, materials, and end connections are listed in the table below.

| Inline pipe sizes in inches = | | | | | | | | | | | |
|-------------------------------|---|---|---|------|---|---|---|------|---|---|---|
| 0.25 | ○ | ● | ○ | 0.50 | ○ | ● | ○ | 0.75 | ○ | ● | ○ |
| 1.00 | ○ | ● | ○ | 1.25 | ○ | ● | ○ | 1.50 | ○ | ● | ○ |
| 2.00 | ○ | ● | ○ | 2.50 | ○ | ● | ○ | 3.00 | ○ | ● | ○ |
| 4.00 | ○ | ● | ○ | 6.00 | ○ | ● | ○ | | | | |

○= SS ●= CS ○= NPT Ends ○= 150lb flanges

Note: See [FT2A Model Codes](#) document for more information.

Note: Inline flow bodies include built-in flow conditioners. [FC20 Flow Conditioners](#) are available as an option for insertion flow meters.

PROBE DIAMETER

Insertion and inline flow Meters: Probe diameter: 1/2"

DRAWINGS

See [FT2A Dimensional Drawings](#) on Fox Thermal website.



FM & FMc: Approved

Class I, II, III, Division 2, Groups A, B, C, D, E, F, G,
T4A hazardous locations.

NEMA 4X Approved

NOTE! The EU Pressure Equipment Directive (PED) requires that the minimum ambient and fluid temperature rating for carbon steel flow bodies not be below -29C.

PERFORMANCE SPECS

Flow Accuracy:

Inline meter: ± 1% of reading ± 0.2% of full scale.
 All other sizes: 8 diameters of straight, unobstructed pipe upstream and 4 downstream required.
 Insertion meter: ± 1% of reading ± 0.2% of full scale.
 15 diameters upstream of straight, unobstructed pipe upstream and 10 downstream required.
 (1/4" size): 6" (152mm) of straight, unobstructed pipe upstream and downstream required.

Flow Repeatability: ± 0.2% of full scale

Flow Response Time: 0.9 seconds (one time constant)

Temperature Accuracy:

± 1.8° F (± 1.0° C) over -40 to 250° F (-40 to 121° C);
 ± 3.6° F (± 2.0° C) over 250 to 650° F (121 to 343° C).
 Minimum velocity 60 SFPM.

Calibration: Factory calibration to NIST traceable standards

OPERATING SPECS

Units of Measurement (field-selectable):

SCFM, SCFH, NMPS, NM3/M, NM3/H, NM3/D, NLPS, NLPM, NLPH, MCFD, MSCFD, SCFD, MMSCFD, MMSCFM, SMPS, SM3/D, SM3/H, SM3/M, LB/S, LB/M, LB/H, LB/D, KG/S, KG/M, KG/H, SLPM, SFPM, MT/H

Flow Rates for Insertion Flow Meters:

15 to 60,000 SFPM (0.07 to 280 NMPS) - Air at 70°F (20°C) & 1 ATM
 Turndown: up to 1000:1; 100:1 typical

To determine if an insertion flow meter will operate properly, divide the maximum flow rate by the pipe area. The application is acceptable if the velocity is within the velocity range above.

| Typical Flow Ranges for Insertion Flow Meters | | | |
|---|------------|------------|---------------------|
| Pipe Diameter | SCFM | MSCFD | NM ³ /Hr |
| 1.5" (40mm) | 0 - 840 | 0 - 1,220 | 0 - 1,325 |
| 2" (50mm) | 0 - 1,400 | 0 - 2,020 | 0 - 2,210 |
| 2.5" (63mm) | 0 - 2,000 | 0 - 2,880 | 0 - 3,150 |
| 3" (80mm) | 0 - 3,100 | 0 - 4,440 | 0 - 4,890 |
| 4" (100mm) | 0 - 5,300 | 0 - 7,650 | 0 - 8,360 |
| 6" (150mm) | 0 - 12,000 | 0 - 17,340 | 0 - 18,930 |
| 8" (200mm) | 0 - 20,840 | 0 - 30,020 | 0 - 32,870 |
| 10" (250mm) | 0 - 32,800 | 0 - 47,250 | 0 - 51,740 |
| 12" (300mm) | 0 - 46,600 | 0 - 67,180 | 0 - 73,500 |

| Flow Ranges for Inline Meters | | | |
|-------------------------------|------------|------------|---------------------|
| Pipe Diameter | SCFM | MSCFD | NM ³ /Hr |
| 0.25" | 0 - 7.5 | 0 - 10.8 | 0 - 11.8 |
| 0.5" | 0 - 125 | 0 - 180 | 0 - 200 |
| 0.75" | 0 - 220 | 0 - 320 | 0 - 350 |
| 1" | 0 - 360 | 0 - 520 | 0 - 570 |
| 1.25" | 0 - 625 | 0 - 900 | 0 - 990 |
| 1.5" | 0 - 840 | 0 - 1,220 | 0 - 1,325 |
| 2" | 0 - 1,400 | 0 - 2,020 | 0 - 2,210 |
| 2.5" | 0 - 2,000 | 0 - 2,880 | 0 - 3,150 |
| 3" | 0 - 3,100 | 0 - 4,440 | 0 - 4,890 |
| 4" | 0 - 5,300 | 0 - 7,650 | 0 - 8,360 |
| 6" | 0 - 12,000 | 0 - 17,340 | 0 - 18,930 |

NOTE! Standard conditions of air at 70°F and one atmosphere.
 Consult factory for other gases and for flow ranges above and below those listed above.

Gas Pressure (maximum):

Insertion: 500 psig (34.5 barg)
 316 SS inline w/NPT ends: 500 psig (34.5 barg)
 316 SS inline w/150lb flanges: 230 psig (16 barg)
 CS inline w/NPT ends: 300 psig (20.1 barg)
 CS inline w/150lb flanges: 285 psig (19.7 barg)
 Retractor: 125 psig (8.6 barg)

Notes:

- Check with factory for higher pressure options.
- When teflon ferrule option ordered, gas pressure is 60psig (4.1 barg) maximum.
- Pressure ratings stated for temperature of 100°F (38°C).

Relative Humidity:

90% RH maximum; non-condensing

Temperature:

Std sensor: -40 to 250°F (-40 to 121°C)
 HT Sensor: -40 to 650°F (-40 to 343°C)
 Enclosure: -40 to 158°F (-40 to 70°C) DC Power
 -4 to 158°F (-20 to 70°C) AC Power

Note: Display dims below -4°F (-20°C); function returns once temperature rises again.

Remote sensor junction box ambient temperature:
 -40 to 212°F (-40 to 100°C)

Input Power: (without the Anybus serial communication option)

24VDC --- (±10%), 0.4 Amps (standard DC Power)
 100 to 240VAC ~ (+10%/-15%), 50-60Hz, 0.2 Amps (with AC power option)

Input Power: (with Anybus serial communication option)

24VDC --- (±10%), 0.7 Amps (standard DC Power)
 100 to 240VAC ~ (+10%/-15%), 50-60Hz, 0.2 Amps (with AC power option)

Note: Fluctuations of AC and DC power supply are not to exceed ±10% of rating.

Class I Equipment (Electrical Grounding Required for Safety).

Installation (Over-voltage) Category II for transient over-voltages.

Outputs:

Two isolated 4-20mA outputs (output one is for flow rate & output two is programmable for flow rate or temperature); fault indication per NAMUR NE43.

Isolated pulse output 0 to 100Hz, 5 to 24 volts p/p for flow (the pulse output can be used as an isolated solid state output for alarms); 20mA max.

Serial Communication:

USB connector for connecting to a laptop or computer is standard; free PC-based software tool - FT2A View™ - provides complete configuration, remote process monitoring and data logging functions.

Optional isolated communication outputs: RS485-Modbus, BACnet MS/TP, Profibus-DP, DeviceNet, or Ethernet Modbus TCP.

4-20mA Loop Verification:

Simulation mode used to align 4-20mA output with the input to customer's PLC/DCS.

PHYSICAL SPECS

Sensor Material:

316 stainless steel standard; Hastelloy C276 optional

Inline Flow Body Material:

316 Stainless Steel flow bodies standard; Optional A106 Grade B carbon steel flow bodies and A105 flanges.

Enclosure:

NEMA 4X, aluminum, dual conduit entries with 3/4" NPT or optional M20 x 1.5mm.

Remote Sensor Cable:

5-conductor, 18 AWG, twisted, shielded, 100 feet maximum.