

MODEL

FT2A

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
- 4-20mA output for flow rate & temperature; pulse output for flow/total
- Measures process gas temperature
- USB to connect to a PC standard; optional Modbus RTU (RS485), BACnet MS/TP (RS485), Profibus-DP, DeviceNet or Ethernet Modbus TCP
- Insertion and Inline models, remote sensor option
- Welded, 316 SS sensor construction
- 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



THERMAL MASS TECHNOLOGY

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 analyzes these measurements to deliver a linear 4-20mA signal.

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 gas and process conditions. This real-world approach improves installed accuracy and minimizes measurement uncertainty.





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, with a remote sensor option. The insertion meter is easily installed by drilling a hole in the pipe and welding on a 3/4" NPT branch outlet.

A Fox-supplied compression fitting secures the probe in place. The inline model is available in ½-inch to 6-inch pipe 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.

FT2A models are supplied standard with 316 stainless steel wetted materials (inline flow bodies are 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 = $\frac{1}{2}$ pipe ID (in inches) + 3" + thickness of insulation (if any) + 10" (for retractor if supplied). Round up to the next standard probe length available. Pipe ID is the inner diameter.

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

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 =											
0.50	○	●	⦿	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: $\frac{1}{2}$ "

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



Try the Fox Thermal online configurator to request a quote for a meter suited for your specific process conditions.

foxthermal.com/configure

SPECIFICATIONS

PERFORMANCE SPECS

Flow Accuracy:

± 1% of reading ± 0.2% of full scale.

Straight, unobstructed pipe requirement:

- Insertion meters: 15 diameters upstream, 10 downstream
- Inline meters (½" size): 6" (152mm) upstream and downstream
- Inline meters (all other sizes): 8 diameters upstream, 4 downstream
- Insertion meters with FC20: 5 diameters upstream of FC20, 2 diameters between FC20 and FT2A, 5 diameters downstream of FT2A

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, SLP, 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
0.5"	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 (15.86 barg)

CS inline w/NPT ends: 500 psig (34.5 barg)

CS inline w/150lb flanges: 285 psig (19.65 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).
- The EU Pressure Equipment Directive (PED) requires that the minimum ambient and fluid temperature rating for carbon steel flow bodies not be below -29C.

Relative Humidity:

90% RH maximum; non-condensing

Temperature:

Std sensor: -40 to 250°F (-40 to 121°C)

Enclosure: -40 to 158°F (-40 to 70°C) DC Power

-4 to 158°F (-20 to 70°C) AC Power

Remote sensor enclosure: -40 to 158°F (-40 to 70°C)

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

Input Power: (without Anybus serial communication option)

24VDC --- (±10%), 0.4 Amps (standard DC Power)

100 to 240VAC ~ (+10/-15%), 50-60Hz, 0.2 Amps (AC power option)

Input Power: (Anybus serial communication option)

24VDC --- (±10%), 0.7 Amps (standard DC Power)

100 to 240VAC ~ (+10/-15%), 50-60Hz, 0.2 Amps (AC power option)

Note: Fluctuations of AC and DC power 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: Isolated open collector output rated for 5 to 24VDC, 20mA maximum load, 0 to 100Hz (the pulse output can be configured to either transmit a 0 to 100Hz signal proportional to flow rate or an on/off alarm).

Serial Communication:

USB 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

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 ¾" NPT or optional M20 x 1.5mm.

Remote Sensor Cable:

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

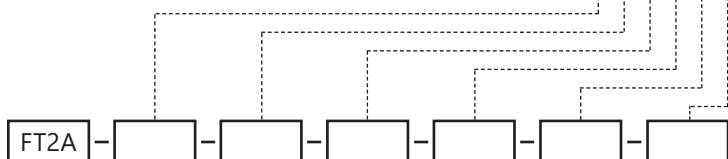
CONFIGURATIONS

Feature 1a: Insertion Sizes	
	Description
06IE	Insertion meter with 6-inch probe
09I	Insertion meter with 9-inch probe
12I	Insertion meter with 12-inch probe
15I	Insertion meter with 15-inch probe
18I	Insertion meter with 18-inch probe
24I	Insertion meter with 24-inch probe
30I	Insertion meter with 30-inch probe
36I	Insertion meter with 36-inch probe
15R	15" probe w/125-psi retractor
18R	18" probe w/125-psi retractor
24R	24" probe w/125-psi retractor
30R	30" probe w/125-psi retractor
36R	36" probe w/125-psi retractor

Feature 1b: Inline Sizes	
	Description
05P	0.5-inch, male NPT ends 12" face-to-face
075P	0.75-inch, male npt ends 12" face-to-face
10P	1-inch, male npt ends 12" face-to-face
125P	1.25-inch, male npt ends 12" face-to-face
15P	1.5-inch, male npt ends 12" face-to-face
20P*	2-inch, male npt ends 12" face-to-face
25P*	2.5-inch, male npt ends 18" face-to-face
30P*	3-inch, male npt ends 18" face-to-face
05F	0.5-inch, 150lb RF flanges 12" face-to-face
075F	0.75-inch, 150lb RF flanges 12" face-to-face
10F	1-inch, 150lb RF flanges 12" face-to-face
125F	1.25-inch, 150lb RF flanges 12" face-to-face
15F	1.5-inch, 150lb RF flanges 12" face-to-face
20F*	2-inch, 150lb RF flanges 12" face-to-face
25F*	2.5-inch, 150lb RF flanges 18" face-to-face
30F*	3-inch, 150lb RF flanges 18" face-to-face
40F*	4-inch, 150lb RF flanges 18" face-to-face
60F*	6-inch, 150lb RF flanges 24" face-to-face

*For carbon steel (CS) material, add "C" to applicable stainless steel (SS) codes. Example: 20P = 2" SS; 20PC = 2" CS.

**100-foot max. cable length, P/N 101570



Example:

FT2A - 06IE - SS - ST - E1 - B0 - G1

Feature 2: Sensor Material	
	Description
SS	316 SS sensor and probe

Feature 3: Sensor Type	
	Description
ST	Standard temperature

Feature 4: Enclosure Type	
	Description
E1	Local NEMA 4X enclosure, 24VDC powered
E2	Local NEMA 4X enclosure, 85-265VAC powered
E3**	Remote with J-box, 24VDC powered
E4**	Remote with J-box, 85-265VAC powered

Feature 5: Communication Options	
	Description
B0	No communication option
MB	Modbus RTU (RS485)
BN	BACnet MS/TP (RS485)
BD	DeviceNet
BP	Profibus-DP
BE	Ethernet Modbus TCP

Feature 6: Calibration	
	Description
G1	Air, N2: MF <1200 SCFM
G2	Air, N2: MF >1200 SCFM
G3	Ar, CH4, CO2, H2, O2, Natural Gas: MF <1000 SCFM
G4	Ar, CH4, CO2, H2, O2, Natural Gas: MF >1000 SCFM
G5	C3H8, He, NH3: MF <700SCFM
G6	C3H8, He, NH3: MF >700SCFM
G7	Biogas, Digester, Flare, Flash, Vent, & all other gases

Optional:	
	Description
NRT	Non Resettable Totalizer

Notes:

- See model code document for full list of codes.
- All inline flowbodies are schedule 40 pipes, 316 stainless steel (SS). A100 Grade B carbon steel (CS) option available.*

COMPARISON

TECHNOLOGY COMPARISON

For customers searching for a lower cost, higher accuracy low flow measurement meter, thermal mass flow meters by Fox Thermal beat DP meters and the other flow technologies on the market today.

Compare the model FT2A thermal mass flow meter to other technologies and review the benefits in the table below and on the Fox Thermal website at www.foxthermal.com.

Technology Comparison		
	Other Technologies	Fox Thermal - Thermal Mass Flow Measurement
Flow Measurement of gases	Other technologies require multiple instruments to determine the volumetric flow rate at reference conditions.	Direct mass flow measurement of air and gases in standard volumetric units (ie MSCFD, SCFM, or NM3/H) or mass units (ie LBS/M or KG/H). Each meter has the option for the user to select a variety of flow units (see Operating Specs).
Pressure or temperature compensation	Differential pressure flow meters require pressure and temperature compensation.	No additional pressure or temperature compensation is required. This is a time and cost saving measure. No additional calculations or equipment are needed to calculate flow because the meter measures the mass flow rate.
Turndown	Vortex meters are more suitable for very high flow rates. DP meters do not have good turndown.	Repeatability and exceptionally broad measurement range: 100:1 typical. Whether the flow is at a very high or low velocity, Fox Thermal mass flow meters can measure it.
Pressure Drop	If a DP meter is used to measure low velocity flow, a very small orifice is required resulting in high pressure drop.	Low pressure drop the pressure drop of a thermal mass flow meter is negligible.
Moving Parts	A meter with moving parts, like a Turbine meter, will need regular maintenance.	No moving parts which means no problems with wear, binding, etc.
Price	Ultrasonic meters are especially expensive.	Cost effective. Thermal mass flow meters offer a low cost alternative.
Installation	Some meter technologies are complicated and difficult to install, require additional equipment, or long straight pipe run requirements.	Easy to install with insertion and inline configurations. Insertion meters are easy to install, inline meters come equipped with flow conditioners to help reduce the straight run requirements. Communication options available and intrinsic to meter electronics.
Operation	Most manufacturers build meters for a single purpose or application. The customer must sift through pages of specs to find the right meter for their application. This is time consuming and ineffective.	Microprocessor based, field rangeable electronics. Fox Thermal pioneered the use of microprocessors in thermal mass flow meters and continues to create innovative solutions to measurement needs across many industries and applications. Free software allow users to interact and program the meter in the field. Using the online Product Configurator, the customer can enter process data into the system for an instant Fox Thermal product recommendation: no need to search a list of meters for the one that's right for you.



Make downtime a thing of the past.

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