

Model FT2 Gas Mass Flow Meter & Temperature Transmitter

For Industrial, Environmental, Energy Monitoring and Process Control Applications

- 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 to 20mA for flow rate & temperature; pulse output for flow/total
- RS232 for connecting to a computer; RS422/RS485-Modbus, 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 FT2 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.

FOX
THERMAL INSTRUMENTS, INC.
FOX IS ISO 9001 CERTIFIED



FM and FMc approved!

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 to 20 mA signal.

Fox Model FT2 Gas Mass Flow Meter & Temperature Transmitter

The Fox Model FT2 measures gas flow rate in standard units without the need for temperature or pressure compensation. It provides isolated 4 to 20 mA and pulse outputs for flow rate, and a 4 to 20 mA output for process gas temperature. The pulse output is normally used for totalization.

An optional on-board 2 line x 16 character, backlit display is available to 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 FT2 is available in both insertion and inline models. The insertion meter is easily installed by drilling a $\frac{3}{4}$ " hole in the pipe and welding on a $\frac{3}{4}$ " NPT coupling. A Fox-supplied compression fitting secures the probe in place. The inline model is available in $\frac{1}{4}$ -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). RS232 for connecting a computer or laptop is standard; interface options include RS422/RS485-Modbus, Profibus-DP, DeviceNet or Ethernet Modbus TCP.

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

SPECIFICATIONS

Performance Specs

Flow Accuracy:

± 1% of reading ± 0.2 % of full scale*

* Point velocity for insertion flow meters. For insertion flow meters, Fox recommends a minimum of 15 diameters of straight pipe upstream of the flow meter and 10 diameters downstream. For inline flow meters, Fox recommends a minimum of 8 diameters of straight pipe upstream of the flow meter and 4 diameters downstream.

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.

Operating Specs

Units of Measurement:

SCFM, SCFH, NMPS, NM3/M, NM3/H, NM3/D, NLPS, NLPM, NLPH, MCFD, MSCFD, SCFD, MMSCFD, MMSCFM, SMPS, SM3/H, 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

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 size	SCFM	NM ³ /hr
1.5" (40mm)	0 - 840	0 - 1,320
2" (50mm)	0 - 1,400	0 - 2,200
3" (80mm)	0 - 3,080	0 - 4,860
4" (100mm)	0 - 5,300	0 - 8,360
6" (150mm)	0 - 12,000	0 - 18,900
8" (200mm)	0 - 20,800	0 - 32,800
12" (300mm)	0 - 46,600	0 - 73,500

Flow Ranges for Inline Flow Meters		
Size	SCFM	NM ³ /hr
0.25"	0 - 20	0 - 32
0.5"	0 - 90	0 - 140
0.75"	0 - 180	0 - 280
1"	0 - 320	0 - 500
1.25"	0 - 580	0 - 910
1.5"	0 - 840	0 - 1,320
2"	0 - 1,400	0 - 2,200
2.5"	0 - 2,000	0 - 3,150
3"	0 - 3,080	0 - 4,860
4"	0 - 5,300	0 - 8,360
6"	0 - 12,000	0 - 18,900

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 Flow Meter:

500 psig (34.5 barg)

Inline (1/4" through 6"):

NPT 500 psig (34.5 barg)

150# flange 230 psig (16 barg)

Check with factory for higher pressure options.

Note: Pressure ratings stated for temperature of 100°F (38°C).

Temperature:

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

HS Sensor: 32 to 400°F (0 to 204°C)

HT Sensor: 32 to 650°F (0 to 343°C)

Enclosure: -40 to 158°F (-40 to 70°C) without display,
32 to 140°F, (0 to 60°C) with display.

Input Power:

24VDC, ±10%, 0.75 amp standard; 85 to 250VAC

50/60Hz, 20 watts optional.

Output:

Two isolated 4 to 20mA outputs (1 for flow & 1 for temperature);
isolated pulse output 0 to 100Hz, 10 volts p/p for flow (the pulse
output can be used as an isolated solid state output for alarms).

RS232 for connecting a laptop or computer; RS422/RS485-

Modbus, Profibus-DP, DeviceNet or Ethernet Modbus TCP.

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:

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.

Options: Remote NEMA 4X electronics enclosure with explosion-
proof sensor j-box.

Cabling:

To Fox remote enclosure: 5-conductor, 18 AWG, twisted, shielded,
100 feet maximum.

Retractor Assemblies:

Packing gland assembly: 125 psig(8.6 barg) max.

High pressure (crank) retractor: NPT 600 psig (41.4 barg), ANSI
150 flange & ANSI 300 flange, no valve supplied.

Dimensional

Insertion Flow Meters:

Probe diameter: 1/2"

Equation for selecting insertion flow meter probe length:

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

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

Pipe Size	Probe Length
1.5" (40mm) to 2" (50mm)	4-inch
2.5" (65mm) to 6" (150mm)	6-inch
8" (200mm) to 12" (300mm)	9-inch
14" (350mm) to 18" (450mm)	12-inch
Use the equation on previous page for larger pipe sizes	

Probe Lengths (LL) in inches(cm) =
 4.0 (10.2) 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)
 Contact Fox for longer probes.

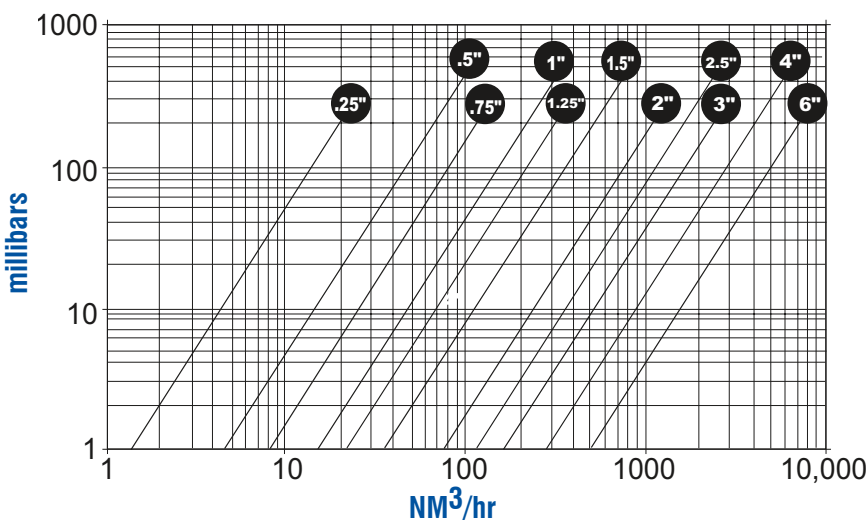
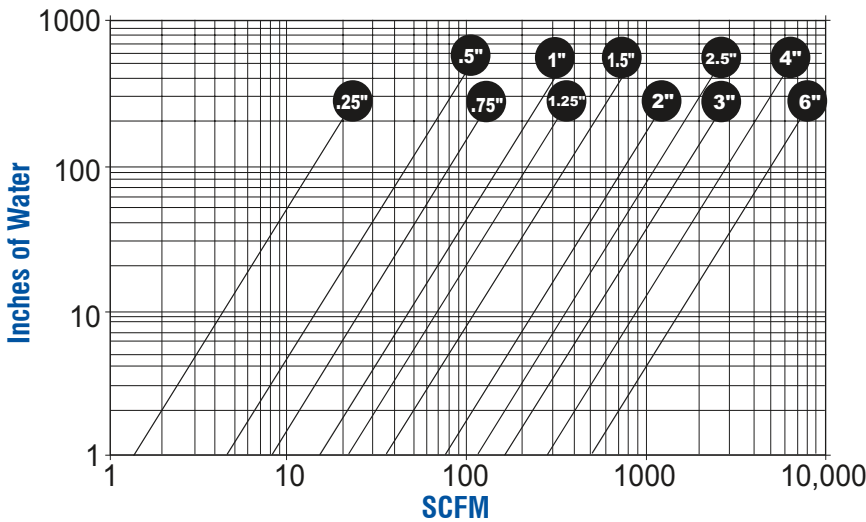
Inline Flow Meter Dimensions		
Pipe size	L	HH
0.25"	5.80 (14.7)	9.9 (25.1)
0.5"	12.0 (30.5)	9.9 (25.1)
0.75"	12.0 (30.5)	9.9 (25.1)
1"	12.0 (38.1)	9.9 (25.1)
1.25"	12.0 (30.5)	9.9 (25.1)
1.5"	12.0 (30.5)	9.9 (25.1)
2"	12.0 (30.5)	9.9 (25.1)
2.5"	18.0 (45.7)	10.0 (25.4)
3"	18.0 (45.7)	10.0 (25.4)
4"	18.0 (45.7)	10.5 (26.7)
6"	24.0 (61.0)	11.6 (29.5)

Note: Dimensions are in inches (cm). For certified drawings, consult factory or view at www.foxthermalinstruments.com/all-dimensions.php

PRESSURE

Pressure Drop Charts for Inline Flow Meters

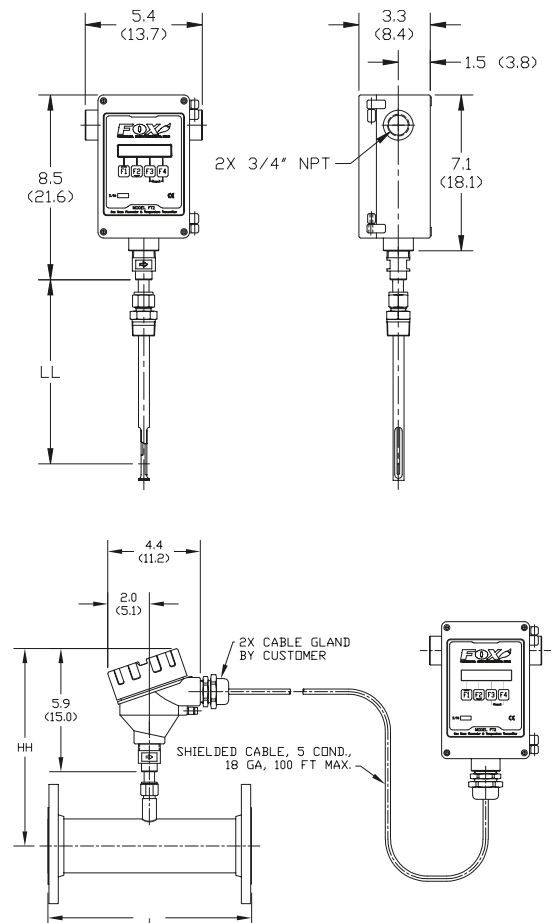
As seen in the charts below, pressure drop is negligible and energy losses are minimal.



DIMENSIONS

Meter Dimensional Drawings

The FT2 is available in many different configurations. An example of the local insertion and remote inline flange configurations are shown below. To see more configurations, please visit our website at www.foxthermalinstruments.com/all-dimensions.php



MODEL CODES

Parent Model No.*	
FT2	Inline Mass Flow Meter & Temperature Transmitter
Feature 1A : Insertion Sensor*	
04I	Insertion meter with 4-inch probe (for 1.5" & 2" pipes)
06I	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/ 150 PSI retractor & full port valve - 3/4" male NPT, 316 SS wetted parts
18R	18" Probe w/ 150 PSI retractor & full port valve - 3/4" male NPT, 316 SS wetted parts
24R	24" Probe w/ 150 PSI retractor & full port valve - 3/4" male NPT, 316 SS wetted parts
30R	30" Probe w/ 150 PSI retractor & full port valve - 3/4" male NPT, 316 SS wetted parts
36R	36" Probe w/ 150 PSI retractor & full port valve - 3/4" male NPT, 316 SS wetted parts
R1	Crank Retractor 1.5" NPT, 600 PSI, no valve - 316 SS wetted parts
R2	Crank Retractor 1.5", 150# flange, no valve - 316 SS wetted parts
R3	Crank Retractor 1.5", 300# flange, no valve - 316 SS wetted parts
Feature 1B : Inline Flow Body* (All available in 316 Stainless steel flowbody, **Available in A106 Grade B Carbon steel pip (+ A105 flanges - if ordered))	
025P	1/4 inch, male npt ends (schedule 40) 5.8" Face-to-face
05P	1/2 inch, male npt ends (schedule 40) 12" Face-to-face
075P	3/4 inch, male npt ends (schedule 40) 12" Face-to-face
10PS	1 inch, male npt ends (schedule 40) 12" Face-to-face
125P	1.25 inch, male npt ends (schedule 40) 12" Face-to-face
15P	1.5 inch, male npt ends (schedule 40) 12" Face-to-face
20P **	2 inch, male npt ends (schedule 40) 12" Face-to-face (**20PC for Carbon Steel)
25P **	2.5 inch, male npt ends (schedule 40) 18" Face-to-face (**25PC for Carbon Steel)
30P **	3 inch, male npt ends (schedule 40) 18" Face-to-face (**30PC for Carbon Steel)
40P **	4 inch, male npt ends (schedule 40) ** 18" Face-to-face (**40PC for Carbon Steel)
05F	1/2 inch, 150# RF flanges (schedule 40) 18" Face-to-face
075F	3/4 inch, 150# RF flanges (schedule 40) 12" Face-to-face
10FS	1 inch, 150# RF flanges (schedule 40) 12" Face-to-face
125F	1.25 inch, 150# RF flanges (schedule 40) 12" Face-to-face
15F	1.5 inch, 150# RF flanges (schedule 40) 12" Face-to-face
20F **	2 inch, 150# RF flanges (schedule 40) 12" Face-to-face (**20FC for Carbon Steel)
25F **	2.5 inch, 150# RF flanges (schedule 40) 18" Face-to-face (**25FC for Carbon Steel)
30F **	3 inch, 150# RF flanges (schedule 40) 18" Face-to-face (**30FC for Carbon Steel)
40F **	4 inch, 150# RF flanges (schedule 40) ** 18" Face-to-face (**40FC for Carbon Steel)
60F	6 inch, 150# RF flanges (schedule 40) ** 24" Face-to-face
Feature 2: Sensor Material*	
SS	316 stainless steel sensor and flowbody
SJ	Hastelloy C-276 sensor w/ 316SS flow body & compression fitting
Feature 3: Sensor Type*	
ST	Standard Sensor -40 to 250F (-40 to 121C)
HS	High Temperature Sensor 32 to 400F (0 to 204C)
HT	High Temperature Sensor 32 to 650F (0 to 343C) E3 or E4, required - AIR ONLY
Feature 4: Enclosure*	
E1	Local NEMA 4X enclosure, 24VDC powered
E2	Local NEMA 4X enclosure, 85 to 250VAC powered
E3	Remote with explosion - proof sensor J-box, 24VDC powered, 100' max, no cable
E4	Remote with explosion - proof sensor J-box, 85 to 250VAC power, 100' max, no cable
Feature 5: Display & Config. Panel*	
D0	No Display & Configuration Panel
DD	Include Rate/Total Display & Configuration Panel
Feature 6: Bus Options*	
B0	No communication bus
MB	Modbus
BD	DeviceNet - DD REQUIRED
BP	Profibus-DP - DD REQUIRED
BE	Ethernet Modbus TCP - DD REQUIRED
Feature 7: Gas Calibration*	
G1	Air, N2: MF less than 1200 SCFM (2040 NM3H)
G2	Air, N2: MF above 1200 SCFM (2040 NM3H)
G3	Ar, CO2, H2, CH4, Natural Gas, O2: MF less than 1000 SCFM (1700 NM3H)
G4	Ar, CO2, H2, CH4, Natural Gas, O2: MF above 1000 SCFM (1700 NM3H)
G5	CO, He, Ammonia, Propane, Digester Gas: MF less than 700 SCFM (1190 NM3H)
G6	CO, He, Ammonia, Propane, Digester Gas: MF above 700 SCFM (1190 NM3H)
G7	All other gases
Optional	
RTC	Non Resettable Totalizer

Adding an "E" after the probe code (i.e. 06IE, 18RE) will provide an equal length sensor. Equal length sensors can be used in pipes as small as 1.5" (40mm). Probes 04I and 15R are shipped standard with equal length sensors.



399 RESERVATION ROAD
 MARINA, CA 93933
 PHONE: 831-384-4300
 FAX: 831-384-4312
 sales@foxthermalinstruments.com
 www.foxthermalinstruments.com