Fox Thermal
Precision Mass Flow Measurement
An ONICON Brand

Model FT4A Gas Mass Flow Meter For Oil & Gas, Industrial, and Wastewater Applications

- 2nd Generation DDC-Sensor™: Robust, non-cantilevered design
- Gas-SelectX®: menu of field selectable gas compositions
- Gross Heating Value and Density of Gas Mix
- Accuracy Compliant with BLM 3175 & API 14.10
- CAL-V™ Calibration Validation
- Insertion and Inline Styles
- Measures gas flow rate in SCFD, MCFD & many more
- Wide measurement range: up to 1000:1 turndown; 100:1 typical
- 4-20mA for flow rate or temperature; HART option
- Choice of second output: pulse output for flow/total or RS485 Modbus RTU
- Standard USB port
- Free FT4A View™ Software available
- Welded, 316 SS sensor and flow body construction, Carbon Steel flow body optional
- Microprocessor based, field-programmable electronics
- Standard on-board 2 line x 16 character, backlit display with configuration panel
- NIST traceable calibration
- Low-end sensitivity for vents and leak detection
- Negligible pressure drop
- FM (U.S.) & FMc (CANADIAN) approved for Class I, Div 1; ATEX/IECEx approved for Zone 1
- NEMA 4X and CE Mark
- 2017 Flow Control Innovation Award Winner
- Processing's 2017 Breakthrough Product Award Winner

FOX THERMAL
399 RESERVATION ROAD
MARINA, CA 93933
PHONE: 831-384-4300
FAX: 831-337-5786
sales@foxthermal.com
www.foxthermal.com

Model F T4A

Thermal Mass Flow Meter and Temperature Transmitter

Accuracy Compliant with BLM 3175 & API 14.10:

- Flare Gas
- Sales Gas
- Fuel Gas

Expansion of the Gas-SelectX® Menu

Customers need a fast solution to their monitoring needs. For these cases, Fox Thermal has developed the Gas-SelectX® gas menu feature for the Model FT4A flowmeter. Gas-SelectX® allows the user to choose from a menu of several common gases or gas mixtures for their application.

The Gas-SelectX® feature has three gas menus with the following available gases:

Pure Gas Menu	Mixed Gas Menu	O&G Gas Menu
Air	Air	Carbon Dioxide
Argon	Argon	Nitrogen
Butane	Butane	Methane (C1)
Carbon Dioxide	Carbon Dioxide	Ethane (C2)
Methane	Ethane	Propane (C3)
Natural Gas	Methane	i-Butane (C4)
Nitrogen	Nitrogen	n-Butane (C4)
Oxygen	Oxygen	Pentanes (C5)
Helium	Helium	Hexanes (C6)
Hydrogen	Hydrogen	Heptanes (C7)
Propane	Propane	Octanes (C8)
		Nonane+(C9+)

The meter's proprietary algorithms allow the user to switch gases or gas mixes in the field, as needed. The Pure and Mixed Gas Menus make the FT4A ideal for measurement of digester gas, Liquefied Petroleum Gas (LPG) and a variety of other biogases. With the addition of the O&G Menu on the Model FT4A, Gas-SelectX® can be used in upstream Oil & Gas applications. Whether you need to measure natural gas, air, flare gas, vent gas, or digester gas, the FT4A brings these options and more to the user with a push of a button.

THERMAL MASS TECHNOLOGY

Fast and Flexible Gas Flow Measurement

Offering you the flexibility to monitor multiple gas types at the push of a button, rotate the housing as needed for tight installations, and configure meter settings from advanced software, the Fox Thermal Model FT4A thermal mass flow meter and temperature transmitter can be used in a large variety of Oil & Gas and Industrial gas flow measurement applications.

Theory of Operation

Fox Thermal Flow Meters use a constant temperature differential (constant Δ T) technology to measure mass flow rate of gases. The thermal mass flow sensor consists of 2 Resistance Temperature Detectors (RTD's).

The Reference RTD measures the gas temperature. The instrument electronics heat the mass flow sensor, or heated element, to a constant temperature differential (constant Δ T) 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.

The Model FT4A flowmeter and temperature transmitter is approved for FM/FMc Class I, Division 1, ATEX/IECEx Zone 1. CE Mark. Accuracy compliant with BLM 3175 & API 14.10.

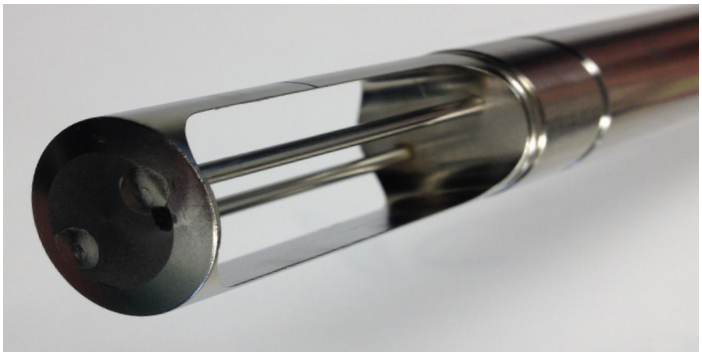
MODEL FT4A

Fox Thermal Model FT4A Thermal Gas Mass Flow Meter Features

The Fox Thermal Model FT4A measures gas flow rate in standard units without the need for temperature or pressure compensation. It provides an isolated 4-20mA output (with a HART option) and pulse or RS485 Modbus RTU.

With a standard 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 access flow meter settings, such as 4-20mA and pulse output scaling, pipe diameter, zero flow cutoff, flow filtering (damping), display options, and high or low alarm limits.

The Model FT4A is available in insertion and inline styles. The insertion style FT4A has a robust stainless steel probe and is easily installed by drilling a hole in the pipe and welding on a 1" NPT coupling. A Fox Thermal-supplied compression fitting secures the probe in place. It is supplied with 316 stainless steel wetted materials standard. Inline styles of the FT4A are available in both stainless steel and carbon steel with NPT ends, 150lb, and 300lb flange options. See Specification section for details on sizing. A USB port to connect to a computer or laptop is standard; interface options include 4-20mA, pulse, HART, and RS485 Modbus RTU.



The Fox Thermal 2nd generation DDC-Sensor™ eliminates the sensor element vibration which can lead to metal fatigue and failure.

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

Advanced Features

Suitable for harsh and hazardous environments, the instrument features:

- Robust DDC-Sensor™Design
- Gas-SelectX® gas selection menu featuring pure gases and the new Oil & Gas Menu
- CAL-V™ Calibration Validation
- Rotatable probe: allows ±180 degree swivel
- FM/FMc, ATEX, IECEx approvals. CE mark.
- 10-30VDC power input, standard
- NIST-traceable calibration
- Free FT4A View™ Software
- High and low alarm limits
- Wetted materials are all welded, 316 stainless steel

Perfect for Oil & Gas, Industrial, and Wastewater applications, the Model FT4A is a superior instrument ready for your application needs.

ADVANCED TECHNOLOGY

DDC-Sensor™

The Fox Thermal DDC-Sensor™ is the state-of-the-art sensor technology used in the Fox Thermal Model FT4A Thermal Gas Flow Meter. The DDC-Sensor™, a Direct Digitally Controlled sensor, is unlike other thermal flow sensors available on the market. Instead of using traditional analog circuitry, the DDC-Sensor™ is interfaced directly to the FT4A microprocessor for more speed and programmability. The DDC-Sensor™ accurately responds to changes in process variables (gas flow rate, pressure, and temperature) to determine mass flow rate, totalized flow, and temperature.

Fox Thermal's DDC-Sensor™ provides a technology platform for calculating accurate gas correlations. The FT4A correlation algorithms allow the meter to be calibrated on a single gas in the factory while providing the user the ability to select other gases or gas mixes in the Gas-SelectX® menu. Fox Thermal's Model FT4A with its DDC-Sensor™ and advanced correlation algorithm provides an accurate, multi-gas-capable thermal gas flow meter.

CAL-V®

For customers that need a quick and easy way to verify the calibration of the meter in the field, the Model FT4A offers the CAL-V™ feature. This feature can be accessed and run through the meter's standard display and configuration panel, Modbus, or the FT4A View™ Software. The test takes less than 5 minutes to run and produces a pass/fail result at the conclusion of the test. A fail result may indicate either a dirty sensor or the need to recalibrate.

If the CAL-V™ test is performed using the FT4A View™ software, a Calibration Validation Certificate can be produced at the conclusion of the test. The certificate will show the date and time of the test along with meter data such as firmware version, meter serial number, configuration settings, and currently selected gas/gas mix. This in situ calibration validation helps operators comply with environmental mandates and eliminates the cost and inconvenience of annual factory calibration.

DIMENSIONS

Dimensional

Refer to dimensional drawings on Fox Thermal website.

Probe Lengths (LL*) 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)

*See dimensional drawings on Fox Thermal website.

Fox Thermal
Precision Mass Flow Measurement
An ONICON Brand

FT4A View™ Software

Fox Thermal has developed advanced software - FT4A View™ - a free PC-compatible application available for download from the Fox Thermal website. Connect your laptop, PC, or control station to the meter using the USB port interface to access the meter's data and configure the meter's settings.

FT4A View™ allows:

- Quick access to all configuration parameters and available gas selections
- Selection of measurement units, flow and temperature ranges, alarm settings and more
- Display of alarm codes
- Storage of meter configurations to a file that can be archived
- Raw data to be viewed in order to diagnose or troubleshoot your meter
- Data logging to an Excel™ spreadsheet
- View gross heating value and density of gas mix

APPROVALS

Approvals

CE Mark: Approved
EMC Directive: 2014/30/EU
Electrical Equipment for Measurement, Control and Lab Use: EN61326-1:2013
EU Directive: 2014/68/EU
Weld Testing: EN ISO 15614-1 and EN ISO 9606-1, ASME B31.3

FM (U.S.) & FMc (CANADA): Approved
Class I, Division 1, Groups B, C, D; Class II, Division 1, Groups E, F, G; and Class III, Division 1; T4, Ta = -40˚ 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 (FM16ATEX0013X): Approved
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): Approved
Ex d 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 60079-0:2012 + A11:2013	IEC 60079-0:2011
EN 60079-1:2014	IEC 60079-1:2014
EN 60079-31:2014	IEC 60079-31:2013
EN 60529:1991 + A1:2000	IEC 60529:2001

The Model FT4A is perfect for monitoring low flow vent gas from tanks as well as high velocity flare gas.

SPECIFICATIONS

Performance Specs

Flow Accuracy:
Air: ±1% of reading ±0.2% of full scale
Other gases: ±1.5% of reading ±0.5% of full scale
Accuracy specification applies to customer's selected flow range
Maximum range: 15 to 60,000 SFPM (0.07 to 280 NMPS)
Minimum range: 15 to 1,000 SFPM (0.07 to 4.7 NMPS)
Straight, unobstructed pipe requirement:
Insertion: 15 diameters upstream 10 downstream
Inline: 8 diameters upstream, 4 downstream

Gross Heating Value Uncertainty:
±0.01% on mass basis; ±1.0% on volume basis

Flow Repeatability: ±0.2% of full scale

Flow Response Time: 0.8 seconds (one time constant)

Temperature Accuracy: ±1° F (±0.6° C)

Calibration:
Factory Calibration to NIST traceable standards
CAL-V™: In-situ, operator-initiated calibration validation

Operating Specs

Gas-SelectX® Gas Selections:
Pure Gas, Mixed Gas, and Oil & Gas Mixed Gas Menus to suit any application. See the Fox Thermal website for more information on availability of current gases.

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

Gas Pressure (maximum; at 100°F):
Insertion meter: 740 psig (51.02 barg)
316 SS inline w/NPT ends: 500 psig (34.5barg)
316 SS inline w/150lb flanges: 230 psig (16 barg)
316 SS inline w/300lb flanges: 600 psig (41 barg)
CS inline w/NPT ends: 300 psig (21 barg)
CS inline w/150lb flanges: 285 psig (20 barg)
CS inline w/300lb flanges: 740 psig (51 barg)
Retractor: 150 psig (10.3 barg) max.
- 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:
DDC-Sensor™: -40 to 250°F (-40 to 121°C)
Enclosure: -40 to 158°F (-40 to 70°C)*
*NOTE! Display dims below -4˚F (-20˚C); function returns once temperature rises again.

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.

Input power: 12 to 28 VDC, 6 watts max. (CE requirement)
Full input power range: 10 to 30 VDC.

Outputs:
One standard isolated 4-20mA output for flow or temperature; fault indication per NAMUR NE43; HART communication option.
Second output for pulse or RS485 Modbus RTU.
Isolated pulse output: 5 to 24VDC, 10mA max., 0 to 100Hz for flow (the pulse output can be used as an isolated solid state output for alarms).

Flow Velocity Range: 15 to 60,000 SFPM (0.07 to 280 NMPS)
Turndown: up to 1000:1; 100:1 typical

Flow Ranges - Insertion Meters			
Pipe Diameter	SCFM	MSCFD	NM3/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

NOTE! To determine if the FT4A will operate accurately in other pipe sizes, divide the maximum flow rate by the pipe area. The application is acceptable if the resulting velocity is within the velocity range above. Check Fox Thermal website for velocity calculator.

Flow Ranges - Inline Meters			
Pipe Diameter	SCFM	MSCFD	NM3/Hr
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! Consult factory for flow ranges above those listed. Inline meters above 2,500 SCFM (3,950 NM3/H) may require third party calibration. Contact Fox Thermal.

Serial Communication:
USB connector for connecting to a laptop or computer is standard.
Optional isolated communication outputs: RS485 Modbus RTU.
Free PC-based software tool - FT4A View™ - provides complete configuration, remote process monitoring and data logging functions.

Physical Specs

Probe diameter: ¾"

Sensor Material: 316 stainless steel

Enclosure: NEMA 4X, aluminum, dual ¾" FNPT conduit entries.

Fox Thermal recommends the following probe lengths (without insulation):

Pipe Diameter	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	

Equation for Selecting Probe Length

Probe length = ½ pipe ID (in inches) + 3" + thickness of insulation (if any). Round up to the next standard probe length available.