

MODEL

FT4A

Fox Thermal Gas Mass Flow Meter

HIGHLIGHTS

- 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
- Flow Control Innovation Award Winner
- Processing's Breakthrough Product Award Winner



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.

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 branch outlet. 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 Modbus RTU (RS485).

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

THEORY OF OPERATION

Fox Thermal Flow Meters use a constant temperature differential (constant ΔT) 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 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.



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

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 rotation
- 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 Biogas, 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.

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 flow meter. Gas-SelectX® allows the user to choose from a menu of several common gases or gas mixtures for their application.

Visit the [Fox Thermal website](#) to view the gases available for the FT4A.

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.

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.

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

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 = ½ 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

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



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

foxthermal.com/configure

SALES@FOXTHERMAL.COM | (831) 384-4300

INLINE STYLES

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

Inline pipe sizes in inches =														
0.75	○	●	◐	◑	1.00	○	●	◐	◑	1.25	○	●	◐	◑
1.50	○	●	◐	◑	2.00	○	●	◐	◑	2.50	○	●	◐	◑
3.00	○	●	◐	◑	4.00	○	●	◐	◑	6.00	○	●	◐	◑

○= SS ●= CS ◐= NPT Ends ◑= 150lb flanges ◒= 300lb flanges

Note: See [FT4A 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: ¾"

DRAWINGS

See [FT4A Dimensional Drawings](#) on Fox Thermal website.

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

SPECIFICATIONS

PERFORMANCE SPECS

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
 Maximum range: 15 to 60,000 SFPM (0.07 to 280 NMPS)
 Minimum range: 15 to 500 SFPM (0.07 to 2.4 NMPS)
 Straight, unobstructed pipe requirement:

- Insertion: 15 diameters upstream 10 downstream
- Inline: 8 diameters upstream, 4 downstream

Gross Heating Value Uncertainty:

$\pm 0.01\%$ on mass basis; $\pm 1.0\%$ on volume basis

Flow Repeatability:

$\pm 0.2\%$ of full scale

Flow Response Time:

0.8 seconds (one time constant)

Temperature Accuracy:

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

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, 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, SLP/M, MT/H

Gas Pressure (maximum; at 100°F):

Insertion meter: 740 psig (51.02 barg)
 316 SS inline w/NPT ends: 500 psig (34.5 barg)
 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.

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:

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 Modbus RTU (RS485).

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: Modbus RTU (RS485). Free PC-based software tool - FT4A View™ - provides complete configuration, remote process monitoring and data logging functions.

PHYSICAL SPECS

Probe diameter:

$\frac{3}{4}"$

Sensor Material:

316 stainless steel

Enclosure:

NEMA 4X, aluminum, dual $\frac{3}{4}"$ FNPT conduit entries.

CONFIGURATIONS

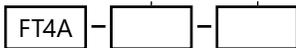
MODEL CODES - CHOOSE METER SIZE AND FEATURES

The FT4A is available in insertion and inline styles. The insertion meter is easily installed with a weld-o-let and compression fitting and requires straight pipe runs of 15D upstream/10D downstream.

The inline model is available in 3/4" to 6" sizes and includes built-in flow conditioners that eliminate the need for long, straight pipe runs. Straight run requirements are decreased to 8D upstream/4D downstream for the inline style meters.

Feature 1a: Insertion Sizes	
Code	Description
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
18R	18" probe w/150-psi retractor
24R	24" probe w/150-psi retractor
30R	30" probe w/150-psi retractor
36R	36" probe w/150-psi retractor

Feature 1b: Inline Sizes	
Code	Description
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
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
15G	1.5-inch, 300lb RF flanges 12" face-to-face
20G*	2-inch, 300lb RF flanges 12" face-to-face
25G*	2.5-inch, 300lb RF flanges 18" face-to-face
30G*	3-inch, 300lb RF flanges 18" face-to-face
40G*	4-inch, 300lb RF flanges 18" face-to-face
60G*	6-inch, 300lb RF flanges 24" face-to-face



Example:

FT4A - 06I - P1

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.*

Feature 2: Outputs	
Code	Description
P1	4-20mA + Pulse Output
RS	4-20mA + Modbus RTU (RS485)
BH	4-20mA/HART + Pulse Output

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

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 FT4A thermal mass flow meter equipped with the state-of-the-art DDC-Sensor™

technology, new expanded Gas-SelectX® gas selection menu, and CAL-V™ Calibration Validation as the alternative to other technologies.

Take a look at the other benefits Fox Thermal gas mass flow meters offer over other flow measurement technologies.

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 only suitable for very high flow rates. DP meters do not have good turndown.	Repeatability and exceptionally broad measurement range: up to 1000:1 (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, gas calibration, 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. Gas-SelectX®, available in the Model FT4A, allows the user to change the gas selection in the field. Displays with configuration panels and 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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