

MODEL

FT4A

Fox Thermal Gas Mass Flow Meter

HIGHLIGHTS

- DDC-Sensor™ (Direct Digitally Controlled)
- Gas-SelectX®: menu of field selectable gas compositions
- CAL-V™ Calibration Validation
- Gross Heating Value and Density Calculations of Gas Mix
- Insertion and Inline Styles
- Measures gas flow rate in SCFM, MCFD, KG/H, and many more units
- Wide measurement range: up to 1000:1 turndown; 100:1 typical
- 4-20mA for flow rate or temperature; HART option
- Choice of second channel: pulse output for flow/total or Modbus RTU (RS485)
- USB port to connect to a PC, standard
- ModbusView™ and FT4A View™ software available
- Welded, 316 SS sensor construction
- Robust sensor design, sensing elements supported at both ends
- Stainless or carbon steel inline flow bodies 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 flares, vents, and leak detection
- Negligible pressure drop
- FM (U.S.) & FMc (CANADIAN) approved for Class I, Div 1; ATEX/IECEX (EU/Global) approved for Zone 1
- NEMA 4X and CE Mark



THERMAL MASS TECHNOLOGY

FAST AND FLEXIBLE GAS FLOW MEASUREMENT

Offering you the flexibility to reprogram the gas composition 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 can be used in a large variety of Oil & Gas, Industrial, Biogas, and Wastewater 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 a second channel with pulse output or Modbus RTU (RS485).

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, gas composition, 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 an 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 two Resistance Temperature Detectors (RTDs).

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 Fox Thermal DDC-Sensor™ provides a technology platform for calculating accurate gas correlations.

ADVANCED FEATURES

Suitable for harsh and hazardous environments, the instrument features:

- Robust DDC-Sensor™ Design available in ¾" and ½" probe diameters
- Gas-SelectX® gas selection menu featuring pure gases and the expanded Mixed Gas and Oil & Gas menus
- CAL-V™ Calibration Validation
- Rotatable probe: allows ± 180 degree rotation
- FM/FMc, ATEX, IECEx approvals. CE mark.
- 12-24VDC power input, standard
- NIST-traceable calibration
- ModbusView™ and FT4A View™ software available
- 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 model FT4A thermal mass 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 control, precision, 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 users who 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 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 View™ software applications (see next section), 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.

EXPANSION OF THE GAS-SELECTX® MENU

Fox Thermal has developed the Gas-SelectX® gas selection feature which allows the user to choose from menus of single gases or create custom gas mixtures.

The meter's proprietary algorithms allow the user to switch gases or gas mixes in the field, as needed. Quickly choose a single or

pure gas from the first list or create a custom gas mix with the Mix or Oil & Gas menus. Whether you need to measure air, natural gas, biogas, flare gas, vent gas, or digester gas, the FT4A brings these options and more to the user with a quick push of a button.

Programmable Gases		
Air	Ammonia	Pentanes
Argon	Chlorine	Hexanes
Butane	CO	Heptanes
CO2	Propadiene	Octanes
Ethane	Iso Butane	Nonanes+
Ethylene	Ozone	Difluoromethane
Helium	Iso Pentane	Sulfur hexafluoride
Hydrogen	Methanol	Sulfur Dioxide
Methane	1-Butyne	Nitrous Oxide
Natural Gas	Benzene	Pentafluoroethane
Nitrogen	Water	Tetrafluoroethane
Oxygen	Acetone	Trifluoroethane
Propane	Decane	Chlorodifluoromethane
Propylene	Ethanol	Hydrogen Sulfide

ADVANCED SOFTWARE SOLUTIONS

Fox Thermal's ModbusView™ and FT4A View™ are PC-based tools for configuring Fox Thermal flow meters, monitoring measurements, and performing diagnostics like calibration validation from a PC.

Shared capabilities

- Available free from the Fox Thermal website.
- Quick access to measurement units, flow and temperature ranges, and alarm settings.
- Provides access to available gas selections.
- Displays flow rate, totalized flow, and temperature measurements for the programmed gas.
- Calculates and displays density and gross heating values of the programmed gas.
- Includes flow and temperature simulation tools for testing and setup.
- Create CAL-V™ Calibration Validation certificates.
- Display alarm codes and manage alarm behavior.

ModbusView™ distinctive features:

- Connects using a Modbus serial communication interface (requires "RS" model code selection).
- Designed for continuous use.
- Advanced remote capabilities, not limited by USB cable length.
- Model agnostic -- works also with FT1 and FT4X.
- Supports storage of Gas-SelectX® mixes for archiving and reloading into the meter.

FT4A View™ distinctive features

- Connects using a USB port interface.
- Designed for periodic use (startup & maintenance).
- Collects meter data to .csv (MS Excel not included).

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 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.

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

Pressure Equipment Directive: 2014/68/EU

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

FM (FM16US0005X) & FMc (FM16CA0005X): 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

INLINE STYLES

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

Inline pipe sizes in inches =									
0.75	○	●	○	●	1.00	○	●	○	●
1.50	○	●	○	●	2.00	○	●	○	●
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

3/4" probe diameter standard with 1" MNPT compression fitting (3/4" fitting optional).

1/2" probe diameter optional with 3/4" MNPT compression fitting (1/2" fitting optional).

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	IEC 60079-0
EN 60079-1	IEC 60079-1
EN 60079-31	IEC 60079-31
EN 60529 + A1 + A2	IEC 60529



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:

Air and Nitrogen (N2): $\pm 1\%$ 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 user'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 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, SLP, MT/H

Gas Pressure - maximum at 100°F (38°C):

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: 500 psig (34.5 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.
- The EU Pressure Equipment Directive (PED) minimum required ambient and fluid temperature rating for carbon steel flow bodies is -29°C .

Relative Humidity:

90% RH maximum; non-condensing

NOTE! Condensing liquids contacting the sensor can cause erratic flow indication.

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.

Input power:

12 to 24 VDC $\overline{\text{---}}$, 6 watts

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.

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

Check Fox Thermal website for velocity calculator.

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).

PC-based software tools - FT4A View™ and ModbusView™ - provide complete configuration, remote process monitoring and data logging functions through either USB or RS485.

4-20mA and Pulse Verification:

Simulation mode used to align 4-20mA output and pulse output (if ordered) with the input to user's PLC/DCS.

PHYSICAL SPECS

Sensor Material:

316 stainless steel

Enclosure:

NEMA 4X, aluminum, dual 3/4" FNPT conduit entries.

Insertion flow meter installation:

Fox-supplied compression fitting connects to customer-supplied branch outlet welded to pipe.

CONFIGURATIONS

MODEL CODES - CHOOSE METER SIZE AND FEATURES

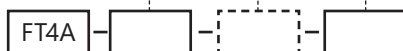
The FT4A is available in insertion and inline styles. The insertion meter is easily installed with a branch fitting and compression fitting and requires straight pipe runs of 15D upstream/10D downstream. An insertion model paired with the FC20 flow conditioner at 2D upstream of the probes reduces the straight run requirements to 5D upstream of the FC20 and 5D downstream of the probe.

The inline model is available in ½" 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 retracto
36R	36" probe w/150-psi retractor

Feature 1b: Probe Diameter (insertion only, optional)	
Code	Description
[blank]	Standard ¾" diameter probe, 1" MNPT compression fitting included
S2	½" diameter probe, ¾" MNPT compression fitting included

Feature 1b: Inline Sizes	
Code	Description
05PS2	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
05FS2	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
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



Examples:

FT4A - 06I - - P1

FT4A - 06I - S2 - P1

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

Notes:

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

*For carbon steel (CS) material, add "C" to applicable stainless steel (SS) codes.

Example: 20P = 2" SS;

20PC = 2" CS.

COMPARISON

TECHNOLOGY COMPARISON

For users searching for a lower cost, higher accuracy low flow measurement meter, thermal mass flow meters by Fox Thermal beat 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 (DP) 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 user 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 software allow users to interact and program the meter in the field. Using the online Product Configurator , the user 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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