

# MODEL FT4X

## Fox Thermal Gas Mass Flow Meter

### HIGHLIGHTS

- DDC-Sensor™: Robust, non-cantilevered design
- Programmable Contract Time
- Gas-SelectX®: menu of field selectable gas compositions
- Gross Heating Value and Density Calculations of Gas Mix
- Standard Data Logger with date/time stamp and 40 24-Hour daily totals
- CAL-V™ Calibration Validation
- Insertion, Inline, and Remote Styles Measures gas flow rate in SCFM, MCFD, KG/H, & many more
- Wide measurement range: up to 1000:1 turndown; 100:1 typical
- Two 4-20mA outputs for flow rate or temperature
- Choice of HART or Modbus RTU (RS485) communication options
- USB port to connect to a PC, standard
- Free FT4X View™ Software available
- Welded, 316 SS sensor 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 flares, vents, and leak detection
- Negligible pressure drop
- FM (U.S.) & FMc (CANADA) approved for Class I, Div 1; ATEX/IECEx approved for Zone 1
- NEMA 4X and CE Mark
- Accuracy Compliant with BLM 3175 & API 14.10



## MODEL FT4X

### 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 FT4X thermal mass flow meter and temperature transmitter can be used in a large variety of Oil & Gas, Industrial, Biogas, and Wastewater gas flow measurement applications.

#### THEORY OF OPERATION

Fox Thermal Flow Meters use a constant temperature differential (constant  $\Delta T$ ) technology to measure mass flow rate of air and gases. The thermal mass flow sensor consists of two 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  $\Delta T$ ) 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.

#### FOX THERMAL GAS MASS FLOW METER FEATURES

The Fox Thermal Model FT4X measures gas flow rate in standard units without the need for temperature or pressure compensation. It provides two isolated 4-20mA outputs, a pulse/alarm output, a contact input, and optional Modbus RTU (RS485) or HART communication options.

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/ configuration panel can also be used to access flow meter settings, such as 4-20mA and pulse output scaling, pipe diameter, low flow cutoff, flow filtering (damping), display options, and high or low alarm limits.

The Model FT4X is available in both insertion and inline styles. The insertion probe 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 models are available in 3/4" to 6" sizes and includes built-in flow conditioners that eliminate the need for long, straight pipe runs.

A USB port to connect to a computer or laptop is standard; interface options include 4-20mA, pulse, HART, and Modbus RTU (RS485).

#### 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
- Data Logger with 40 Daily Totals (24 hour totals)
- Settable Contract Time defines Contract Day
- Gross Heating Value and Density calculations of gas mix
- CAL-V™ Calibration Validation
- Rotatable probe: allows  $\pm 180$  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 FT4X is a superior instrument ready for your application needs.

#### CAL-V™

For customers that need a quick and easy way to verify the calibration of the meter in the field, the Model FT4X offers the CAL-V™ feature. This feature can be accessed and run through the meter's standard display and configuration panel, Modbus, or the FT4X 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 FT4X 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 test helps operators comply with environmental mandates and eliminates the cost and inconvenience of annual factory calibration. View historical CAL-V™ test data in the log.



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

### DDC-SENSOR™

The Fox Thermal DDC-Sensor™ is the state-of-the-art sensor technology used in the Fox Thermal Model FT4X 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 FT4X 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 FT4X 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 FT4X with its DDC-Sensor™ and advanced correlation algorithm provides an accurate, multi-gas-capable thermal gas flow meter.

### NEW STANDARD DATA LOGGER WITH DATE/TIME STAMP

Every Fox Thermal Model FT4X comes equipped with an advanced intrinsic Data Logger for advanced record-keeping and data retention. Data logging is commonly used in applications such as flare and waste gas monitoring, gas studies, gas royalties and allocation, and gas flow research.

To start logging daily totals, alarms and events, the Data Logger must be activated upon installation. It can be activated quickly and easily through the flow meter's front panel keypad. The date and local time must be set for accurate records.

The Data Logger records flow rate totals and other events and alarms. The advanced features of the Model FT4X Data Logger include:

- 40 daily totals (24-hour totals)
- Settable Contract Time defines Contract Day
- Time/date stamped alarm & event logs; 7 year history
- Power off totalizer; power failure creates event log entry

The logs in the Model FT4X Data Logger also give information about the meter's settings and functionality:

- View the meter's gas or gas mix composition
- View the meter's configuration and other meter settings
- View Calibration Validation historical test data
- View and print logs of events and alarms

The Data Logger can be accessed with a Modbus RTU (RS485) communication option and the free FT4X View™ Software.

### GAS-SELECTX® GAS SELECTION MENU

Many customers need a fast solution to their monitoring needs. For these cases, Fox Thermal has developed the Gas-SelectX® gas selection menu feature for the Model FT4X 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 FT4X.

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 FT4X ideal for measurement of flare gas and a variety of other gases.

With the O&G Menu on the Model FT4X, Gas-SelectX® contains gases common to Oil & Gas applications. Whether you need to measure natural gas, air, flare gas, vent gas, or digester gas, the FT4X brings these options and more to the user with a quick push of a button.

### FT4X VIEW™ SOFTWARE

Fox Thermal has developed advanced software - FT4X 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.

FT4X View™ allows:

- Quick access to all configuration parameters and available gas selections
- Selection of measurement units, flow and temperature ranges, alarm settings and more
- View or print a CAL-V™ Calibration Validation certificate
- 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



*The Oil & Gas industry requires flow gas meters to measure changing compositions, record data, gross heating value, density of gas mix, and gas flow totals all while operating reliably in harsh conditions. A Model FT4X from Fox Thermal is ideal for these 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 = 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  
Pressure Equipment Directive: 2014/68/EU  
Weld Testing: EN ISO 15614-1, EN ISO 9606-1, ASME B31.3

FM (FM17US0061X) & FMc (FM17CA0032X): Approved

Class I, Division 1, Groups B, C, D;  
Class II, Division 1, Groups E, F, G;  
Class III, Division 1; T6 or T4, Ta = -40° to 70°C;  
Class 1, Zone 1, AEx/Ex db IIB + H2 T6 or T4 Gb; Ta = -20°C to 70°C; Type 4X, IP67

Enclosure/Power	Divisions (All)		Zones (Gas)		Zones (Dust)	
	Main Enclosure	Remote	Main Enclosure	Remote	Main Enclosure	Remote
E1	T4	N/A	T4	N/A	T135°C	N/A
E3	T6	T4	T6	T4	T85°C	T135°C

Temperature code ratings for Zones are dependent on external process temperature factors and equipment enclosure configuration. See the above for specific temperature code ratings.

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 FT4X 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 FT4X Dimensional Drawings on Fox Thermal website.

ATEX (FM17ATEX0015X): Approved

II 2 G Ex db IIB + H2 T6 or T4 Gb Ta = -20°C to +70°C; IP67  
II 2 D Ex tb IIIC T85°C or T135°C Db Ta = -20°C to +70°C; IP67

IECEx (IECEx FMG 17.0008X): Approved

Ex db IIB + H2 T6 or T4 Gb Ta = -20°C to +70°C; IP67  
Ex tb IIIC T85°C or T135°C Db Ta = -20°C to +70°C; IP67

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

NOTE! The EU Pressure Equipment Directive (PED) requires that the minimum ambient and fluid temperature rating for carbon steel flow bodies not be below -29°C

# 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, SLPM, MT/H

### 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 FT4X 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 5,000 SCFM (7,900 NM3/H) air may require third party calibration. Contact Fox Thermal

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### Temperature:

DDC-Sensor™: -40 to 250°F (-40 to 121°C)

Enclosure: -40 to 158°F (-40 to 70°C)\*

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.

### Relative Humidity:

90% RH maximum; non-condensing

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

### 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.

- 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).

### Input power:

12 to 28 VDC, 6 watts max.

Full input power range: 10 to 30 VDC.

A 20 Watt or greater power supply is recommended to power the FT4X

Class I Equipment (Electrical Grounding Required for Safety).

Installation (Over-voltage) Category II for transient over-voltages.

### Inputs/Outputs:

#### 4-20mA Channel 1:

- Standard isolated 4-20mA output configured to indicate for flow; fault indication per NAMUR NE43. HART communication option.
- The 4-20mA load resistance must be 125 ohms or less when operating on 12 volt power and 600 ohms or less on 24 volt power.

#### 4-20mA Channel 2:

- Standard isolated 4-20mA output configured to indicate either flow or temperature.

#### Pulse/Alarm:

- 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).

#### Remote Switch Input:

- Can be configured to reset the flow totalizer and elapsed time.

#### Serial Communication:

- Isolated Modbus RTU (RS485) option
- Isolated HART communication option

#### USB Communication:

- Isolated USB 2.0 for interfacing with a laptop or computer is standard.
- FT4X View™: A free PC-based software tool that provides complete configuration, remote process monitoring, and data logging functions through USB communication.

### 4-20mA and 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

### Enclosure:

NEMA 4X (IP67), aluminum, dual 3/4" FNPT conduit entries.

### Cabling to remote enclosure:

8-conductor, 18 AWG, twisted pair, shielded, 100 feet maximum.

### Insertion flow meter installation:

Fox-supplied compression fitting connects to customer-supplied 1" branch outlet welded to pipe.





Make downtime a thing of the past.

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