MODEL

FT4X

Fox Thermal Gas Mass Flow Meter

HIGHLIGHTS

- DDC-Sensor™ (Direct Digitally Controlled)
- Robust sensor design, sensing elements supported at both ends
- Gas-SelectX®: menu of field selectable gas compositions
- CAL-V™ Calibration Validation
- Gross Heating Value and Density Calculations of Gas Mix
- Standard Data Logger with date/time stamp and 40 24-Hour daily totals
- Programmable Contract Time
- Insertion, Inline, and Remote styles
- Measure gas flow rate in SCFM, MCFD, KG/H, and many more units
- 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
- 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 (CANADA) approved for Class I, Div 1; ATEX/UKEX/IECEx approved for Zone 1
- NEMA 4X and CE Mark
- Accuracy Compliant with BLM 3175 & API 14.10

FOX™ THERMAL

OIL & GAS | INDUSTRIAL | BIOGAS | WASTEWATER

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 Δ 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 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 output 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 signal outputs, a pulse/alarm output, a contact input, and optional Modbus RTU (RS485) or HART communication options.

A USB port to connect to a computer or laptop is standard.

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 ¾" to 6" pipe sizes and include built-in flow conditioners that eliminate the need for long, straight pipe runs.

ADVANCED FEATURES

Suitable for harsh and hazardous environments, the instrument features:

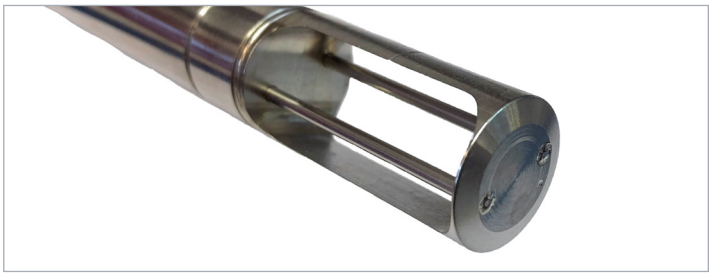
- Robust DDC-Sensor™ Design
- Gas-SelectX® gas selection menu featuring pure gases and the new Oil & Gas Menu
- Data Logger with 40 Daily Totals (24 hour totals)
- Settable Contract Time defines Contract Day
- Gross Heating Value and Density calculations of gas mix
- CAL-V™ Calibration Validation
- Rotatable probe: allows ±180 degree enclosure orientation
- FM/FMc, ATEX, IECEx approvals. CE mark.
- 12-28VDC power input, standard. Optional 100 to 240VAC power input available
- NIST-traceable calibration
- Free FT4X View™ Software
- High and low alarm limits
- Wetted materials are 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 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 sensor element vibration which can lead to metal fatigue and failure.

ADVANCED TECHNOLOGY

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 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 easily through the flow meter's front panel keypad or FT4X View™ software. 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

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.

Single (100%)	Mixes	Oil & Gas
Air	Air	Methane
Argon	Argon	Ethane
Butane	Butane	Propane
Carbon Dioxide	Carbon Dioxide	Iso Butane
Ethane	Ethane	Normal Butane
Ethylene	Ethylene	Pentanes
Helium	Helium	Hexanes
Hydrogen	Hydrogen	Heptanes
Methane	Methane	Octanes
Natural Gas	Nitrogen	Nonanes+
Nitrogen	Oxygen	Carbon Dioxide
Oxygen	Propane	Nitrogen
Propane	Propylene	Ethylene
Propylene		Propylene

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 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

DIMENSIONS

INSERTION STYLES

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

Pipe Size	Probe Lengh
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.

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.

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 Article 13
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

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

UKEX (FM21UKEX0170X): 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

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	IEC 60529

Specific Conditions of Use:
1. The flameproof joints of the equipment are not intended to be repaired. Consult the manufacturer if dimensional information on the flameproof joints is necessary.
2. Refer to the manufacturer's instructions to reduce the potential of an electrostatic charging hazard on the equipment or enclosure.
3. The equipment temperature code ratings are dependent on the enclosure configuration model code (local or remote). Refer to the following table for specific temperature code markings.

Model Code	Divisions (All)		Zones (Gas)		Zones (Dust)	
Enclosure/Power	Main Enclosure	Remote	Main Enclosure	Remote	Main Enclosure	Remote
E1	T4	N/A	T4	N/A	T135°C	N/A
E2	T4	N/A	T4	N/A	T135°C	N/A
E3	T6	T4	T6	T4	T85°C	T135°C
E4	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.

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 500 SFPM (0.07 to 2.4 NMPS)
Typical 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 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

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

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 (34.5barg)
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: 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.
- 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).

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

Input power:
12 to 28 VDC ⎓, 6 watts. Full input power range: 10 to 30 VDC (standard DC power).
A 20-Watt or greater DC power supply is recommended to power the FT4X.
100 to 240 VAC ~, 50-60Hz, 7 watts. Full input power range: 85 to 264 VAC (AC power option).
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.

CONFIGURATIONS

MODEL CODES - CHOOSE METER SIZE AND FEATURES

The FT4X is available in insertion, inline, and remote styles. The insertion meter is easily installed with a branch fitting and compression fitting and requires minimum straight pipe runs of 15D upstream/10D downstream.

The inline model is available in ¾" to 6" sizes and includes built-in flow conditioners that eliminate the need for long, straight pipe runs. Straight run minimum requirements are decreased to 8D upstream/4D downstream for the inline style meters. In a remote configuration, the electronics can be mounted up to 100' from the sensor.

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

Example:
FT4X – 06I – E1 – RS

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.**

*Contact Fox Thermal about higher-pressure retractor options.

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

Feature 2: Enclosure Type	
Code	Description
E1	Local NEMA 4X enclosure, 24VDC powered
E2	Local NEMA 4X enclosure, 85-264VAC powered
E3***	Remote with explosion-proof J-box, 24VDC powered
E4***	Remote with explosion-proof J-box, 85-264VAC powered

Feature 3: Communication Options	
Code	Description
B0	No communication option
RS	Modbus RTU (RS485)
BH	HART enabled on primary 4-20mA output

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

***100' max, cable optional

COMPARISON

TECHNOLOGY COMPARISON

For customers 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 FT4X thermal mass flow meter equipped with the state-of-the-art DDC-Sensor™ technology, new expanded Gas-SelectX® gas selection menu, CAL-V™ Calibration Validation, and a standard data logger with date and time stamp as the alternative to other technologies.

Review the table below to discover 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/ Rangeability	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 my be 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 FT4X, 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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