

MODEL

# FT3

## Fox Thermal Gas Mass Flow Meter

### HIGHLIGHTS

- Field-selectable units SCFM, NM3/HR, LBS/HR, KG/HR, & many more
- Wide measurement range; 100:1 turndown typical
- Measures process gas and temperature
- Two 4-20mA outputs for flow rate & temperature; pulse output for flow/total
- USB port to connect to a PC standard; Optional Modbus RTU (RS485) or HART
- Insertion and Inline models
- Welded, 316 SS sensor construction
- Microprocessor based, field programmable electronics
- Optional display, LCD 2 line, 16 character, backlit; Infrared (IR) button configuration panel to view/set readings and parameters
- CAL-V™ and Zero CAL-CHECK™ in-situ calibration validation
- Power input 24 VDC or optional 100 to 240 VAC in local or remote enclosures
- Free FT3 View™ Software available
- NIST traceable calibration
- Low-end sensitivity for leak detection
- Negligible pressure drop
- No moving parts design
- FM (U.S.) & FMc (CANADIAN) approved for Class I, Div 1
- ATEX/IECEx approved for Zone 1
- NEMA 4X and CE Mark
- EMC Directive; 2014/30/EU
- Low Voltage Directive (LVD): 2014/35/EU
- Product Safety Testing: EN 61010-1: 2010
- Pressure Equipment Directive: 2014/68/EU
- Weld Testing: EN ISO 15614-1 and EN ISO 9606-1, ASME B31.3



SMART, REAL-TIME MASS FLOW MEASUREMENT

The Fox Model FT3 measures two important process variables with a single instrument, providing isolated 4-20mA and pulse outputs for flow rate, and a 4-20mA pulse output for process gas temperature or a second flow rate output.

Direct mass flow measurement, exceptional low-flow sensitivity, fast response, and low maintenance requirements distinguish the Fox Model FT3. Virtually immune to changes in temperature and pressure, the flow meter delivers repeatable, accurate mass flow measurement under varying conditions. It's rugged, no-moving-parts design is also ideal for high-vibration industrial environments, and enhanced EMI immunity makes it suitable for environments where electric motors, ignitors, or dirty power may affect instrument performance.

CREATIVE SOLUTIONS: CALIBRATION VALIDATION

Fox Thermal knows that customers want creative and effective solutions to some of their common process problems. Downtime due to equipment maintenance or calibration costs money and wastes valuable time. Calibration Validation of flow meters in the field provides assurance of the functionality of the meter and avoids the downtime associated with annual calibrations.

Used in succession, Fox's CAL-V™ and Zero CAL-CHECK™ tests can give you the reassurance that your meter is performing accurately in the field without the need to interrupt flow or send the meter back to the factory. The tests are quick and easy to perform at any time and help with the challenging requirements for measuring the flow of air and gases.

CAL-V™

The CAL-V™ feature is an in-situ calibration routine that validates the flow meter's calibration accuracy by testing the functionality of the sensor and its associated signal processing circuitry. This innovative approach lets you validate instrument calibration in the pipe, at process conditions, with just a push of a button. At the conclusion of the test, the meter will

display a pass/fail message and the CAL-V™ data is saved in the meter for look-up at any time.

CAL-V™ is an operator-initiated test that can be performed at any flow rate, including zero, and is completed in just three to four minutes. During the test, the meter's microprocessor adjusts the signal to the sensor elements and determines the resulting electrical characteristics. These site-determined characteristics are compared with the data that was collected and stored in the instrument electronics during the original factory calibration. Matching data within established tolerances confirms the meter is measuring accurately.

ZERO CAL-CHECK™ TESTS

The Zero CAL-CHECK™ test is used to ensure that the flow meter still retains its original NIST-traceable calibration at zero flow. The test can be performed in one of two ways: In-situ or Out-of-Pipe.

IN-SITU ZERO CAL-CHECK™

If zero flow can be established, the sensor does not need to be removed and the procedure can be done in the pipe. If zero flow cannot be established, a Fox Packing Gland Assembly is used to remove the sensor from the gas stream to simulate a "no flow" condition.

The test compares sensor characteristics at zero flow with customer-set zero flow baseline and takes less than five minutes to complete after zero flow condition has been established.

OUT OF PIPE ZERO CAL-CHECK™

If zero flow cannot be established and the meter must be removed from the pipe, this test may be used. The test will compare the sensor characteristics at zero flow at ambient temperature and atmospheric pressure with the factory characteristics. This test can also be performed in less than five minutes once the set up is complete.

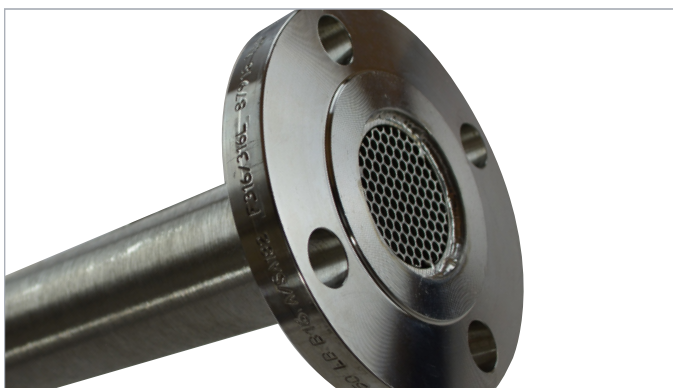
CALIBRATION VALIDATION: Typical Requirements of Competitive Models	Other Thermal Flow Meters	FT3 with CALV™ & Zero CALCHECK
Stop the flow*	Required	Not Required
Remove meter from pipe*		
Disconnect wires from flow meter		
Look up data on flow meter's calibration certificate		
Measure electrical characteristics with volt ohm meter		
Perform calculations to evaluate flow meter performance		
Set process pressure to manufacturer's calibration pressure		
Connect auxiliary test equipment and/or test gases to flow meter		

\*When Using A Packing Gland Assembly For Zero CAL-CHECK™

## EASY ACCURACY REPORTING

Both CAL-V™ and the Zero CAL-CHECK™ Tests can be initiated from the front panel, USB connection, Modbus RTU (RS485) or HART. If initiated by Fox's FT3 View™ software tool, CAL-V™ or Zero CAL-CHECK™ Calibration Validation Certificates can be produced at the conclusion of the tests.

This feature is of particular value in environmental monitoring applications, such as flares and vents, where periodic calibration validation is mandated. These tests help operators comply with environmental mandates and eliminates the cost and inconvenience of annual factory calibration. It can also be used to streamline quality assurance, improve process initiatives, and apply scheduled maintenance procedures.



*Built-in flow conditioning improves measurement accuracy in space-constrained applications.*

## RUGGED, RELIABLE PERFORMANCE

The Fox PowerPro™ sensor operates at a higher power level than competitive thermal flow sensors resulting in improved response time and wider turndown. The PowerPro™ sensor also provides exceptional accuracy at high velocities - up to 60,000 SFPM (280 NMPS).

The Model FT3 features a dual-compartment, explosion-proof electronics enclosure. One compartment houses the instrument electronics and the second compartment is accessible for wiring. A seal between the compartments helps prevent moisture damage and maintain the integrity of the instrument electronics.

An optional on-board 2 line x 16 character backlit display is available to view flow rate, total flow, elapsed time, process gas temperature, and alarms. The display is also used in conjunction with the Configuration Panel for field configuration of flow meter settings such as 4-20mA and pulse output scaling, pipe area, zero flow cutoff, flow filtering or damping,

display configurations, diagnostics, and alarm limits. Optically activated keys provide interface to the flow meter without removing the cover.

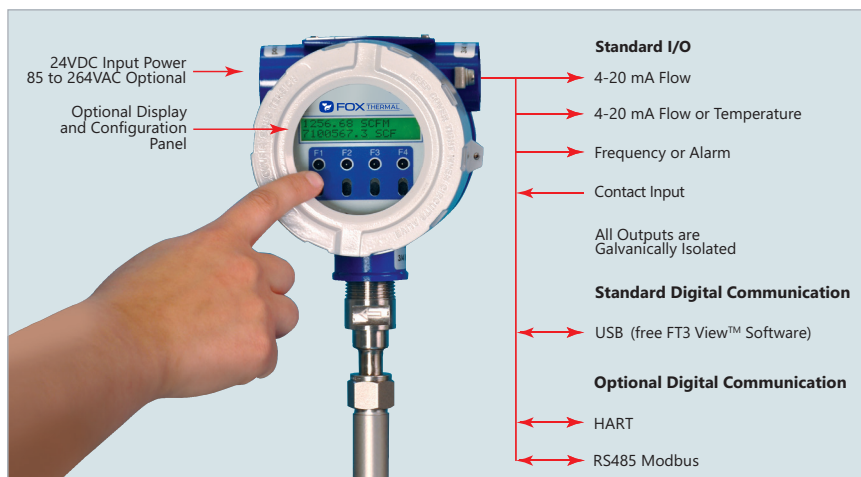
The Model FT3 features galvanically-isolated outputs and enhanced EMI immunity. A variety of meter configurations, materials, process connections, and output options offer improved design flexibility, lower cost-of-ownership, and enhanced control capabilities. The Model FT3 is available in both insertion and inline models. The insertion meter is easily installed with a branch outlet and compression fitting. The inline model is available in 1/4-inch to 6-inch sizes and includes built-in flow conditioners that eliminate the need for long, straight pipe runs.

## COMMUNICATIONS OPTIONS

A USB connection is standard on the Model FT3, and Fox's free FT3 View™ software provides complete configuration and remote process monitoring functions. FT3 View™ lets you adjust meter configuration, evaluate transmitter alarm conditions, collect process data, and view measurements from your PC or control station. HART and Modbus RTU (RS485) are available options. All digital communication is isolated to provide immunity from electrical interference.

## NIST TRACEABLE FACTORY CALIBRATION

Fox calibrations are performed with NIST traceable flow standards. Whether you require a straightforward air calibration or a complex mixed gas calibration, our goal is to achieve the highest accuracy and the fastest turnaround time. The Fox Calibration Lab employs a wide range of gases, gas mixtures, temperatures, pressures and line sizes to simulate actual fluid and process conditions. This real-world approach improves installed accuracy and minimizes measurement uncertainty.



*The Model FT3 is a full-featured thermal mass flow meter with a configuration panel that comes equipped with IR buttons for easy configuration of the meter settings*

## 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 =  $\frac{1}{2}$  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: Approved

EMC Directive; 2014/30/EU  
Electrical Equipment for Measurement, Control and Lab Use:  
EN61326-1:2013  
Low Voltage Directive (LVD): 2014/35/EU  
Product Safety Testing: EN 61010-1: 2010  
Pressure Equipment Directive: 2014/68/EU  
Weld Testing: EN ISO 15614-1 and EN ISO 9606-1,  
ASME B31.3

### FM/FMc: Approved

Class I, Div. 1, Gps B, C, D; Class II, Div. 1, Gps E, F, G; and Class III, Div. 1; T3C, Ta = -40° to 70°C; Class I, Zone 1, AEx/Ex d IIB + H2 (T6, T4 or T1\*); Ta = -20°C to 70°C; Type 4X, IP67.

### ATEX (FM12ATEX0034X): Approved

II 2 G Ex d IIB + H2 (T6, T4 or T1\*); Gb Ta = -20°C to 70°C; IP67  
II 2 D Ex tb IIIC (T85°C, T135°C or T450°C\*) Db Ta = -20°C to 70°C; IP67

### IECEX (IECEX FMG 12.0010X): Approved

Ex d IIB + H2 (T6, T4 or T1\*) Gb Ta = -20°C to 70°C; IP67  
Ex tb IIIC (T85°C, T135°C or T450°C\*) Db Ta = -20°C to 70°C; IP67\*\*

### INLINE STYLES

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

Inline pipe sizes in inches =											
0.50	○		●	●	○	0.75	○		●	●	
1.25	○	●	●	●	○	1.50	○	●	●	●	○
2.50	○	●	●	●	○	3.00	○	●		○	
6.00	○				○						

○ = SS ● = CS ● = NPT Ends ○ = 150lb flanges

**Note:** See [FT3 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:  $\frac{1}{2}$ "

### DRAWINGS

See [FT3 Dimensional Drawings](#) on Fox Thermal website.

### 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

Model Code		Temp. Code (Gas)		Temp. Code (Dust)	
Encl.	Sensor	Mn. Encl.	Remote	Mn. Encl.	Remote
E1	ST	T4	N/A	135°C	N/A
E2	ST	T4	N/A	135°C	N/A
E3	ST	T6	T4	85°C	135°C**
E4	ST	T6	T4	85°C	135°C**

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

\*\* The IECEx dust rating does not apply to the Remote Enclosure.

# SPECIFICATIONS

## PERFORMANCE SPECS

### Flow Accuracy:

- ± 1% of reading ± 0.2% of full scale
- Straight, unobstructed pipe requirement:
  - Inline: 8 diameters upstream; 4 downstream.
  - Insertion: 15 diameters upstream; 10 downstream

### Flow Repeatability: ±0.2% of full scale

### Flow Response Time: 0.9 seconds (one time constant)

### Temperature Accuracy:

- ± 1.8° F (± 1.0° C) -40 to 250° F (-40 to 121° C); ± 3.6° F. (±2.0° C), 2.0° C, 250 to 650° F (121 to 343° C); 60 SFPM minimum.

### Calibration:

Factory Calibration to NIST traceable standards

### CAL-V™ & Zero CAL-CHECK™:

In-situ, user-initiated calibration validation

## OPERATING SPECS

### Units of Measurement (field selectable):

SCFM, SCFH, NMPS, NM3/M, NM3/H, NM3/D, NLPS, NLPM, NLPH, MCFD, MSCFD, SCFD, MMSCFD, MMSCFM, SMPS, SM3/D, SM3/H, SM3/M, LB/S, LB/M, LB/H, LB/D, KG/S, KG/M, KG/H, SLPM, SFPM, MT/H

### Flow Rates for Insertion Flow Meter

15 to 60,000 SFPM (0.07 to 280 NMPS) - Air at 70°F (20°C) & 1 ATM  
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

Flow Ranges - Inline Meters			
Pipe Diameter	SCFM	MSCFD	NM3/Hr
0.5"	0 - 125	0 - 180	0 - 200
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: Standard conditions of air at 70°F and one atmosphere. Consult factory for other gases and for flow ranges above those listed. Inline meters above 5,000 SCFM (7,900 NM3/H) air may require third party Calibration. Contact Fox.

### Gas Pressure (maximum; at 100°F):

Insertion: 500 psig (34.5 barg)  
316 SS inline w/NPT ends: 500 psig (34.5 barg)  
316 SS inline w/150lb flanges: 230 psig (16 barg)  
CS inline w/NPT ends: 500 psig (34.5 barg)  
CS inline w/150lb flanges: 285 psig (19.7 barg)  
Retractor: 125 psig (8.6 barg)

#### Notes:

- Check with factory for higher pressure options.
- With Teflon ferrule option, gas pressure max: 60psig (4.1 barg)
- Pressure ratings stated for temperature of 100°F (38°C).

### Temperature: (see Agency Approvals table)

ST sensor: -40 to 250°F (-40 to 121°C)

Enclosure Ambient Temperature:

Without display or AC power supply: -40 to 158°F (-40 to 70°C)

With display and/or AC power supply: -4 to 158°F, (-20 to 70°C)

Remote sensor junction box: -40 to 212°F (-40 to 100°C)

### Relative Humidity:

90% RH maximum; non-condensing

### Input Power:

24 VDC --- (± 10%), 0.7 Amps (standard DC power)

100 to 240VAC ~ (+10%/-15%), 50-60Hz, 0.2 Amps (with AC power option)

Note: Fluctuations of AC and DC power supply are not to exceed 10% of rating.

Class I Equipment (Electrical Grounding Required for Safety).

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

### Outputs:

Two isolated 4-20mA outputs (output one is for flow rate and output two is programmable for flow rate or temperature); fault indication per NAMUR NE43.

Isolated pulse output 0 to 100Hz, 5 to 24 volts p/p for flow (the pulse output can be used as an isolated solid state output for alarms); 10mA max.

### Serial Communication:

USB communication port is standard. The free PC-based software tool - FT3 View™ - provides complete configuration, remote process monitoring, and data logging functions.

Optional serial communication: HART and Modbus RTU (RS485).

### 4-20mA 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 standard

### Enclosure:

NEMA 4X (IP67), Aluminum, dual conduit entries with ¾" NPT or optional M20 x 1.5mm.

Cabling to remote enclosure: 5-conductor, 18 AWG, twisted, shielded, 100 feet maximum.

### Insertion Flow Meter Installation:

Fox-supplied compression fitting connects to customer-supplied ¾" female coupling welded to pipe.

### Dimensions:

[www.foxthermal.com/literature/](http://www.foxthermal.com/literature/)



# CONFIGURATIONS

Feature 1a: Insertion Sizes	
	Description
06IE	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/125-psi retractor
18R	18" probe w/125-psi retractor
24R	24" probe w/125-psi retractor
30R	30" probe w/125-psi retractor
36R	36" probe w/125-psi retractor

Feature 1b: Inline Sizes	
	Description
05P	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
05F	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

Feature 2: Sensor Material	
	Description
SS	316 SS sensor and probe

Feature 3: Sensor Type	
	Description
ST	Standard temperature

Feature 4: Enclosure Type	
	Description
E1	Local NEMA 4X enclosure, 24VDC powered
E2	Local NEMA 4X enclosure, 85-265VAC powered
E3**	Remote with J-box, 24VDC powered
E4**	Remote with J-box, 85-265VAC powered

Feature 5: Communication Options	
	Description
B0	No communication option
B1	Isolated 24VDC power + terminal block for remote
MB	Modbus RTU (RS485) + B1 code features
BH	HART + B1 code features

Feature 6: Calibration	
	Description
G1	Air, N2: MF <1200 SCFM
G2	Air, N2: MF >1200 SCFM
G3	Ar, CH4, CO2, H2, O2, Natural Gas: MF <1000 SCFM
G4	Ar, CH4, CO2, H2, O2, Natural Gas: MF >1000 SCFM
G5	C3H8, He, NH3: MF <700SCFM
G6	C3H8, He, NH3: MF >700SCFM
G7	Biogas, Digester, Flare, Flash, Vent, & other mixes All other gases

Optional:	
	Description
NRT	Non Resettable Totalizer

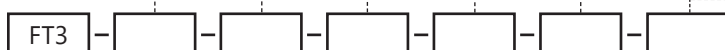
\*For carbon steel (CS) material, add "C" to applicable stainless steel (SS) codes.

Example: 20P = 2" SS; 20PC = 2" CS.

\*\* 100-foot max. cable length, sold separately, P/N 101570

## 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.\*



Example:

FT3 - 06IE - SS - SS - E1 - B0 - G1

# 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 FT3 thermal mass flow

meter equipped with 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 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. 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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