

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; Hastelloy C276 optional
- 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 85 to 264 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



# FOX THERMAL MODEL FT3

## 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 loads. 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

Zero CAL-CHECK® tests are 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:<br>Typical Requirements of Competitive Models | Other Thermal<br>Flow Meters | FT3 with CALV™<br>& Zero CALCHECK |
|---|------------------------------|-----------------------------------|
| Stop the flow*  |                              |                                   |
| 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      |                              |                                   |
|   | Required                     | Not Required                      |

\*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 waterproof 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.

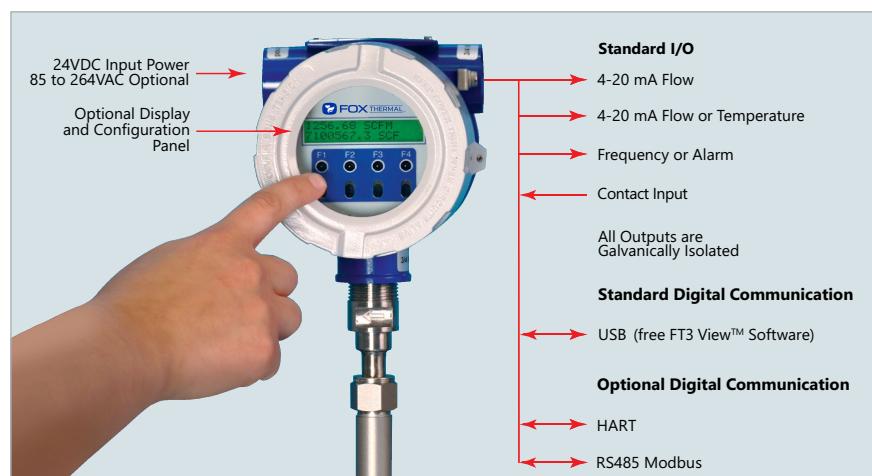
The Model FT3 features galvanically-isolated outputs and enhanced EMI immunity. A variety of meter configurations, materials, process connections, and output options offer improved design flexibility, lower cost-of-ownership, and enhanced control capabilities. The Model FT3 is available in both insertion and inline models. The insertion meter is easily installed with a weld-o-let 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/FM<sub>c</sub>: 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

### INLINE STYLES

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

| Inline pipe sizes in inches = |   |   |   |   |  |      |   |   |   |   |      |   |   |   |   |
|-------------------------------|---|---|---|---|--|------|---|---|---|---|------|---|---|---|---|
| 0.25                          | ○ |   | ○ |   |  | 0.50 | ○ |   | ○ | ○ | 0.75 | ○ |   | ○ | ○ |
| 1.00                          | ○ |   | ○ | ○ |  | 1.25 | ○ | ○ | ○ | ○ | 1.50 | ○ | ○ | ○ | ○ |
| 2.00                          | ○ | ● | ○ | ○ |  | 2.50 | ○ | ○ | ○ | ○ | 3.00 | ○ | ○ | ○ | ○ |
| 4.00                          | ○ | ● | ○ | ○ |  | 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.

### 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\*\*

| 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** |
| E3         | HT     | T6               | T1     | 85°C              | 450°C** |
| E4         | HT     | T6               | T1     | 85°C              | 450°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:

Inline meter:  $\pm 1\%$  of reading  $\pm 0.2\%$  of full scale

Insertion meter:  $\pm 1\%$  of reading  $\pm 0.2\%$  of full scale

Straight, unobstructed pipe requirement:

- Inline: 8 diameters upstream; 4 downstream.
- Insertion: 15 diameters upstream; 10 downstream
- Insertion (1/4" size): 6" (152mm) upstream & downstream

### Flow Repeatability:

$\pm 0.2\%$  of full scale

### Flow Response Time:

0.9 seconds (one time constant)

### Temperature Accuracy:

$\pm 1.8^\circ F$  ( $\pm 1.0^\circ C$ ) -40 to 250° F (-40 to 121° C);  $\pm 3.6^\circ F$ .

( $\pm 2.0^\circ C$ , 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     |
| 0.25"                       | 0 - 7.5    | 0 - 10.8   | 0 - 11.8   |
| 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: 300 psig (34.5 barg)

316 SS inline w/150lb flanges: 230 psig (16 barg)

CS inline w/NPT ends: 300 psig (20.1 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)

HT Sensor: -40 to 650°F (-40 to 343°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 212F (-40 to 100°C)

### Relative Humidity:

90% RH maximum; non-condensing

### Input Power:

24 VDC  $\sim$  (± 10%), 0.7 Amps (standard DC power)

100 to 240VAC  $\sim$  (+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; Hastelloy C276 optional

### Enclosure:

NEMA 4X (IP67), Aluminum, dual conduit entries with 3/4" 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 3/4" female coupling welded to pipe.

### Dimensions:

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



Make downtime a thing of the past.

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