

# BioTrak™ 645i 745i

Thermal Mass Flow Meter for Wastewater Processes

## FEATURES

### DEDICATED ACCURACY

- Bioselect™ menu provides field selectable, air, methane, and digester gas
- Accuracy  $\pm 1\%$  of reading  $\pm 0.2\%$  of full scale (Air)  
Flow accuracy for other gases:  $\pm 1.5\%$  of reading  $\pm 0.5\%$  full scale
- AC or DC power input available
- Optional hot tap packing gland and retractor
- Insertion and inline versions
- Integral and remote electronic configurations available
- DigiSense™ robust sensor design
  - Sensing elements supported at both ends
  - Swivel probe  $\pm 180^\circ$  into four positions
- Gross Heating Value and Density Calculations of Gas Mix
- Measure gas flow rate in SCFM, MCFD, KG/H, and many more units
- Wide measurement range: up to 1000:1 turndown; 100:1 typical
- Negligible pressure drop
- Two 4-20mA outputs for flow rate or temperature
- Choice of HART or Modbus RTU (RS485) communication options
- Welded, 316 SS sensor construction
- Stainless or carbon steel inline flow bodies optional
- Low-end sensitivity for wastewater applications
- FM (U.S.) & FMc (CANADA) approved for Class I, Div 1; ATEX/UKEX/IECEx approved for Zone 1
- NEMA 4X and CE Mark

### FIELD FLEXIBILITY

- Microprocessor based, field programmable electronics
- Standard on-board 2 line x 16 character, backlit display with configuration panel
- Free BioView™ Software available
- USB port to connect to a PC, standard
- BioCal™ calibration validation
- NIST traceable calibration



### Fast and Flexible Flow Measurement

The BioTrak™ thermal mass flow meter is designed to measure gas flows in aeration, digester, and cogeneration processes found in wastewater applications. It offers the flexibility to monitor multiple gas types at the push of a button, rotate the housing as needed for tight installations, and configure meter settings from advanced software. Both AC and DC power inputs are available.

### Available in Inline or Insertion Models

The BioTrak is available in insertion (645i) and inline (745i) models and in a remote version with junction box and cable. A USB port to connect to a computer or laptop is standard for insertion and inline configurations; interface options include HART or Modbus RTU (RS485).

The insertion meter is easily installed with a branch and compression fitting, and requires minimum straight pipe runs of 15D upstream/10D downstream. Hot-tap capability allows for insertion or removal of the sensor under flowing conditions. It has a robust stainless steel probe and is easily installed by drilling a hole in the pipe and welding on a NPT coupling. A compression fitting secures the probe in place. It is supplied with 316 stainless steel wetted materials standard.

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. The inline style flow meters are available in both stainless steel and carbon steel with NPT and 150lb flange options.

### Thermal Mass Flow Meters You Can Trust

The BioTrak measures gas flow rate in standard units without the need for temperature or pressure compensation. It provides two galvanically isolated 4-20mA analog outputs, HART communication (optional), a pulse output, switch input, and Modbus RTU (RS485) (optional).

Sierra's BioTrak flow meters use a constant temperature differential (constant  $\Delta T$ ) technology to measure the mass flow rate of gases. The thermal mass flow sensor consists of two Resistance Temperature Detectors (RTD's). The Reference RTD measures the gas temperature. Meanwhile, 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 mass flow rate of the gas.

### BioCal Calibration Validation

For operators needing a quick and easy way to verify the meter's calibration in the field, BioTrak offers BioCal™. Initiate this feature through the meter's optional display configuration panel, Modbus, or the BioView software. The test takes less than five minutes to run and produces a pass/fail result afterwards. A fail result may indicate either a dirty sensor or the need to recalibrate.

Using the BioCal test with BioView software, you can produce a Calibration Validation Certificate upon conclusion. The certificate will show the date and time of the test along with meter data such as firmware version and meter serial number. This in-situ calibration validation helps operators comply with environmental mandates and eliminates the cost and inconvenience of annual factory calibration.



**PERFORMANCE SPECIFICATIONS**

**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 25,000 SFPM (0.07 to 120 NMPS)  
 Minimum range: 15 to 500 SFPM (0.07 to 2.4 NMPS)

**Straight, unobstructed pipe requirement**

- 645i Insertion: 15 diameters upstream 10 downstream
- 745i Inline: 8 diameters upstream, 4 downstream

**Gross Heating Value Uncertainty**

±0.01% on mass basis; ±0.01% 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

**BioCal™**

In-situ, operator-initiated calibration validation

**OPERATING SPECIFICATIONS**

**BioSelect™ Gas Selections**

Pure gas menu or digester gas mix to suit wastewater applications.

Gases: Air, Methane, and Digester Gas

**Gas Pressure**

Maximum gas pressure at 100°F

Insertion: 740 psig (51 barg)

316 SS inline w/NPT ends: 500 psig (34 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 barg)

CS inline w/150lb flanges: 285 psig (20 barg)

CS inline w/300lb flanges: 740 psig (51 barg)

Retractor: 150 psig (10 barg) max

Notes: Check with factory for higher pressure options.

With Teflon Ferrule option, maximum gas pressure is 60 psig (4.1 barg) maximum.

Pressure ratings stated for temperature of 100°F (38°C).

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.

**Temperature**

DigiSense™ Sensor . . . . -40°C to 250°F (-40°C to 121°C)

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

Remote Sensor Enclosure: -40°F to 158°F (-40°C to 70°C)

\*NOTE: Display dims below -4°F (-20°C); function returns once temperature rises again.

**Flow Velocity Range**

15 to 25,000 SFPM at 70°F (0.07 to 120 NMPS)

Turndown: up to 1000:1; 100:1 typical

Flow Ranges - 645i Insertion Meters			
Pipe Diameter	SCFM	MSCFD	NM3/Hr
1.5" (40mm)	0 - 354	0 - 510	0 - 558
2" (50mm)	0 - 583	0 - 840	0 - 920
2.5" (63mm)	0 - 830	0 - 1,310	0 - 1,200
3" (80mm)	0 - 1,280	0 - 1,840	0 - 2,020
4" (100mm)	0 - 2,210	0 - 3,180	0 - 3,480
6" (150mm)	0 - 5,010	0 - 7,210	0 - 7,910
8" (200mm)	0 - 8,680	0 - 12,500	0 - 13,700
10" (250mm)	0 - 13,600	0 - 19,600	0 - 21,450
12" (300mm)	0 - 19,400	0 - 27,900	0 - 30,600

NOTE: To determine if the 645i/745i 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.

**OPERATING SPECIFICATIONS continued**

Flow Ranges - 745i Inline Meters			
Pipe Diameter	SCFM	MSCFD	NM3/Hr
0.75"	0 - 93	0 - 134	0 - 146
1"	0 - 150	0 - 216	0 - 237
1.25"	0 - 260	0 - 374	0 - 410
1.5"	0 - 354	0 - 510	0 - 558
2"	0 - 583	0 - 840	0 - 920
2.5"	0 - 830	0 - 1,310	0 - 1,200
3"	0 - 1,280	0 - 1,840	0 - 2,020
4"	0 - 2,210	0 - 3,180	0 - 3,480
6"	0 - 2,500	0 - 3,600	0 - 3,950

NOTE: Consult factory for flow ranges above those listed. Inline meters above 2,500 SCFM (3,940 NM3/H) may require third party calibration. Contact Sierra Instruments.

**Relative Humidity**

90% RH maximum; non-condensing

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

**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

**Input Power**

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

Full input power range: 10 to 30 VDC.

20 Watt or greater power supply is recommended.

100 to 240 VAC  $\sim$ , 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 NEMUR NE43. HART communication option.

The 4-20mA Load resistance must be 125 ohms or less on 24 volt power.

**4-20mA Channel 2:**

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

**Pulse/Alarms**

Isolated open collector output rated for 5 to 24 VDC.

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.

CalView™: 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 SPECIFICATIONS**

**Sensor Material**

316 stainless steel

**Enclosure**

NEMA 4X (IP67), aluminum, 3/4-inch FNPT conduit entries

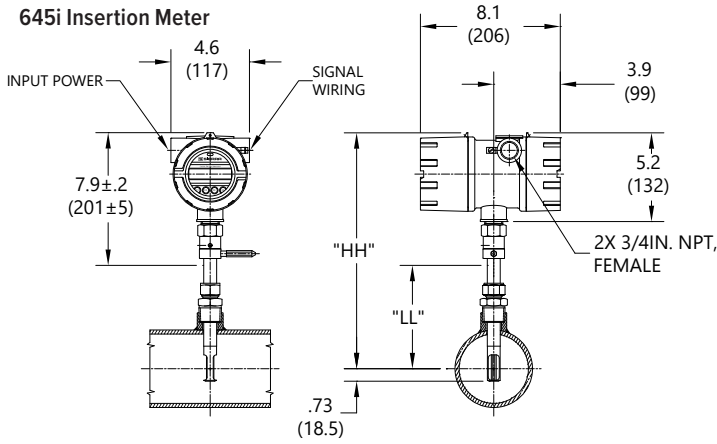
**Cabling to remote enclosure**

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

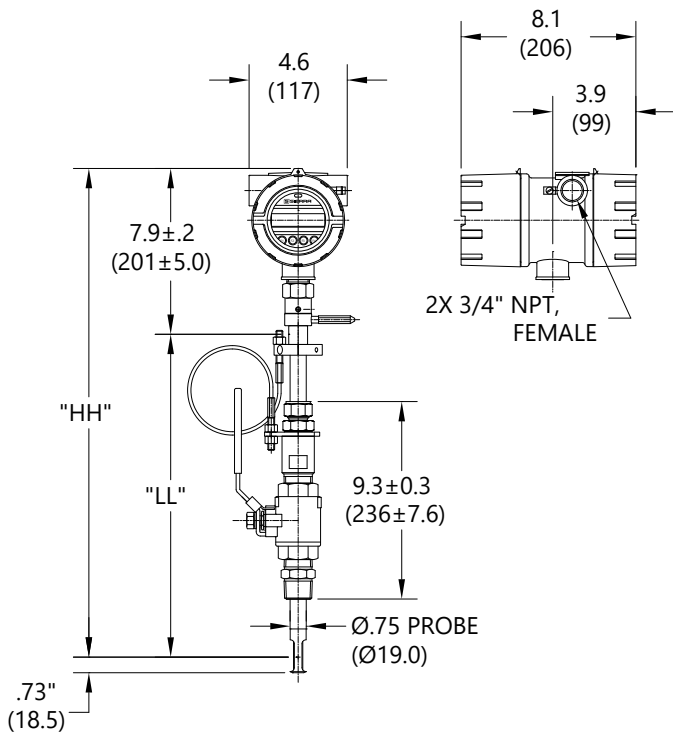
**Insertion flow meter installation**

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

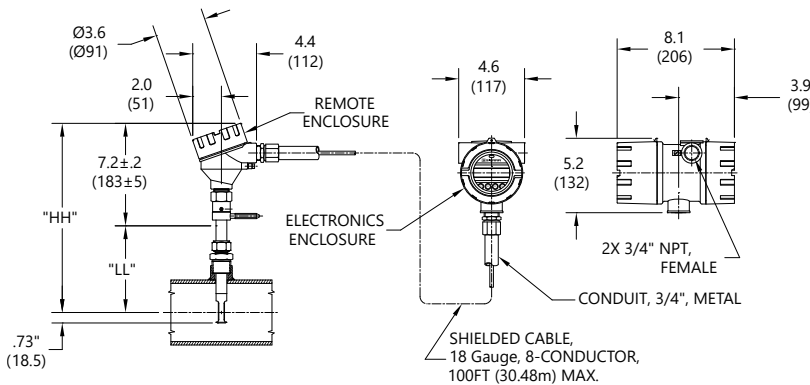
645i Insertion Meter



645i Insertion Meter with Retractor



645i Insertion Remote Meter



645I INSERTION STYLES

Standard Probe Lengths in Inches (cm) =	
6.0 (15.2)	15.0 (38.1)
9.0 (22.9)	24.0 (61.0)
12.0 (30.5)	30.0 (76.2)
18.0 (45.7)	36.0 (91.4)

Assuming there is no insulation or retractor, Sierra 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

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 Sierra for longer probes.

745I INLINE STYLES

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

Note: 745i inline flow bodies include built-in flow conditioners. FlowTrak Flow Conditioners are available as an option for 645i insertion flow meters.

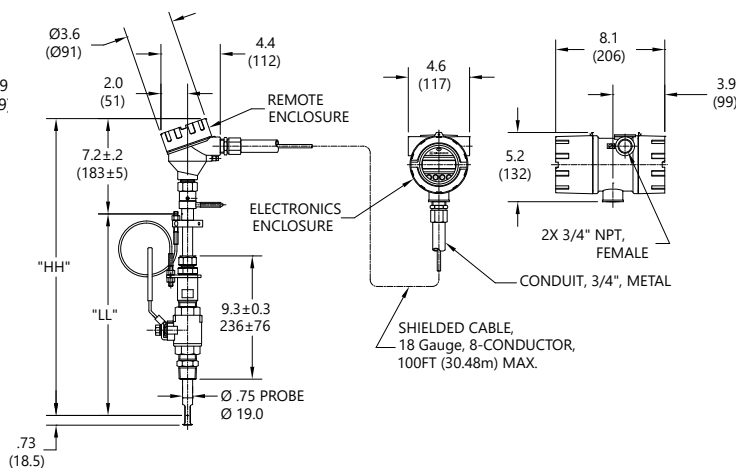
Inline pipe sizes in Inches =											
0.75	○	◐	◑	1.50	○	◐	◑	3.00	○	◐	◑
1.00	○	◐	◑	2.00	○	◐	◑	4.00	○	◐	◑
1.25	○	◐	◑	2.50	○	◐	◑	6.00	○	◐	◑

○= SS   ●= CS   ◐= NPT Ends   ◑= 150lb flanges   ◒= 300lb flanges

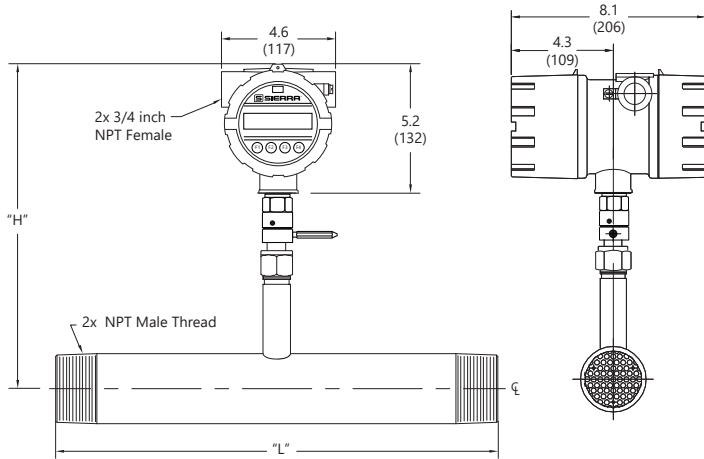
Probe Diameter

Probe diameter 3/4-inch for insertion and inline flow meters.

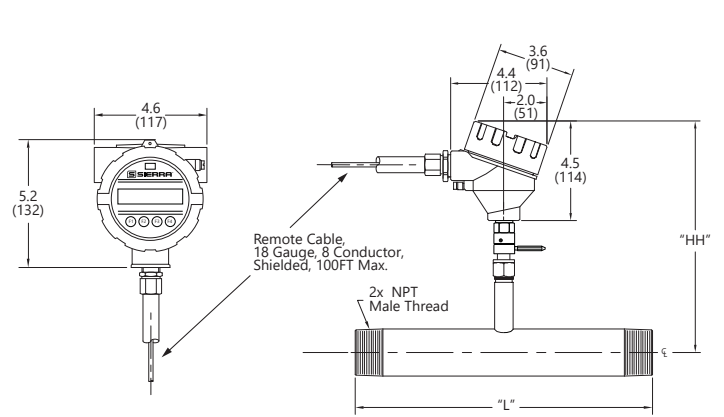
645i Insertion Remote Meter with Retractor



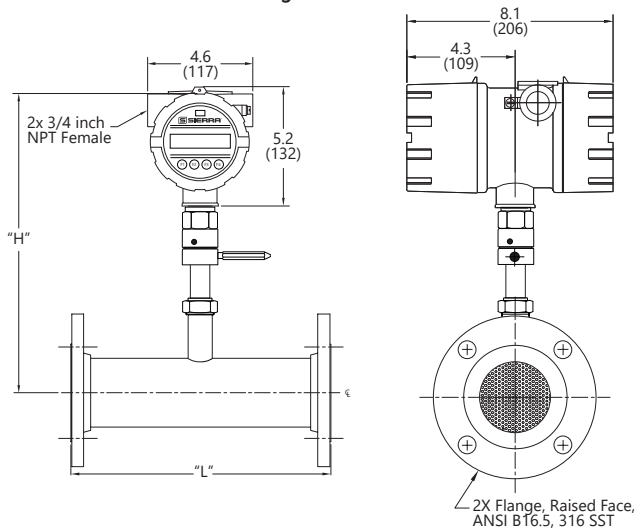
745i Inline Meter - NPT



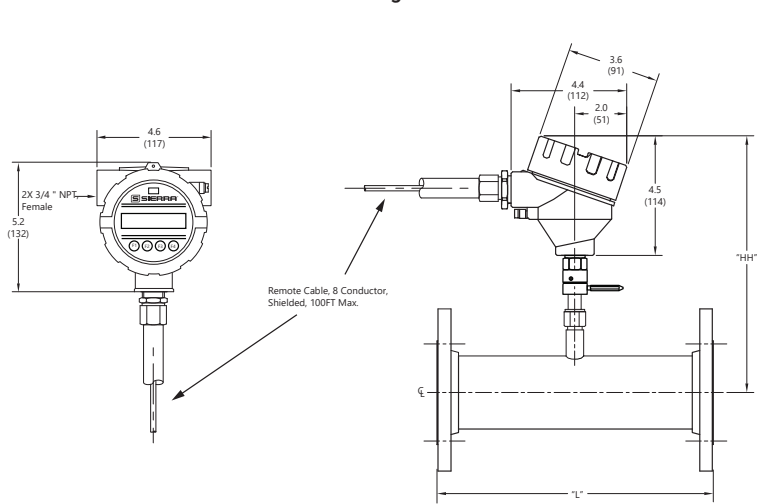
745i Inline Remote Meter - NPT



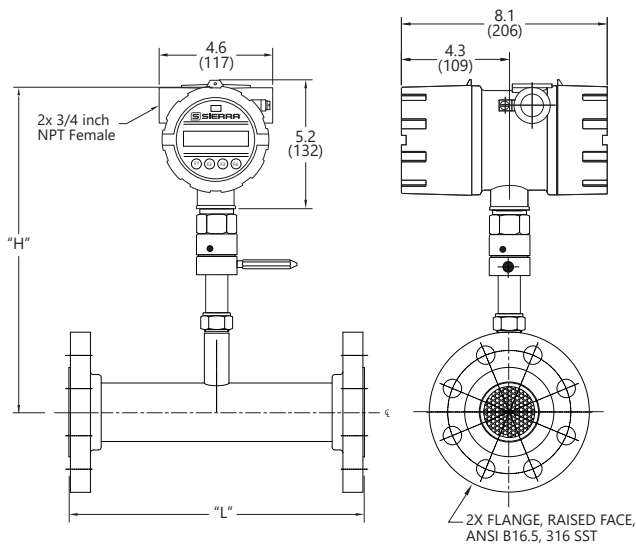
745i Inline Meter - 150 lb Flange



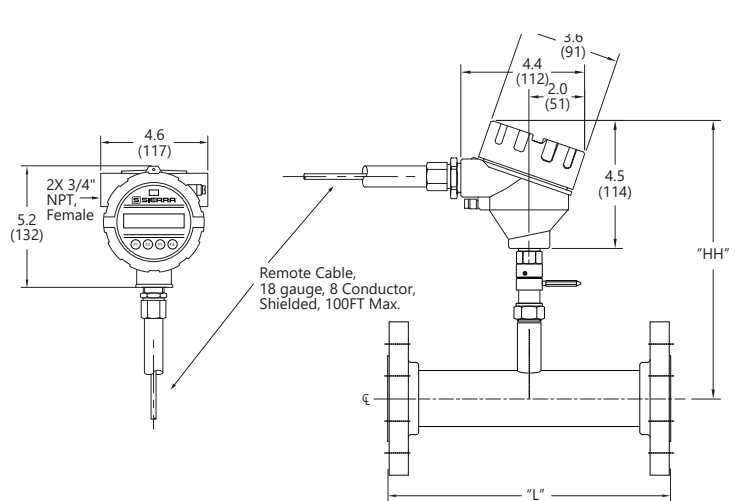
745i Inline Remote Meter - 150 lb Flange



745i Inline Meter - 300 lb Flange



745i Inline Remote Meter - 300 lb Flange



**CE Mark**

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 Article 13  
 Weld Testing: EN ISO 15614-1 and EN ISO 9606-1, ASME B31.3

**FM (FM21US0124X) and FMc (FM21CA0090X)**

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°C to +70°C;  
 Class I, Zone 1, AEx/Ex db IIB + H2 T6 or T4; Gb Ta = -20°C to 70°C; Type 4X, IP67

**ATEX (FM17ATEX0015X)**

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)**

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)**

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**

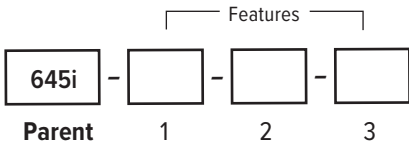
EN IEC 60079-0	EN 60079-31	IEC 60079-0	IEC 60079-31
EN 60079-1	EN 60529 +A1 +A2	IEC 60079-1	IEC 60529

**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 flame-proof 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.

Enclosure Model Code	Temperature Code Marking - Division (All)		Temperature Code Marking - Zones (Gas)		Temperature Code Marking - Zones (Dust)	
	Main Enclosure	Remote Enclosure	Main Enclosure	Remote Enclosure	Main Enclosure	Remote Enclosure
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.



Instructions: To order a 645i, please fill in each feature number block by selecting the codes from the corresponding features below.

Notes: The Parent Model Number and one of each Feature must be specified. Example: 645i-09I-E1-RS

Parent Number	
645i	Insertion Mass Flow Meter; includes two 4-20mA outputs, pulse output, contact input, display & configuration panel, USB connection, BioSelect™

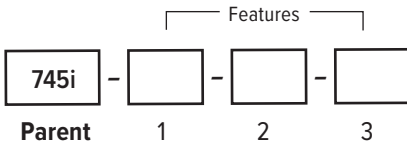
Feature 1: Probe	
06I	Insertion meter with 6-inch probe
09I	Insertion meter with 9-inch probe
12I	Insertion meter with 12-inch probe
15I	Insertion meter with 15-inch probe
18I	Insertion meter with 18-inch probe
24I	Insertion meter with 24-inch probe
30I	Insertion meter with 30-inch probe
36I	Insertion meter with 36-inch probe
15R	15" probe w/ 150-psi retractor & full port valve, 1" male NPT, 316 SS wetted parts
18R	18" probe w/ 150-psi retractor & full port valve, 1" male NPT, 316 SS wetted parts
24R	24" probe w/ 150-psi retractor & full port valve, 1" male NPT, 316 SS wetted parts
30R	30" probe w/ 150-psi retractor & full port valve, 1" male NPT, 316 SS wetted parts
36R	36" probe w/ 150-psi retractor & full port valve, 1" male NPT, 316 SS wetted parts

Notes: See model code document for full list of codes.

Feature 2: Enclosure Type	
E1	Local NEMA 4X enclosure, 12-24VDC powered
E2	Local NEMA 4X enclosure, 100-240VAC powered
E3	Remote explosion-proof J-box, 12-24VDC powered, includes remote mounting kit, cable sold separately
E4	Remote explosion-proof J-box, 100-240VAC powered, includes remote mounting kit, cable sold separately

Feature 3: Communication Options	
BO	No communication option
RS	RS485 Modbus RTU
BH	HART enabled on primary 4-20mA output

Notes: See separate model code document for FlowTrak Flow Conditioners for use with insertion style flow meters.



Instructions: To order a 745i, please fill in each feature number block by selecting the codes from the corresponding features below.  
 Notes: The Parent Model Number and one of each Feature must be specified. Example: 745i-075P-E1-P1

Parent Number*	
745i	Inline Mass Flow Meter; includes two 4-20mA outputs, pulse output, contact input, display & configuration panel, USB connection, BioSelect™

Feature 1: 316 Stainless Steel Flow Body*	
075P	3/4 inch flow body (schedule 40), male NPT ends, 12" face-to-face length
10P	1 inch flow body (schedule 40), male NPT ends, 12" face-to-face length
125P	1-1/4 inch flow body (schedule 40), male NPT ends, 12" face-to-face length
15P	1-1/2 inch flow body (schedule 40), male NPT ends, 12" face-to-face length
20P	2 inch flow body (schedule 40), male NPT ends, 12" face-to-face length
25P	2-1/2 inch flow body (schedule 40), male NPT ends, 18" face-to-face length
30P	3 inch flow body (schedule 40), male NPT ends, 18" face-to-face length
075F	3/4 inch flow body (schedule 40), 150# RF flange ends, 12" face-to-face length
10F	1 inch flow body (schedule 40), 150# RF flange ends, 12" face-to-face length
125F	1-1/4 inch flow body (schedule 40), 150# RF flange ends, 12" face-to-face length
15F	1-1/2 inch flow body (schedule 40), 150# RF flange ends, 12" face-to-face length
20F	2 inch flow body (schedule 40), 150# RF flange ends, 12" face-to-face length
25F	2-1/2 inch flow body (schedule 40), 150# RF flange ends, 18" face-to-face length
30F	3 inch flow body (schedule 40), 150# RF flange ends, 18" face-to-face length
40F	4 inch flow body (schedule 40), 150# RF flange ends, 18" face-to-face length**
60F	6 inch flow body (schedule 40), 150# RF flange ends, 24" face-to-face length**
15G	1-1/2 inch flow body (schedule 40), 300# RF flange ends, 12" face-to-face length
20G	2 inch flow body (schedule 40), 300# RF flange ends, 12" face-to-face length
25G	2-1/2 inch flow body (schedule 40), 300# RF flange ends, 18" face-to-face length
30G	3 inch flow body (schedule 40), 300# RF flange ends, 18" face-to-face length
40G	4 inch flow body (schedule 40), 300# RF flange ends, 18" face-to-face length**
60G	6 inch flow body (schedule 40), 300# RF flange ends, 24" face-to-face length**

Feature 1: A106 Grade B Carbon Steel Flow Body (w/ A105 flanges if ordered)	
20PC	2 inch flow body (schedule 40), male NPT ends, 12" face-to-face length
25PC	2-1/2 inch flow body (schedule 40), male NPT ends, 18" face-to-face length
30PC	3 inch flow body (schedule 40), male NPT ends, 18" face-to-face length
20FC	2 inch flow body (schedule 40), 150# RF flange ends, 12" face-to-face length
25FC	2-1/2 inch flow body (schedule 40), 150# RF flange ends, 18" face-to-face length
30FC	3 inch flow body (schedule 40), 150# RF flange ends, 18" face-to-face length
40FC	4 inch flow body (schedule 40), 150# RF flange ends, 18" face-to-face length**
60FC	6 inch flow body (schedule 40), 150# RF flange ends, 24" face-to-face length**
20GC	2 inch flow body (schedule 40), 300# RF flange ends, 12" face-to-face length
25GC	2-1/2 inch flow body (schedule 40), 300# RF flange ends, 18" face-to-face length
30GC	3 inch flow body (schedule 40), 300# RF flange ends, 18" face-to-face length
40GC	4 inch flow body (schedule 40), 300# RF flange ends, 18" face-to-face length**
60GC	6 inch flow body (schedule 40), 300# RF flange ends, 24" face-to-face length**

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.\*\*

Feature 2: Enclosure Type*	
E1	Local explosion-proof enclosure, 24VDC powered
E2	Local explosion-proof enclosure, 85-264VAC powered
E3	Remote explosion-proof J-box, 24VDC powered, includes remote mounting kit, cable sold separately***
E4	Remote explosion-proof J-box, 85-264VAC powered, includes remote mounting kit, cable sold separately***

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

Note: For carbon steel (CS) material, add "C" to applicable codes. Example: 20P = 2" Stainless Steel; 20PC = 2" Carbon Steel.  
 \*\*\*100' max, cable optional

Note:\* The Parent Model Number and one of each Feature must be specified.  
 Note: See separate model code document for FlowTrak Flow Conditioners for use with insertion style flow meters.