

## SMARTLINK® METER specifications and instructions

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## Specifications

### Product description

SMARTLINK® METER is a highly accurate and repeatable mass flow measurement device for industrial process applications. The design is based on a well established thermal mass flow sensing principle and an innovative redundant architecture that provides continuous and user-commanded diagnostic functions to ensure measurement integrity for combustion system performance and safety. This advancement in technology eliminates difficult field validation techniques and extends accuracy over wider ranges of fluid temperature.

The meter uses a constant temperature differential ( $\Delta T$ ) technique with two reference-grade, platinum RTD (Resistive Temperature Device) elements welded in a rugged stainless probe assembly. One RTD measures fluid temperature and an "intelligent" bridge circuit heats the second RTD element, maintaining a constant temperature differential above the temperature of the process fluid. Based on the amount of power delivered to the heated element, the mass flow rate is calculated by the on-board microprocessor. The highly integrated sensor probe and electronic design permits fully automated factory calibration, providing every manufactured unit with out-of-the-box, measurement accuracy.

SMARTLINK® METER incorporates an input/output (I/O) module with analog 4-20mA current loops for monitoring flow and air/fuel ratio or fluid temperature. System redundancy is employed for "on-line" flow meter test functions and fail-safe alarm, limit, and test status indication. A 4x20 character liquid crystal display (LCD) and a membrane switch permit simple meter configuration and local viewing of meter status without opening the NEMA 4X (IP66) rated enclosure. Each unit is calibrated for air or natural gas and includes an "in-line" flow body that conditions the fluid velocity profile and sets the depth of the probe assembly for proper measurement in the flow stream.

SMARTLINK® METER provides a turnkey, reliable flow measurement solution with advanced diagnostics tailored for combustion systems. The product offering is simple to select, order, and commission. The subsequent application guidelines, model information, and specification sections will help ensure proper meter selection.



## Application guidelines

SMARTLINK® METER has been specifically designed to meet the demanding requirements of flow measurement for industrial combustion systems. The following list of application questions should be carefully reviewed as a first step in the product selection process. Prior to configuring a model number, a thorough review of the product specifications should also be performed to ensure all flow measurement requirements can be satisfied.

### Flow measurement application questions

---

#### 1. Can the cost of flow metering be justified by one or more of the following application benefits?

- Monitoring natural gas usage for allocation and tracking of fuel operating costs
- Monitoring air/fuel ratio for periodic burner tuning to optimize fuel efficiency and/or maintain low emission performance
- Monitoring air/fuel ratio to ensure safe combustion system commissioning and operation
- Fully-metered air/fuel ratio control for repeatable, optimized burner performance to reduce fuel consumption and maintain consistent product quality

#### 2. Is the combustion system fired on natural gas and air?

SMARTLINK® METERS are accurately calibrated for measurement of natural gas and air. Measuring flow for other gas hydrocarbons and oxygen is not yet supported.

#### 3. Is the combustion fuel and air flow range addressed by the product's offerings?

Fuel and air flow monitoring for burner capacities ranging from 4-75 MBtu/h can be supported.

#### 4. Does the natural gas supply have a heating value /chemical constituency that does not significantly vary over time and is the supply free of condensing moisture?

Thermal mass flow meters are calibrated for a specific gas type and chemical mixture. Gas sources with widely varying heating values (as found in oil field gas supplies or local gas distribution with inert gas additives during peak periods of gas usage) should be avoided. In addition, condensing moisture on the meter's probe causes momentary spikes in the output flow reading and water droplets must be eliminated for proper use, particularly in flow control applications.

#### 5. If air flow measurement is required, is the combustion air non-preheated?

SMARTLINK® METERS do not currently support pre-heated combustion air. The maximum fluid temperature specification is 212°F which is intended to address fan heat-of-compression in hot ambient process environments.

#### 6. Is there adequate room for the up and downstream flow meter piping requirements?

Depending on the piping configuration, 3 to 5 undisturbed upstream and 1 to 3 downstream diameters are required for accurate and repeatable flow measurement. (Refer to piping requirements section for detailed configuration drawings and special cases.)

#### 7. If the application is combustion air/fuel ratio control, is the sensor response time adequate for the speed required to change burner firing rate (or process temperature)?

For a step change in flow rate, SMARTLINK® METER achieves 63% of the final value in 1 to 2 seconds and 95% of its final value in 5 to 10 seconds.

#### 8. For air flow measurement, can the combustion blower provide the additional pressure drop across the flow meter's integrated flow conditioning screens?

The pressure drop across the air meter flow body at its maximum calibrated flow is approximately 12" wc at Standard Temperature and Pressure (STP = 60°F and 14.73 psia). Therefore, the maximum flow body pressure for the application is calculated as follows:

$$DP (\text{max @STP}) = \left( \frac{\text{Application max flow}}{\text{Calibrated max flow}} \right)^2 \times 12" \text{ wc.}$$

## Flow specifications

In-line natural gas meters				
Model number	Nominal flow body size (in)	Minimum flow (scfh)	Maximum Flow (scfh)	Max DP @ STP [1] [2] (" wc)
0200 SLM	2	160	8,000	10.0
0300 SLM	3	360	18,000	10.0
0400 SLM	4	640	32,000	11.4
0600 SLM	6	1500	75,000	10.9

- [1] STP (Standard Temperature and Pressure) conditions for scfh (Standard Cubic Feet per Hour) are 60°F and 14.73 psia as per ANSI/API MPMS (Manual of Petroleum Measurement Standards), 14.3.1
- [2] Stated differential pressures (DP) assume STP conditions and the maximum rated in-line meter flow rate with a natural gas density of 0.0425 lb/ft<sup>3</sup>

In-line air meters				
Model number	Nominal flow body size (in)	Minimum flow (scfh)	Maximum flow (scfh)	Max DP @ STP [1] [2] (" wc)
0800 SLM	8	2800	140,000	12.1
1200 SLM	12	6200	310,000	12.0
1600 SLM	16	9700	485,000	11.8
2000 SLM	20	15,000	750,000	11.0
2400 SLM	24	22,000	1,100,000	11.7
2800 SLM	28	30,000	1,500,000	11.7

- [1] STP (Standard Temperature and Pressure) conditions for scfh (Standard Cubic Feet per Hour) are 60°F and 14.73 psia as per ANSI/API MPMS (Manual of Petroleum Measurement Standards), 14.3.1
- [2] Stated differential pressures (DP) assume STP conditions and the maximum in-line meter flow rate with an air density of 0.076 lb/ft<sup>3</sup> and 25% RH (relative humidity)

## Product specifications

Performance specifications	
Flow accuracy [1]	± 2% of reading over 5%-100% (20:1 turndown) of flow range in calibration flow stand
Flow turndown	50:1
Flow response time	1-2 seconds to 63% of final value
Temperature accuracy	+/- 1°F

[1] Less than ± 2% additional "installed" error due to fluid temperature variation, gas constituency, upstream piping, and flow body differences.

Operating specifications			
Process fluids	Natural gas, air		
Units of measure  Note 1: Selectable from user display	Abbreviation	Definition	User display abbreviation
	scfh	Standard Cubic Feet per Hour	SCFH
	scfm	Standard Cubic Feet per Minute	SCFM
	sfp/h	Standard Feet per Minute	SFPM
	sfp/s	Standard Feet per Second	SFPS
	lb/h	Pounds per Hour	LB/H
	lb/m	Pounds per Minute	LB/M
	lb/s	Pounds per Second	LB/S
	m <sup>3</sup> <sub>(n)</sub> /h	Normal Cubic Meters per Hour	NM3H
	m <sup>3</sup> <sub>(n)</sub> /m	Normal Cubic Meters per Minute	NM3M
	m <sub>(n)</sub> /h	Normal Meters per Minute	NMPM
	m <sub>(n)</sub> /s	Normal Meters per Second	NMPS
	l <sub>(n)</sub> /h	Normal Liters per Hour	NLPH
	l <sub>(n)</sub> /m	Normal Liters per Minute	NLPM
	kg/h	Kilograms per Hour	KG/H
	kg/m	Kilograms per Minute	KG/M
	kg/s	Kilograms per Second	KG/S
m <sub>(st)</sub> /m	Standard Meters per Minute	SMPM	
m <sub>(st)</sub> /s	Standard Meters per Second	SMPS	
Reference conditions (for volumetric / velocity readings)	<p>Temperature and pressure conditions for flows displayed in "Standard" volumetric, "Standard" velocity, and all mass flow rate units: 60°F and 14.73 psia per ANSI/API MPMS (Manual of Petroleum Measurement Standards), 14.3.1</p> <p>Temperature and pressure conditions for flows displayed in "Normal" volumetric and "Normal" velocity flow units: 32°F and 14.696 psia</p>		
Reference densities (for mass rate readings)	<p>Air models: 0.076 lbs/ft<sup>3</sup> Natural gas models: 0.042 lbs/ft<sup>3</sup></p>		
Maximum flow body pressure Drop (at reference conditions)	<p>11.4" wc (Gas models at max flow rate) 12.1" wc (Air models at max flow rate)</p>		
Maximum fluid pressure (flow body limit)	<p>100 psi (Gas models) 5 psi (Air models)</p>		
Process fluid temperature range	-40°F to +212°F		
Electronics ambient temperature range	-40°F to +158°F (for measurement only; see User Display temperature range for viewing LCD)		

Operating specifications (continued)	
User display	<p>4 line x 20 character Liquid Crystal Display (LCD) -4°F to 122°F- temperature range for viewing only; meter measures and outputs flow rate over wider electronics ambient temperature stated above</p> <p><b>Meter status information:</b> Mode of Operation, Flow Rate, Alarm Status, Process Fluid, Totalized Flow and Time, Fluid &amp; Electronic Housing Temperature, Ratio Status, 4-20mA Output A &amp; B Status, 4-20mA Input A Status, Relay Drive Output Status, Event Log Display, Passcode Entry, Manufacturing Data, and Calibration Data</p> <p><b>User commands:</b> Totalizer Reset, Meter/Flow Test, Outputs ON Test, Outputs OFF Test, Set-up Reset (to factory defaults), Event Log Reset, All Tests OFF</p> <p><b>Meter configuration settings:</b> Flow Units, Temperature Units, Analog Output-B Setup, Flow Input Multiplier (X-Factor), 20mA Ratio Setup, AC Filter (50/60Hz), 21.5mA Alarm Enable, Flow Filter, Flow Bias, Flow Cutoff, Low &amp; High Limit Flow Output A, Low &amp; High Limit Output B, 20mA Output A (Flow) and B Full Scale %, and Change Passcode</p>
Keypad	5-Key Membrane Switch Assembly for display navigation
Flow totalizer	9-digit total displayed in user-selectable flow rate engineering units



Electrical specifications	
Power Input	Standard DC Model: 24VDC, 0.2A Optional AC Model: 115/230VAC (50/60Hz), 0.04/0.02A
Analog outputs	<p>Two linearized 4-20mA outputs; External 24VDC (maximum) loop power is required for factory default setting; Internal (meter) 24VDC loop power is user switch selectable for local diagnostic purposes only; 750 ohm maximum loop resistance for 24VDC loop power supply; User selectable NAMUR-43 compatible alarm output state -- 21.5mA is output to indicate any meter alarm condition</p> <p><b>Analog Output A:</b> Flow rate 4mA = 0 flow; 20mA = 100% full scale flow (factory default setting); 20mA % full scale definition is user adjustable</p> <p><b>Analog Output B:</b> User configurable for 1 of the 3 following settings</p> <p>1. Ratio AI/AO = <math>\left[ \frac{\text{Flow rate input (analog in)}}{\text{Flow rate output (analog out)}} \right]</math></p> <p>Factory default setting; 4mA = 0, 20mA = 20; 20mA ratio max is user adjustable</p> <p>2. Ratio AO/AI = <math>\left[ \frac{\text{Flow rate output (analog out)}}{\text{Flow rate input (analog in)}} \right]</math></p> <p>Factory default setting; 4mA = 0, 20mA = 20; 20mA ratio max is user adjustable</p> <p>3. Fluid Temperature; 4mA = -50C, 20mA = 110C; 20mA % full scale is user adjustable</p>
Analog input	One linearized 4-20mA flow rate Input (from an external meter) used for ratio calculation
Solid-state outputs	<p>Three, fail-safe open collector relay drive outputs: Relay Drive Output A: Meter/Flow Test Active (OFF state) Relay Drive Output B: Meter Alarm (OFF state) Relay Drive Output C: Limit Indication (OFF state)</p> <p>30VDC and 100mA (open collector maximum ratings) Current through each output is returned to Relay (Drive) Return, Terminal #1, of the 12-position, low voltage wiring block. All outputs are de-energized if microprocessor or firmware execution halts</p>
Solid-state input	5-24VDC @ 10mA (max) Input A: Start Meter/Flow Test; Momentary ½ second ON state required; Test lasts 0.5 to 3 minutes depending on flow rate



Physical specifications	
Electronics enclosure	IP66, NEMA 4X, 12, and 13
Electrical conduit connection	¾" watertight conduit hub (provided with meter)
Piping requirements [1] [2]	<p>Gas meter installations should include an upstream drip leg, Y-strainer (with 100 mesh stainless steel screen), and a high-turndown regulator (such as a Sensus 243-RPC, 441-57S with "V-wing" option). The Y-strainer prevents debris from clogging the regulator as well as the meter's flow conditioning screens and moisture reaching the sensor element. Proper sizing of the regulator, using upstream/downstream pressures and min/max flows required, is essential for preventing low flow regulator "chatter" which affects meter performance. Follow all regulator installation requirements for location of the downstream sense line.</p> <p>Air meter installations with a process or combustion fan should include an inlet filter to minimize the collection of debris on the removable flow conditioning screens. If air flow control is performed using a valve, a surge-less fan should be specified to ensure flow pulsations do not affect meter performance. (See detailed drawings for customer installation of NPT fitting to pressure check for air flow body screen blockage.)</p> <p>The symbol "Ø" represents the internal pipe diameter of the meter flow body. The following up and downstream piping lengths are specified as <u>minimum</u>. Straight lengths <u>greater</u> than those specified are recommended to minimize installation-related flow measurement error.</p> <p>Minimum undisturbed <u>upstream</u> straight length - diameters (Ø) for the following configurations upstream of the meter:</p> <p>One 90° elbow: 3Ø or 12 inches, whichever is greater</p> <p>Two 90° elbow (same plane): 3Ø or 12 inches, whichever is greater Reduction: 3Ø or 12 inches, whichever is greater Expansion: 5Ø or 12 inches, whichever is greater Control valve: 5Ø (only recommended for air installations when valve must be installed close to fan outlet to prevent surge/pulsations) Two 90° elbow (in different planes): 5Ø or 12 inches, whichever is greater Combustion blower outlet: 5Ø</p> <p>Minimum undisturbed <u>downstream</u> straight length diameters (Ø): 2Ø or 6 inches, whichever is greater, for all downstream configurations except the following: Control valve: 3Ø or 12 inches, whichever is greater Combustion blower inlet: Not recommended</p>
Process fluid connections	<p>Natural Gas models: ANSI 150# Flanges Air models: ½" thick flanges with ANSI bolt patterns Meter-to-Flow Body: Swagelok Compression Fitting (provided with meter)</p>
Wetted materials	<p>Probe Assembly: 316 Stainless Steel (1.4401); hydrostatic tested to 500 psi Flow Body: Carbon Steel (1.0037) Flow Conditioning Screens: 316 Stainless Steel (1.4401)</p>
Vibration	3G peak, 10-500Hz, 3 axes per EN60068-2-6:1998

[1] Refer to piping drawings within installation section for more detail

[2] The symbol "Ø" represents the internal pipe diameter of the flow body

**Physical specifications (continued)**

Electromagnetic compatibility (EMC)	<p>Immunity:  EN61000-4-2, Electostatic Discharge  EN61000-4-3, Radiated Electromagnetic Fields  EN61000-4-4, Electrical Fast Transient/Burst  EN61000-4-5, Surge Immunity  EN61000-4-6, Conducted Immunity  EN61000-4-11, Voltage Dips &amp; Interruptions  Frequency Variations, <math>\pm 5\%</math>  Power Supply Reductions, +10/-15%, &lt;20%</p> <p>Emissions:  EN55011 Group 1, Class B  VCCI, Class B  ICES-003, Class B  CNS 13428, Class B  FCC Part 15, Class B</p> <p>Harmonics &amp; Flicker:  EN61000-3-2, Section 2, Limits for Harmonic Current Emissions  EN61000-3-3, Section 3, Limitations of Voltage Fluctuations and Flicker</p> <p>Other EMC Specifications:  NAMUR NE-21, Version: 10.02.2004 Electromagnetic compatibility of industrial process and laboratory control equipment</p> <p>Stress levels, frequency ranges, and dwell times were increased to address the following additional application-specific EMC requirements:  EN12067-2:2004 Gas/air ratio controls for gas burners and gas appliances, Part 2: Electronic types; Section 8.6.  EN298:2003 Automatic gas burner control systems for gas burning appliances with or without fans; Sections 8.2-8.8.  ISO 23550:2004 Safety and control devices for gas burners and gas-burning appliances -- General requirements; Section 8  ISO/CD 23552-1 (2004-08-11) Safety and control devices for gas and oil burners and gas and oil appliances -- Particular requirements -- Part 1: Fuel air/ratio controls, electronic type; Section 8</p> <p>Independent NVLAP-Accredited Test Lab:  Sypris Test &amp; Measurement, Inc  Test Reports T-42067-33, T-41954-33, and T-42067-13</p>
Hazardous location approvals	Factory Mutual (Project ID. 3027670): Non-incendive for Class I, Division 2, Groups A, B, C, D Class I, Zone 2, Group IIC; Class II, Division 2, Groups F, G Dust Ignition Proof for Class II, III, Division 1, Groups E, F, and G Hazardous (Classified) indoor/outdoor (Type 4X, 12, 13) location
Electrical safety approvals	Factory Mutual (Project ID. 003027657): IECEE CB Scheme Test Certificate No. USFM-014 IEC 61010-1 (edition 2) Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General requirements
CE compliance	EMC Directive, 89/336/EEC as amended by 92/31/EEC and 93/68/EEC Low Voltage Directive, 73/23/EEC

## Model number descriptions

A MAXON SMARTLINK® METER can be accurately defined by the model number that appears on the unit product label. The example below shows a typical SMARTLINK® METER configured for measuring natural gas, with a maximum flow range of 8000 scfh , 24VDC input power voltage, and an LCD display mounted in the standard, upright position. The other fields in the model number are currently forced to a default selection but are provided for future product options.

SMARTLINK® METER model number													
Size	Series	-	Fluid	Calibration (temp. and velocity)	Sensor Material	Power Input Voltage	I/O Configuration	LCD Display Position	Software Version	-	Flow Body and Screen Material	End Connections	Hardware - Gaskets & Fasteners
0200	SLM	-	N	1	S	A	1	U	01	-	A	A	1

### SIZE

#### NATURAL GAS MODELS:

0200 - 2"  
0300 - 3"  
0400 - 4"  
0600 - 6"

#### AIR MODELS:

0800 - 8"  
1200 - 12"  
1600 - 16"  
2000 - 20"  
2400 - 24"  
2800 - 28"

### SERIES

SLM - SMARTLINK® METER

### FLUID

N - Natural gas (N.G.)  
A - Air  
X - Special

### SENSOR CALIBRATION

1 - Std vel/temp range  
\* - Flow body only  
X - Special

### SENSOR MATERIAL

S - 316 stainless  
\* - Flow body only  
X - Special

### POWER INPUT VOLTAGE

A - 24VDC  
B - 100-240 VAC  
\* - Flow body only  
X - Special

### I/O CONFIGURATION

1 - Analog/digital I/O module  
\* - Flow body only  
X - Special

### LCD DISPLAY POSITION

U - Upright  
I - Inverted  
\* - Flow body only

### SOFTWARE VERSION

01 - Original version  
\*\* - Flow body only  
XX - Special

### FLOW BODY & SCREEN MATERIAL

A - CS body 304; SS screen (Air)  
B - CS body; CS screen (N.G.)  
\* - Sensor only  
X - Special

### END CONNECTIONS

A - ANSI 150# rated flange (N.G.)  
B - ANSI 1/2" thick flange (Air)  
\* - Sensor only  
X - Special

### HARDWARE-GASKETS & FASTENERS

1 - Fiber gasket (Air)  
2 - None (N.G.)  
\* - Sensor only  
X - Special

### Additional ordering choices

(not included in Model Number fields above):

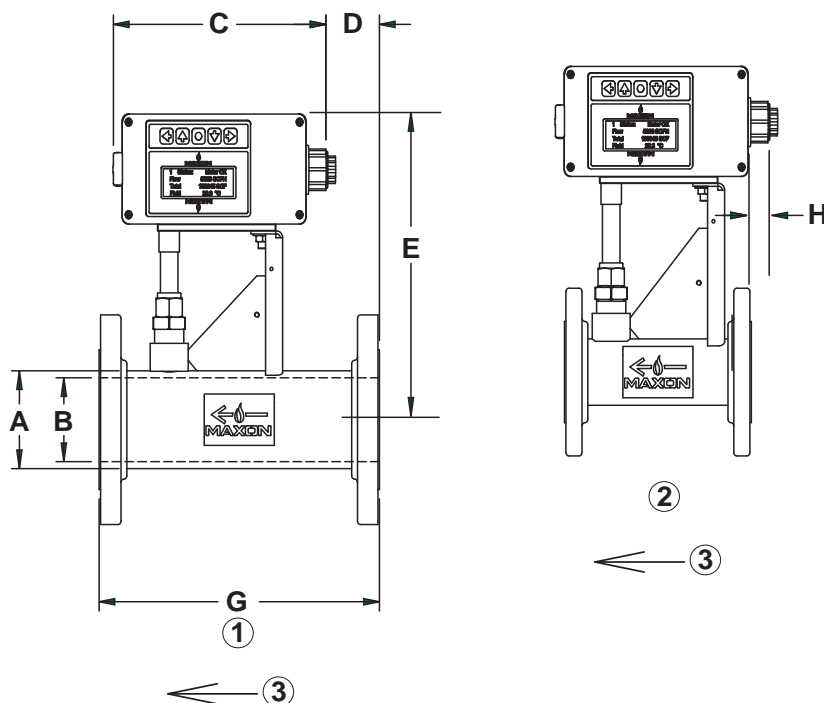
1. Sensor, flow body, or both required
2. Tagging options: ALW (Aluminum Wire-on), NONE, SSP (Stainless Steel Permanent), SSW (Stainless Steel Wire-on)
3. Screen position: 0 (N/A, gas flow body), \* (N/A - Sensor Only), L (Left), R (Right), T (Top) , B (Bottom)
4. Instruction language: E (English), F (French), G (German)



## Dimensions and weights

### Natural gas models

- 1) Over raised faces
- 2) 0200 SLM only
- 3) Flow direction

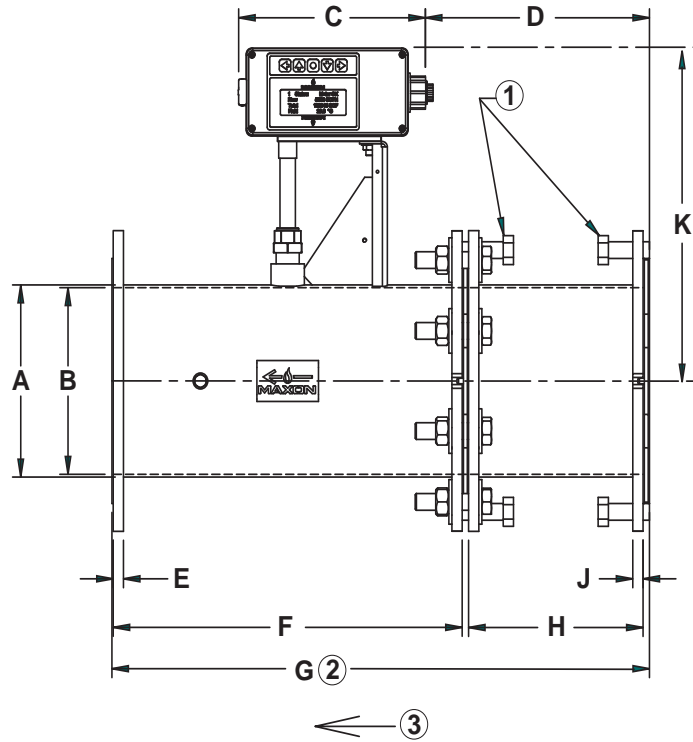


Dimensions in inches unless stated otherwise

Model	Size	A	B	C	D	E	G	H	Weight lb
0200 SLM	2"	2.4	2	9.1	-	10.9	8	0.7	19
0300 SLM	3"	3.5	3	9.1	2.3	10.9	12	-	32
0400 SLM	4"	4.5	3.9	9.1	5.3	10.9	16	-	49
0600 SLM	6"	6.6	6	9.1	11.3	11.8	24	-	83

Air models

- 1) Jack bolts
- 2) Over gaskets
- 3) Flow direction

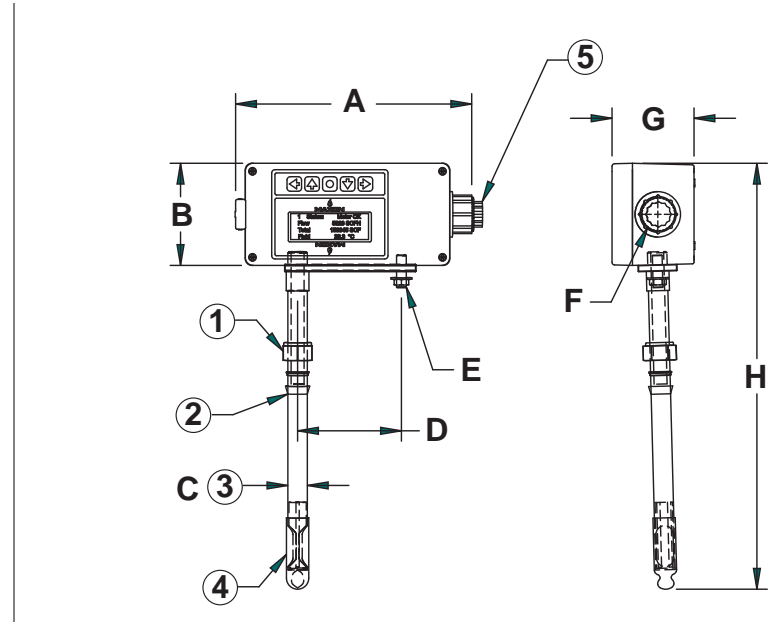


Dimensions in inches unless stated otherwise

Model	Size	A	B	C	D	E	F	G	H	J	K	Weight lb
0800 SLM	8"	8.6	8.4	9.1	10.9	0.5	17	26.2	8.5	0.5	14.9	74
1200 SLM	12"	12.8	12.5	9.1	18.9	0.5	25	38.2	12.5	0.5	14.9	142
1600 SLM	16"	16	15.8	9.1	25.9	0.5	32	48.7	16	0.5	16.4	225
2000 SLM	20"	20	19.8	9.1	33.9	0.5	40	60.7	20	0.5	18.4	299
2400 SLM	24"	24	23.8	9.1	41.9	0.5	48	72.7	24	0.5	20.4	401
2800 SLM	28"	28	27.8	9.1	49.9	0.5	48	76.7	28	0.5	22.4	497

Electronic sensor assembly

- 1) Compression fitting
- 2) Ferrules
- 3) 3/4" dia. probe
- 4) Shipping cap
- 5) Conduit fitting plug

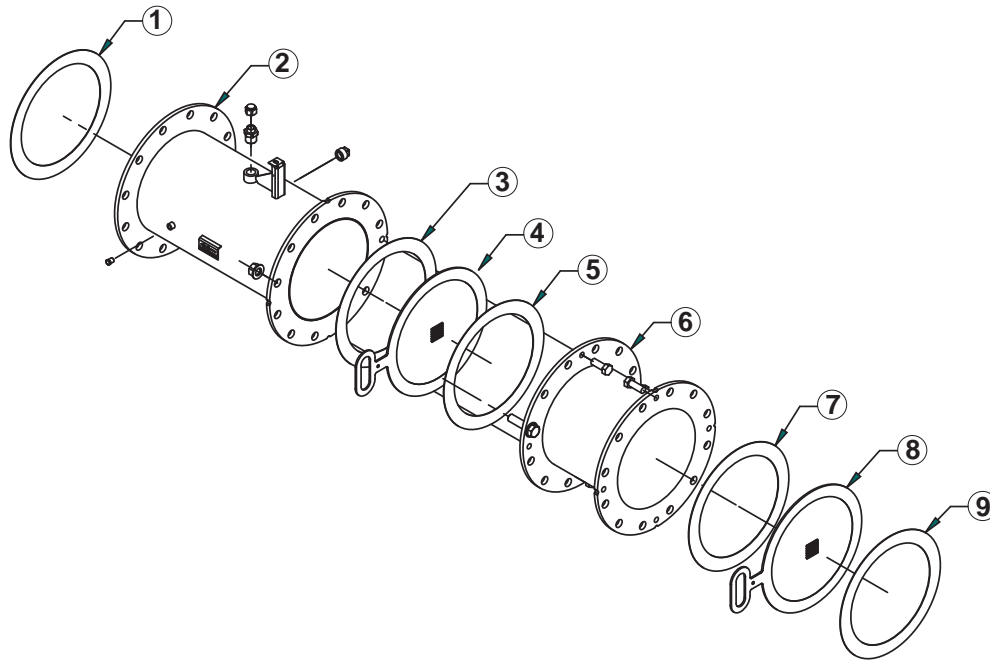


Dimensions in inches unless stated otherwise									
Model	Size	A	B	C	D	E	F	G	H
0800 SLM	8"	9.1	3.9	0.75	4.0	3/8 - 24	3/4 NPT	3.2	16.4
1200 SLM	12"	9.1	3.9	0.75	4.0	3/8 - 24	3/4 NPT	3.2	16.4
1600 SLM	16"	9.1	3.9	0.75	4.0	3/8 - 24	3/4 NPT	3.2	16.4
2000 SLM	20"	9.1	3.9	0.75	4.0	3/8 - 24	3/4 NPT	3.2	16.4
2400 SLM	24"	9.1	3.9	0.75	4.0	3/8 - 24	3/4 NPT	3.2	16.4
2800 SLM	28"	9.1	3.9	0.75	4.0	3/8 - 24	3/4 NPT	3.2	16.4

**Air flow body**

**Exploded view of air flow body**

- 1) Gasket
- 2) Flow body
- 3) Gasket
- 4) Downstream screen
- 5) Gasket
- 6) Flow body extension
- 7) Gasket
- 8) Inlet screen
- 9) Gasket



**Meter accessories**

Accessories
Power supply, 115-230 VAC input, 24VDC output, 50 watt
Cable for 4-20mA wiring, 18 AWG, 2-conductor with shield
1/8 DIN analog input panel meter, 24VDC input power
Mating 150# raised-face, threaded steel flange pair (with hardware and gaskets) for 2" gas meter
Mating 150# raised-face, slip-on, steel flange pair (with hardware and gaskets) for 3" gas meter
Mating 150# raised-face, slip-on, steel flange pair (with hardware and gaskets) for 4" gas meter
Mating 150# raised-face, slip-on, steel flange pair (with hardware and gaskets) for 6" gas meter
Mating ANSI bolt pattern, 1/2" thick flange pair for 8" air meter
Mating ANSI bolt pattern, 1/2" thick flange pair for 12" air meter
Mating ANSI bolt pattern, 1/2" thick flange pair for 16" air meter
Mating ANSI bolt pattern, 1/2" thick flange pair for 20" air meter
Mating ANSI bolt pattern, 1/2" thick flange pair for 24" air meter
Mating ANSI bolt pattern, 1/2" thick flange pair for 28" air meter