

# Model 510C

## Mass Flow Meter

aerospace  
climate control  
electromechanical  
filtration  
fluid & gas handling  
hydraulics  
pneumatics  
process control  
sealing & shielding

Porter Model 510C Series II Mass Flow Meter is designed for precise measurement of virtually all conventional process gases. The 510C consists of a thermal mass flow sensor, and microprocessor based circuitry with signal and fieldbus conversion. The mass flow rate is provided as analog signal or digitally via RS232 or various fieldbus options. Each unit is specifically sized and calibrated depending on the type of gas and the process conditions of the application.



### Product Features:

- Full Scale Flow Ranges from 0.7 ml/min to 9 ml/min
- Operating Pressures up to 1450 PSIA
- High accuracy and repeatability
- Storage of max. 8 calibration curves
- User configurable control characteristics
- Flow Parameter Adjust functionality up to 150 PSIA
- Effective Rangeability <180:1
- Analog or digital: RS232, DeviceNet™, ProfibusDP®, Modbus-RTU

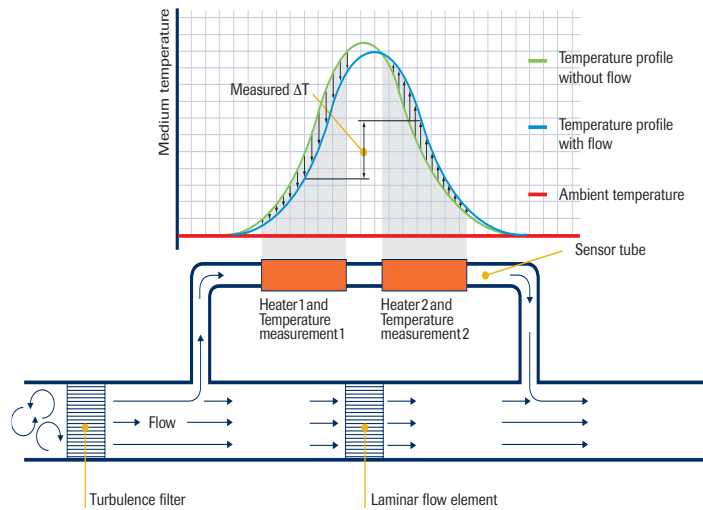


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# 500/600 Series II Flowmeter Products

## Thermal Mass Flow Measuring Principle

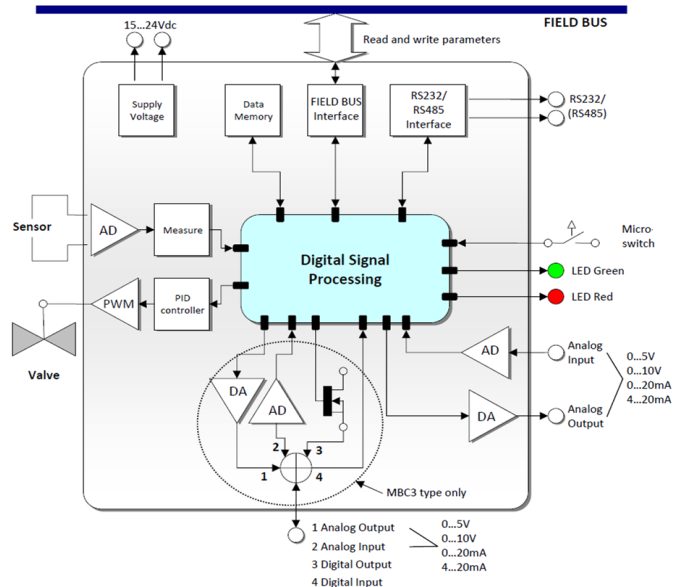
The Mass Flow Sensing System consists of a stainless steel capillary tube with two precision heater and temperature sensing elements wound around the outside of the tube. As gas flows through the capillary tube, heat is displaced to the downstream temperature sensor creating a differential between the two sensors. The difference is directly proportional to mass flow through the tube. In the main flow channel, a patented laminar flow element package creates a restriction that forces a fixed percentage of the total flow through the sensor for temperature differential detection.



$$\Delta T = k \cdot C_p \cdot \dot{m} \quad \Delta T = T_2 - T_1 \text{ in Kelvin} \quad C_p = \text{specific heat} \quad \dot{m} = \text{mass flow}$$

## State of the Art Digital Design

Porter's Series II Mass Flow products are equipped with a microprocessor based digital pc-board offering high accuracy, excellent temperature stability and fast MFC response time. The basic digital pc-board contains all of the general functions needed for measurement and control. RS232 communication and analog I/O are included. An optional integrated communication interface board provides DeviceNet™, Profibus-DP® or Modbus-RTU.



## Models and Flow Ranges

Model	Minimum	Nominal	Maximum
510C - A	0.014 to 0.7 ml/min	0.014 to 2 ml/min	0.014 to 5 ml/min
510C - B	0.6 to 3 ml/min	0.6 to 5 ml/min	0.6 to 9 ml/min

All flow ranges are at standard conditions of 14.7 PSIA and 70°F (21.1°C)

# Specifications

## Measurement / Control System

<b>Accuracy (incl. linearity) (based on actual calibration)</b>	Standard: $\pm 0.5\%$ Reading plus $\pm 0.1\%$ Full Scale ( $\pm 1\%$ Full Scale for ranges 3-5 ml/min; $\pm 2\%$ Full Scale for ranges $< 3$ ml/min)
<b>Turndown</b>	1 : 50 (in digital mode up to 1 : 187.5)
<b>Repeatability</b>	$< 0.2\%$ Reading
<b>Operating Temperature</b>	-10 to $+70^{\circ}\text{C}$
<b>Temperature Sensitivity</b>	Zero: $< 0.05\%$ Full Scale/ $^{\circ}\text{C}$ ; span: $< 0.05\%$ Reading/ $^{\circ}\text{C}$
<b>Pressure Sensitivity</b>	0.1%/ATM typical N <sub>2</sub> ; 0.01%/ATM typical H <sub>2</sub>
<b>Leak Integrity, outboard</b>	Tested $< 2 \times 10^{-9}$ mbar l/s He
<b>Attitude Sensitivity</b>	Max. error at $90^{\circ}$ off horizontal 0.2% at 1 ATM, typical N <sub>2</sub>
<b>Warm-Up Time</b>	30 min. for optimum accuracy 2 min. for accuracy $\pm 2\%$ Full Scale

## Mechanical Parts

<b>Material (wetted parts)</b>	Stainless steel 316L or equivalent
<b>Surface Quality (wetted parts)</b>	Ra= 0.8 $\mu\text{m}$ typical
<b>Process Connections</b>	Compression or face seal fittings
<b>Seals</b>	Standard: Viton Options: EPDM, Kalrez (FFKM)
<b>Ingress Protection (housing)</b>	IP40

## Electrical Properties

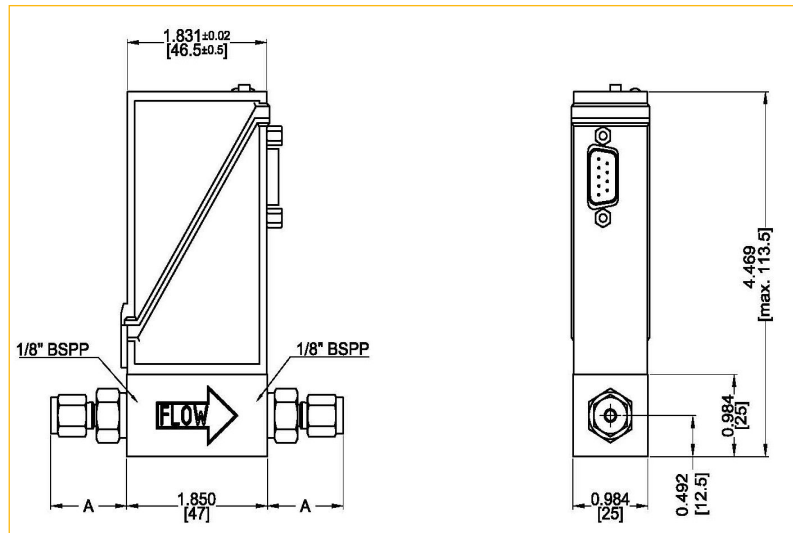
<b>Power Supply</b>	+15-24 Vdc
<b>Power Consumption</b>	Meter: 70 mA; Controller: max. 320 mA; Add 50 mA for Profibus, if applicable
<b>Analog Output/Command</b>	0-5 (10) Vdc or 0 (4)-20 mA - specify - (Sourcing output)
<b>Digital Communication</b>	Standard: RS232 Options: Profibus-DP®, DeviceNet™, EtherCAT®, Modbus

## Electrical Connection

<b>Analog/RS232</b>	9-pin D-connector (male)
<b>Profibus-DP®</b>	Bus: 9-pin D-connector (female) Power: 9-pin D-connector (male)
<b>DeviceNet™</b>	5-pin M12-connector (male)
<b>EtherCAT®</b>	2 x RJ45 modular jack (in/out)
<b>Modbus-RTU/FLOW-BUS</b>	RJ45 modular jack

*Technical specifications and dimensions subject to change without notice.*

# Dimensions



Brackets = Millimeters

Compression	1/8" BSPP
	Size A
Fitting 3 mm OD	0.996 (25.3)
Fitting 6 mm OD	1.08 (27.6)
Fitting 8 mm OD	1.126 (28.6)
Fitting 1/16" OD	0.811 (20.6)
Fitting 1/8" OD	0.996 (25.3)
Fitting 1/4" OD	1.087 (27.6)
Fitting 3/8" OD	1.161 (29.5)

Face-Seal Male	A
	Fitting 1/8" inlet
Fitting 1/4" inlet	0.933 (23.7)

(Millimeters)

# Ordering Information

5 1 0C A A A D 11 V

Base	
5	Meter

Pressure Rating	
1	1450 PSIA

Ranges	
0C	0 to 0.7 / 0 to 9 ml/min

Nominal Range	
	Factory Selected

Communication (I/O)	
A	RS232 + analog (n/c control)
B	RS232 + analog (n/o control)
D	RS232 + DeviceNet (n/c)
E	RS232 + DeviceNet (n/o)
M	RS232 + Modbus-RTU (n/c)
N	RS232 + Modbus-RTU (n/o)
P	RS232 + Profibus -DP (n/c)
Q	RS232 + Profibus - DP (n/o)
R	RS232 + FLOW-BUS (n/c)
S	RS232 + FLOW-BUS (n/o)

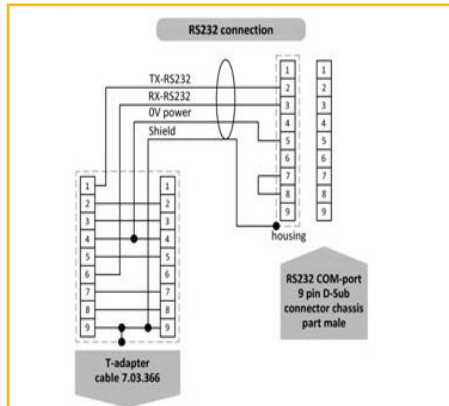
Internal Seals	
V	Viton (Factory Standard)
E	EPDM
K	Kalrez (FFKM)

Connections (in/out)	
1	1/8" OD Compression Type
2	1/4" OD Compression Type
3	6 mm OD Compression Type
8	1/4" Face Seal Male
9	Other
0	None

Supply Voltage	
D	+15 to 24 Vdc

Analog Output	
A	0 to 5 Vdc
B	0 to 10 Vdc
F	0 to 20 mA Sourcing
G	4 to 20 mA Sourcing

# Hook-up Diagram for Analog or RS232 Communication



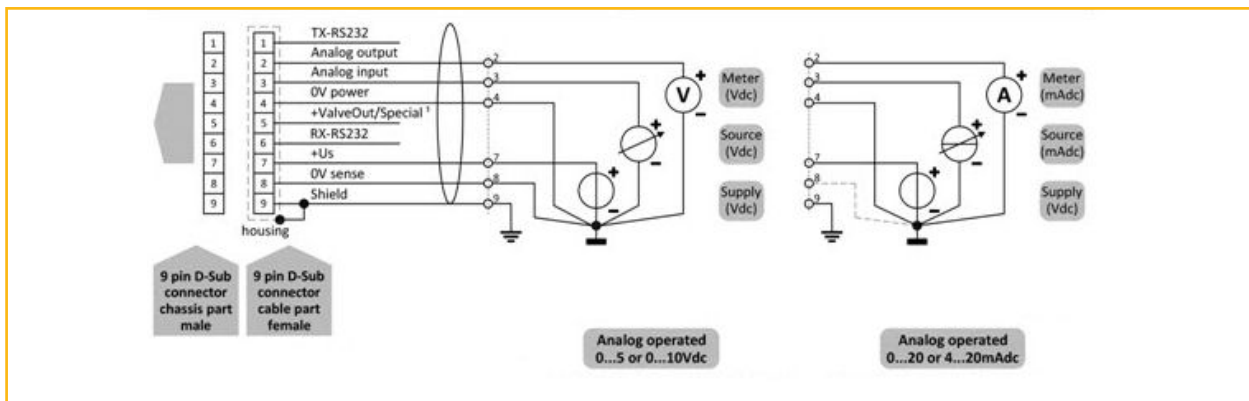
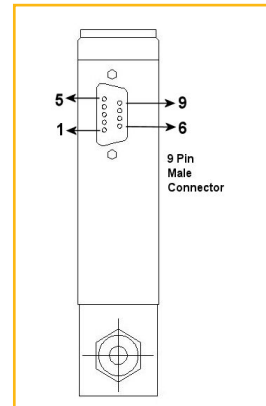
**Note:** Pin 4 and Pin 8 should be separately and connected to power common at the power supply.

**Note:** When using a unit configured for a fieldbus or RS232 I/O, it is not possible to operate the instrument using analog I/O without changing the "control mode" parameter. (See users manual)

**Note:** For hookup details of modbus, Profibus or DeviceNet communications, see users manual.

**Note:** Do not connect external valve to instruments configured as flow meters

**Note:** Valve out signal is 0 - 10 Vdc, .1mA



## ⚠ WARNING – USER RESPONSIBILITY

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