

# Model 5850EM & Model 5851EM

Thermal Mass Flow

## Metal Sealed, Thermal Mass Flow Controllers



Models 5850EM & 5851EM

### Product Description

The Brooks® Model 5850EM Metal Sealed Mass Flow Controller has all the features of the standard Model 5850E plus all metal seals for outstanding leak integrity and cleanliness. The Model 5850EM eliminates the need for continuous monitoring and readjustment of gas pressures to provide a stable mass flow.

The Brooks® Model 5851EM Metal Sealed Mass Flow Controller offers state-of-the-art performance in high flow gas measurement and control. It combines the outstanding leak integrity of metal seals with a variety of options which allow maximum flexibility.

The heart of the system is the highly stable sensor which produces an electrical output signal linear with flow rate. This signal is used for indicating, recording and/or control purposes without the need for an auxiliary auto-zero circuit.

### Product Features

#### Model 5850EM

- Wide flow range (0.06 sccm through 30,000 sccm N<sub>2</sub>)
- High leak integrity (less than 10<sup>-10</sup> atm-cc/sec He)
- Enhanced process (5 Ra avg.) internal finish (optional)
- Electropolished wetted surfaces (optional)
- Vented-polished internal threads
- Normally Closed Valve (Normally Open Valve optional)
- Insensitive to mounting attitude
- Mechanically and electrically compatible with other mass flow controllers
- Electrically activated valve override
- Low command flow cutoff
- TTL compatible "valve off" and purge function
- 0(4)-20 mA I/O, 24 Vdc, i-Series design (optional)
- Available with all popular process connections
- Downport C-Seal (optional)

#### Model 5851EM

- High flow capability 100 slpm N<sub>2</sub> (200 slpm H<sub>2</sub>)
- High leak integrity (less than 10<sup>-10</sup> atm-cc/sec He)
- Enhanced process (5 Ra avg.) internal finish (optional)
- Electropolished wetted surfaces (optional)
- Normally Closed Valve (Normally Open Valve optional)
- Particulate free
- High purity VAR 316L Stainless Steel
- Fast response to command changes
- Helium leak check ports
- Class 100 assembly and calibration
- Negligible flow overshoot/undershoot
- Insensitive to mounting attitude
- Electrically activated valve override
- Low command flow cutoff
- TTL compatible "valve off" and purge function
- 0(4)-20mA I/O, 24 Vdc power supply (optional)
- Available with all popular process connections

## Principle of Operation

The operating principle of the Brooks Mass Flow Controller is thermodynamic. A precision power supply directs heat to the midpoint of the sensor tube carrying the flow. On the same tube equidistant upstream and downstream of the heat input, are resistance temperature measuring elements.

With no flow, the heat reaching each temperature element is equal. With increasing flow, the flowstream carries heat away from the upstream element, T1 and an increasing amount towards the downstream element T2. An increasing temperature difference develops between the two elements and this difference is proportional to the amount of gas flowing or the mass flow rate. A bridge circuit interprets the temperature difference and an amplifier provides the output to the control circuitry as well as a 0-5 Vdc output signal.

The control circuitry compares the command set-point to the flow signal and positions the precision solenoid control valve. When the command signal is below 1% of full scale, the control valve is positioned fully closed. The control valve can be latched fully open or closed by activating the valve override circuit.

## Product Specifications

Performance	5850EM	5851EM
<b>Flow Ranges*</b>	Any range from 0-3 sccm to -30,000 sccm Nitrogen eq. Lower flows available, consult factory	Any full scale flow from 10 slpm to 100 slpm nitrogen eq., up to 200 slpm H <sub>2</sub> . Higher H <sub>2</sub> flows possible, consult factory
<i>*Standard pressure and temperature in accordance with SEMI (Semiconductor Equipment and Materials International: Standard: 0°C and 101 kPa (760 Torr).</i>		
<b>Control Range</b>	2-100% with elastomeric valve seat 3-100% with metal or Teflon® valve seat	50 to 1 with elastomeric valve seat
<b>Repeatability</b>	0.25% of rate	
<b>Accuracy</b>	1% full scale including linearity, at calibration conditions 1.5% full scale including linearity, for flow ranges >20slpm	±1% full scale including linearity at calibrated conditions
<b>Settling Time</b>	< 3 seconds to within 2% of full scale of final value for a 0-100% command step with normally closed valve*	
	Optional (5850EM): Enhanced response PCB's provide 600 msec typical	
	*Per SEMI Guideline E17-91	
<b>Mounting Attitude Sensitivity</b>	Available in any position 0.5% max. full scale deviation after rezeroing	±0.5% full scale max. deviation from specified accuracy after rezeroing
<b>Temperature Sensitivity</b>	Zero: < ±0.075% full scale per °C; Span: < ±1.0% full scale shift over 10-50°C range	
<b>Pressure Sensitivity</b>	0.008% per psi Nitrogen	±0.03% per psi up to 150 psig Nitrogen

### Ratings

<b>Operating Pressure</b>	1,500 psi (10,342 MPa) max. Note (5850EM): 500 psi with stainless steel fastener.	
<b>Differential Pressure</b>	Valve orifice sized for any pressure drop between 5 to 50 psi (minimum pressure drop depends on gas and range - consult factory)	
<b>(PED) Pressure Equipment Directive (97/23/EC)</b>	As Sound Engineering Practice (SEP)	
<b>Ambient Temperature Limits</b>	Operating: 40°F to 150°F (5°C to 65°C) Non-operating: -13°F to 212°F (-25°C to 100°C)	41°F to 149°F (5°C to 65°C)
<b>Leak Integrity</b>	Inboard to outboard 1x10 <sup>-10</sup> atm. cc/sec He max.	
<b>Particulate</b>	Zero particles per cubic foot greater than 0.1 micron under process conditions. Less than 1 particle per cubic foot greater than 0.02 microns under process conditions with enhanced processing	

### Electrical

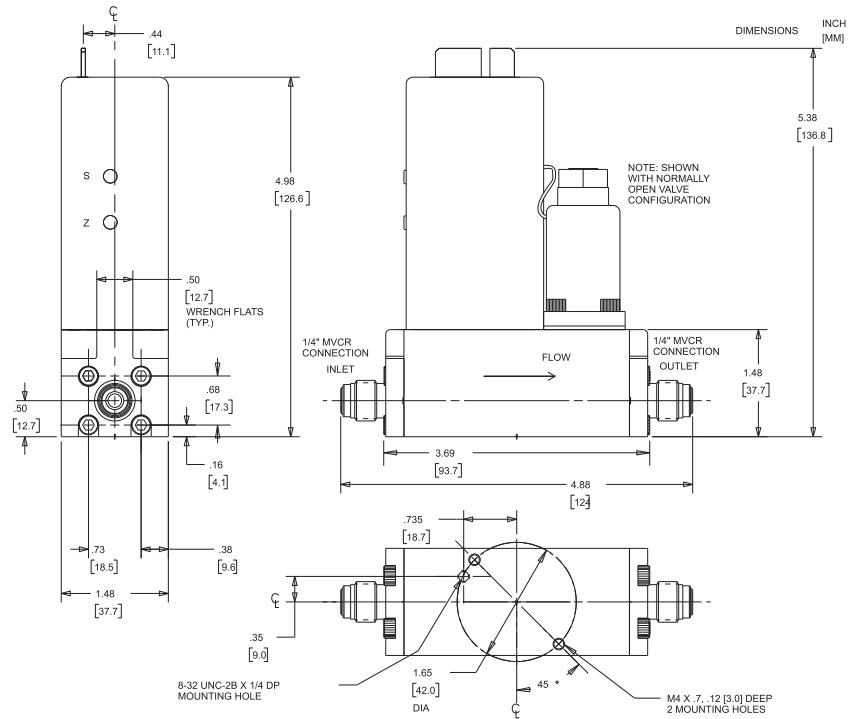
<b>Electrical Connections</b>	Card Edge: 30 microinch gold over low stress nickel-plated copper or 15-pin D-Connector (DA-15P)	
<b>Command Input</b>	Voltage Option: 0-5 Vdc (input resistance 40 k ohm min.) Current Option: 4-20 mAdc (input resistance 75 ohm)	0-5 Vdc (200 k ohms input resistance)
<b>Output Signal</b>	Voltage Option: 0 to 5 Vdc into 2,000 ohms minimum Current Option: Jumper selective 4-20 mAdc or 0-20 mAdc	0 to 5 Vdc (Max load 2 k ohms) 5 volts ±0.2% Reference (max load 2 k ohms)
<b>5 Volt Reference Output</b>	5 Volts. ±0.01 Vdc into 2,000 ohms minimum	
<b>Power Requirements</b>	Voltage Option: N.C. Valve (or N.O. Valve with less than 2.5 slpm) 3.25 watts max.; +15 Vdc @ 35 mA-15 Vdc @ 180 mA N.O. Valve with flow rate greater than 2.5 slpm: 10.5 watts max., +15 Vdc @ 350 mA, -15 Vdc @ 350 mA Current Option: +15 Vdc to +28 Vdc: 3.68 watts min., + 15 Vdc @ 245 mA, 10.36 watts max., +28 Vdc @ 370 mA	±15 Vdc (±5%) at 350 mAdc, 10.5 watts
<b>Power Supply Sensitivity</b>	None within ±5% of specified voltage (See Power Requirements)	±0.09% full scale over total power supply voltage ±15 Vdc (±5%) at 350 mAdc 10.5 watts power consumption
<b>EMC Directive (89/336/EEC)</b>	Per 61326	

### Mechanical

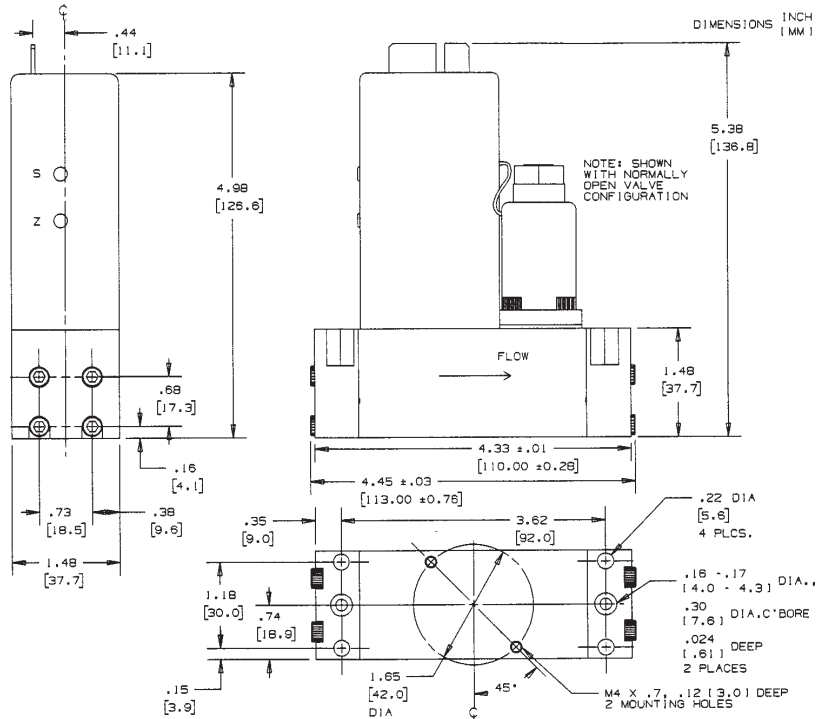
<b>Process Connections</b>	1/4" Tube VCR®; Downport C-Seal	Integrally welded to body: Standard: 1/4" VCR® with 0.250" bore Optional: 1/2" ATW Tube Stub; 3/8" - 1/2" VCR; 1/2" ACLIT
<b>Materials of Construction</b>	316L VAR (Vacuum Arc Remelt), 316L, and high alloy ferritic stainless steel	
External Seals:	Nickel 200	
Internal Seals:	Nickel	Nickel 200
Valve Seat:	316L, Viton® fluoroelastomers, Buna-N, Kalrez® or Teflon®	
<b>Dimensions</b>	See Dimension Figures Pages 4 & 5	See Dimension Figures Pages 6 & 7

# Product Dimensions - 5850EM

## 5850EM Card Edge, Tubing Connections (Ref. No KR-5850-113)

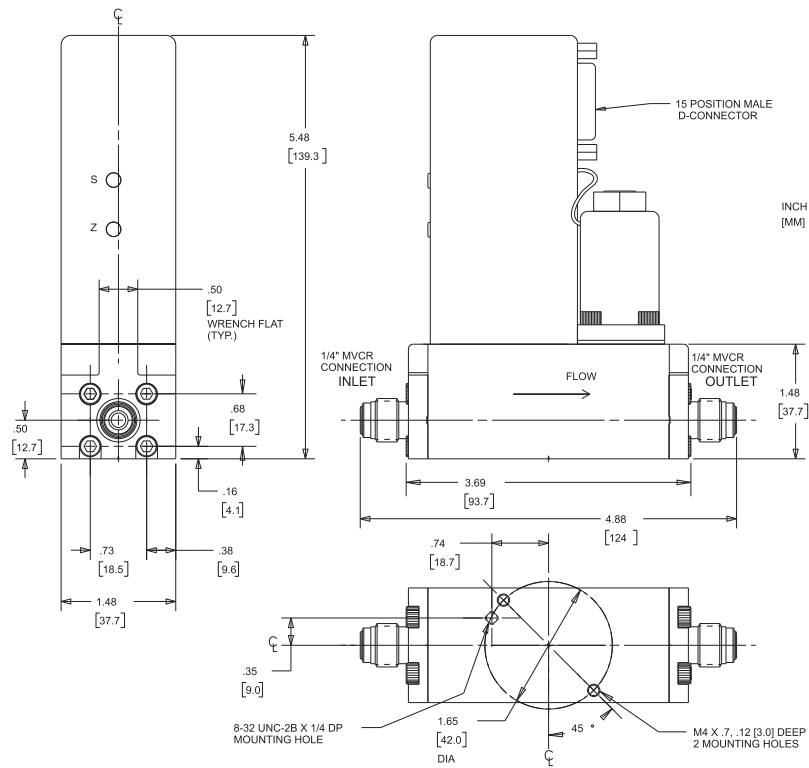


## 5850EM Card Edge, Downported Connections (Ref. No. KR-5850-106)

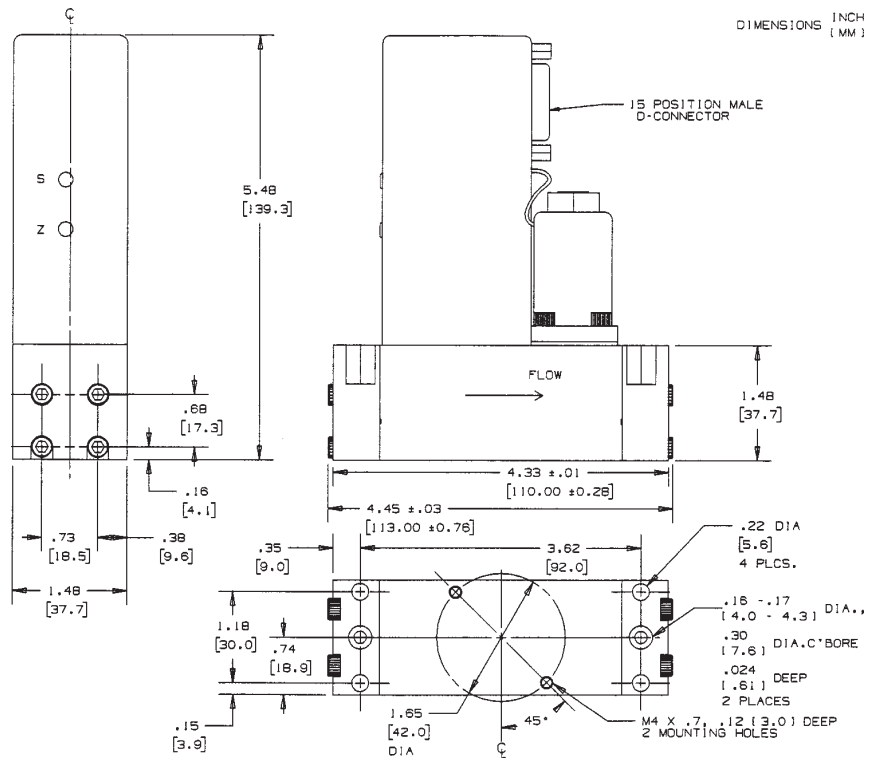


## Product Dimensions - 5850EM (continued)

### 5850EM D-Connector, Tubing Connections (Ref. No. KR-5850-110)

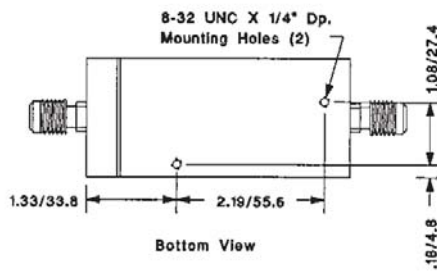
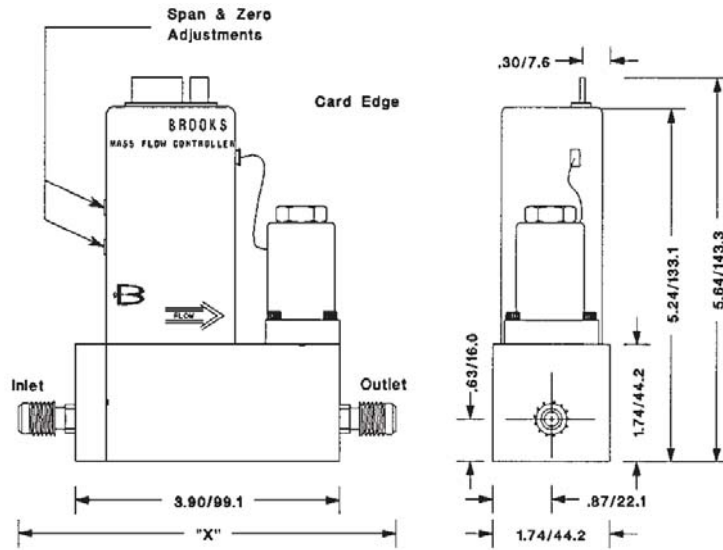


### 5850EM D-Connector, Downported Connections (ref. No. KR-5850-103)



# Product Dimensions - 5851EM

## 5851EM Card Edge, Tubing Connections



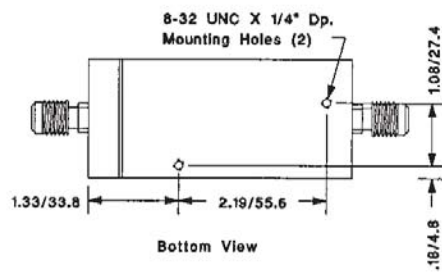
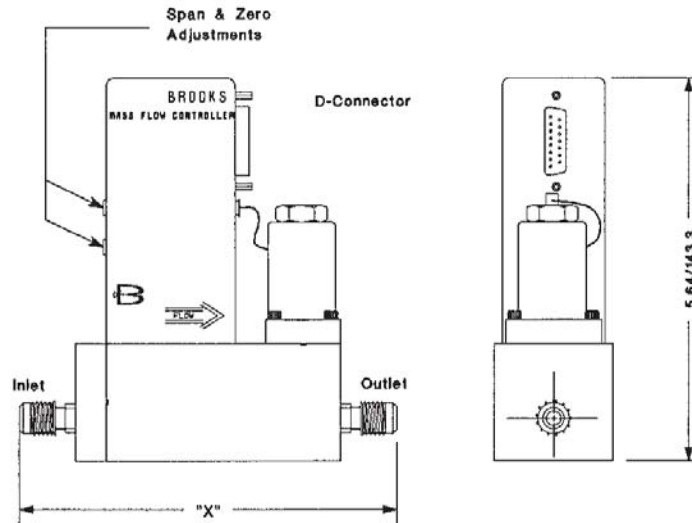
Connection	"X" Dim. *
1/4" Tube VCR	5.57 / 141.4
3/8" Tube VCR	6.64 / 168.7
1/2" Tube VCR	6.64 / 168.7
1/2" Acfit	5.45 / 138.4
1/2" Tube Stub	4.40 / 111.8

\* Mating Surface to Mating Surface

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## Product Dimensions - 5851EM (continued)

### 5851EM D-Connector, Tubing Connections



Connection	"X" Dim. *
1/4" Tube VCR	5.57 / 141.4
3/8" Tube VCR	6.64 / 168.7
1/2" Tube VCR	6.64 / 168.7
1/2" Acfit	5.45 / 138.4
1/2" Tube Stub	4.40 / 111.8

\* Mating Surface to Mating Surface

INCHES / MILLIMETERS

## Brooks Service and Support

Brooks is committed to assuring all of our customers receive the ideal flow solution for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration and is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.

Visit [www.BrooksInstrument.com](http://www.BrooksInstrument.com) to locate the service location nearest to you.

### START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required. For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

### CUSTOMER SEMINARS AND TRAINING

Brooks Instrument can provide customer seminars and dedicated training to engineers, end users, and maintenance persons.

Please contact your nearest sales representative for more details.

Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

### TRADEMARKS

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