

# Model 5850EM

## Metal Sealed Mass Flow Controller

- High leak integrity (less than  $10^{-10}$  atm-cc/sec He)
- Enhanced process (10 Ra) internal finish (optional)
- Electropolished wetted surfaces (optional)
- Exclusive vented-polished internal threads
- Normally Closed Valve (Normally Open Valve optional)
- Wide flow range (0.06 sccm through 30,000 sccm  $N_2$ )
- Insensitive to mounting attitude
- Full penetration welded fittings
- 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)

### 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 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.

### 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.

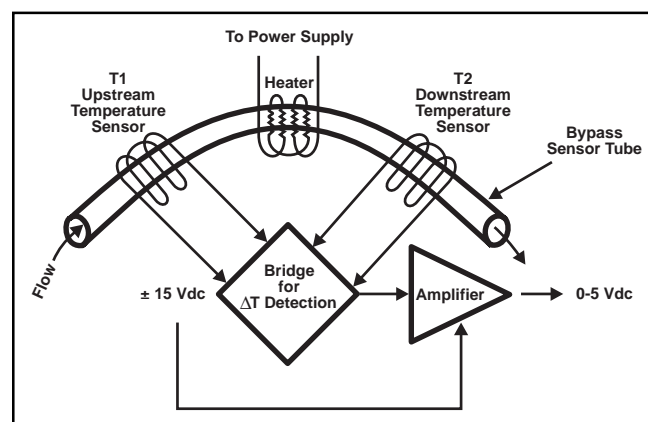


Figure 1 Principle of Operation

# Brooks Instrument

## SPECIFICATIONS

### WARNING

Do not operate this instrument in excess of the specifications listed below. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

#### PERFORMANCE CHARACTERISTICS:

##### Flow Ranges\*

Any range from 0 to 3 sccm to 0-30,000 sccm Nitrogen equivalent. Lower flows available, consult factory.

\*Standard: 0°C and 101 kPa (760 Torr). Per SEMI Guideline E12-96.

##### Control Range

2 - 100% with elastomeric valve seat

3 - 100% with metal or Teflon® valve seat

##### Accuracy

1% Full scale including linearity, at calibration conditions

1.5% Full scale including linearity, for flow ranges greater than 20 slpm

##### Repeatability

0.25% of rate

##### Settling Time

Less than 3 seconds to within 2% of full scale of final value for a 0-100% command step with normally closed valve.\*

Optional: Enhanced response PCB's provide 600 msec typical.

\*Per SEMI Guideline E17-91.

##### Mounting Attitude Sensitivity

Available in any position

0.5% maximum full scale deviation after rezeroing

##### Temperature Sensitivity

Zero: Less than  $\pm 0.075\%$  full scale per °C

Span: Less than  $\pm 1.0\%$  full scale shift over 10-50°C range

##### Pressure Sensitivity

0.008% per psi Nitrogen

#### RATINGS:

##### Operating Pressure

1,500 psi (10.342 MPa) max.

Note: 150 psi for enhanced response and/or stainless steel fastner option.

##### Proof Pressure

Standard Fastner Option: 2250 psig

Stainless Steel Fastner Option: 500 psig

##### Differential Pressure

Valve orifice sized for any pressure drop between 5 to 50 psi (Minimum pressure drop depends on gas and range).

##### Ambient Temperature Limits

Operating: 40°F to 150°F (5°C to 65°C)

Non-Operating: -13°F to 212°F (-25°C to 100°C)

##### Leak Integrity

Inboard to outboard 1 x 10<sup>-10</sup> atm. cc/sec. Helium max.

#### PHYSICAL:

##### Materials of Construction

316L VAR (Vacuum Arc Remelt), 316L, and high alloy ferritic stainless steel.

External seals: Nickel Plated SS, Nickel.

Internal seals: Nickel.

Valve Seat: 316L, Viton®, Buna-N, Kalrez® or Teflon®.

##### Dimensions

Refer to Figures 1 and 2

##### Process Connections

1/4" Tube VCR™

1/4" Tube "S" VCR

1/4" Tube ACLIT™

1/4" Tube Stub

1/4" Tube Female/Male VCR

Downport C-Seal

#### ELECTRICAL CHARACTERISTICS:

##### Electrical Connections

Card edge: 30 microinch gold over low stress nickel-plated copper or 15 Pin D-Connector (DA-15P)

##### Command Input

Voltage Option: 0-5 Vdc (Input resistance 40 k ohm min.)

Current Option: 4-20 mAdc (Input Resistance 75 ohm)

##### Output Signal

Voltage Option: 0 to 5 Vdc into 2,000 ohms minimum

Current Option: Jumper selective 4-20 mAdc or 0-20 mAdc

##### 5 Volt Reference Output

5 Volts,  $\pm 0.01$  Vdc into 2,000 ohms minimum

##### Power Requirements

Voltage Option:

N.C. Valve (or N.O. Valve with flow 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

##### Power Supply Sensitivity

None within  $\pm 5\%$  of specified voltage (See Power Requirements)

#### TRADEMARKS

ACLIT ..... Transfluid

Brooks ..... Brooks Instrument Division, Emerson Electric Co.

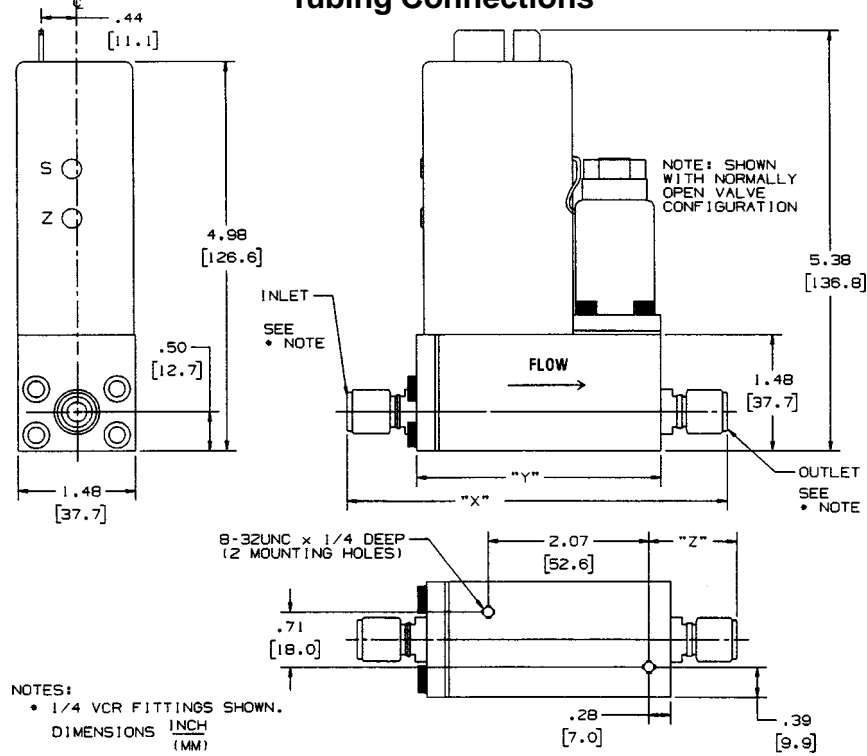
Kalrez ..... E. I. DuPont de Nemours & Company

Teflon ..... DuPont Dow Elastomers

VCR ..... Cajon Co.

Viton ..... DuPont Dow Elastomers

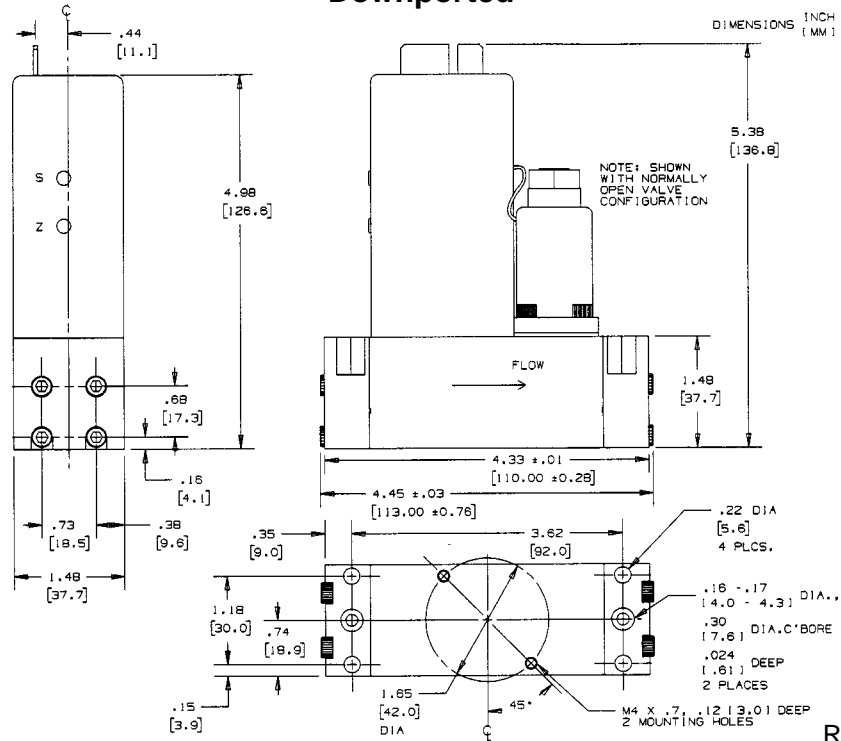
## Tubing Connections



Connection	"X" Dim.	"Y" Dim.	"Z" Dim.
1/4" Tube VCR™	4.88 (124.8)	3.22 (81.8)	1.11 (28.2)
1/4" Tube "S" VCR	5.86 (148.8)	3.22 (81.8)	1.60 (40.6)
1/4" Tube ACLIT™	4.97 (126.2)	3.22 (81.8)	1.16 (29.5)
1/4" Tube Stub	3.92 (99.6)	3.22 (81.8)	.63 (16.0)
1/4" Tube VCR (F)- 1/4" Tube VCR (M)	5.00 (127.0)	3.22 (81.8)	1.11 (28.2)

Ref. No. KR-5850-088

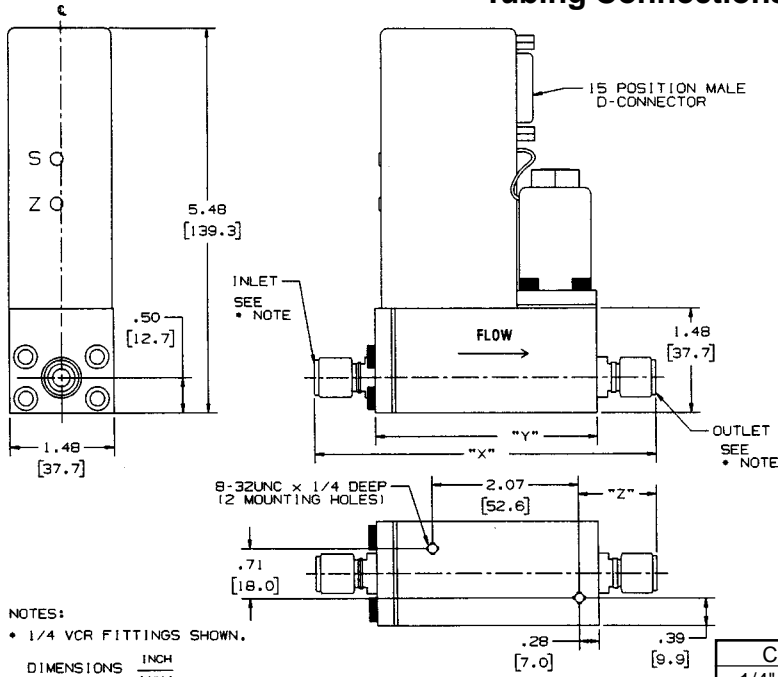
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Figure 1 Model 5850EM Card Edge Dimensions

## Tubing Connections

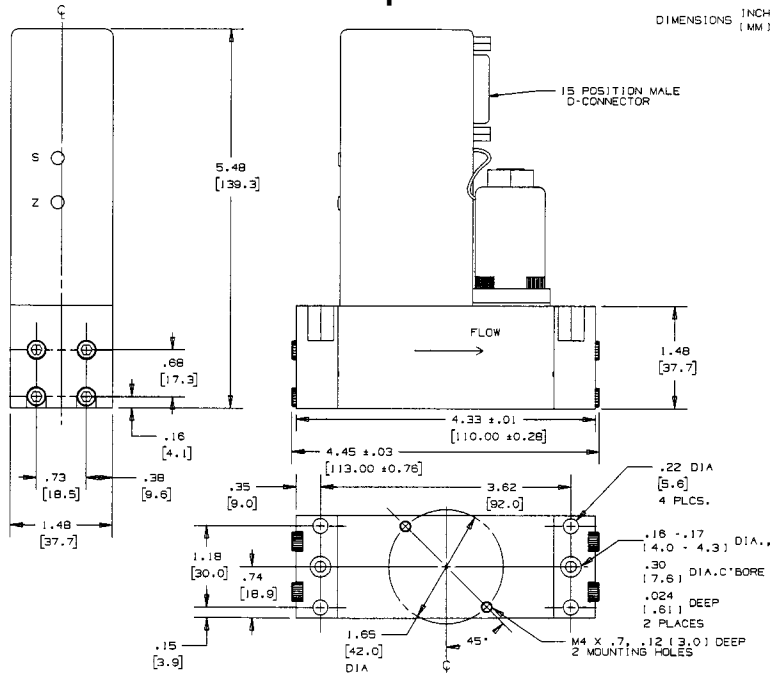


NOTES:  
 • 1/4 VCR FITTINGS SHOWN.  
 DIMENSIONS  $\frac{\text{INCH}}{[\text{MM}]}$

Connection	"X" Dim.	"Y" Dim.	"Z" Dim.
1/4" Tube VCR™	4.88 (124.8)	3.22 (81.8)	1.11 (28.2)
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1/4" Tube VCR (F)- 1/4" Tube VCR (M)	5.00 (127.0)	3.22 (81.8)	1.11 (28.2)

Ref. No. KR-5850-086

## Downported



Ref. No. KR-5850-103

**Figure 2 Model 5850EM D-Connector Dimensions**

Specifications Subject to Change Without Notice

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