MASS FLOW CONTROLLER MANUAL

Purpose

The Mass Flow Controller (MFC) is a mass flow measurement device designed for accurately measuring and rapidly controlling flows of gases. This instruction manual is intended to provide the user with all the information necessary to install and operate the Mass Flow Controller (MFC).

Introduction

The design provides a small, light weight MFC with direct gas sensing technology. The direct sensing technology measures true mass flow. It uses proven techniques involving thermal transfer as it relates to the specific heat characteristics of the gas. With the sensor directly in contact with the flow stream , it eliminates common-mode errors and provides good repeatability, response time, and thermal stability. The limitation of this technology is with the certain gases. Gases which demonstrate typical corrosive properties may be incompatible with internal construction materials to the MFC. Otherwise, the performance of the MFC can be highly effective in applications which do not require corrosive gases.

The mass flow is controlled by an integrated proportional valve and feedback control circuit. The unique valve technology and electronic control circuit offers performance stability and resolution which are well suited to mass flow control of ion and plasma sources. The control technology compensates for parasitic thermal drift that may not be picked up by a PID loop. Plus, it minimizes vibration and attitude sensitivity to mounting orientations.

Identification

Full scale	Input voltage	Control signal	Output signal	Gas A (cal)	Gas B (cal)	Part Number
50 sccm	± 15V	0-5V	0-5V	O2	Ar	51C000050N050A-B4
100 sccm	± 15V	0-5V	0-5V	O2	Ar	51C0000100N0100A-B4
200 sccm	± 15V	0-5V	0-5V	O2	Ar	51C0000200N0200A-B4

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Specifications

Performance:

Linearity ± 3.0% of Full Scale (Typical), depends on flow range
Repeatability & Hysteresis: ± 0.15% FS*
Temperature Coefficient: 0.009% / ºC from 21ºC set point
Response (typical) time from 2% FS to 100% FS and to within 1% of set point: 150mesc
Long Term Stability: 0.2% FS / >7500 hours (continuous operation)

*FS = Full Scale

Gas Requirements:

Calibration Gas: Ar, O2
Standard Flow Ranges: 50 (±1.5%), 100 (±3%), 200 sccm** (±6%)
Specific applications may determine other sizes : 10 (±1%), 25 (±1%), 300 sccm (±12%)
Pressure Range: 0-100 psi, calibration pressure: 25 psi
Differential Pressure: 3 to 100 psi (Acceptable minimum pressure drop depends on gas and range).
Vacuum application: 30psi @ inlet 20 psig (regulator setting), outlet < 1 psi
Internal Leakage 10^{-5} sccm @1, 30 and 100 Psi (He)
External Leakage 2×10^{-6} sccm (He)

**Standard temperature and pressure in accordance with SEMI (Semiconductor Equipment and Materials International) standard: 0°C and 101.3 kPa (760 Torr).

Electrical Requirements:

Input Voltage (single supply) 15 volts +10% - 3%
Power Consumption 1.5 Watts Maximum
Control Voltage: 0-5 VDC
Output Voltage: 0-5V DC

Environmental Requirements:

Operating Ambient Temp. 0-50ºC
Storage Temperature -40 - 70ºC
Humidity Range 5% - 95% (relative,non-condensing)
Calibration Temperature 21ºC ± 5ºC

Mechanical Configuration:

Input/Output Ports
Dimensions 5.08cm (L) x 3.81cm (W) x 4.7cm (H), [2.0” (L) x W: 1.5” (W) x H: 1.85” (H)]
Weight 0.153 Kg (0.34 lbs)
Mounting Attitude Sensitivity: horizontal or vertical

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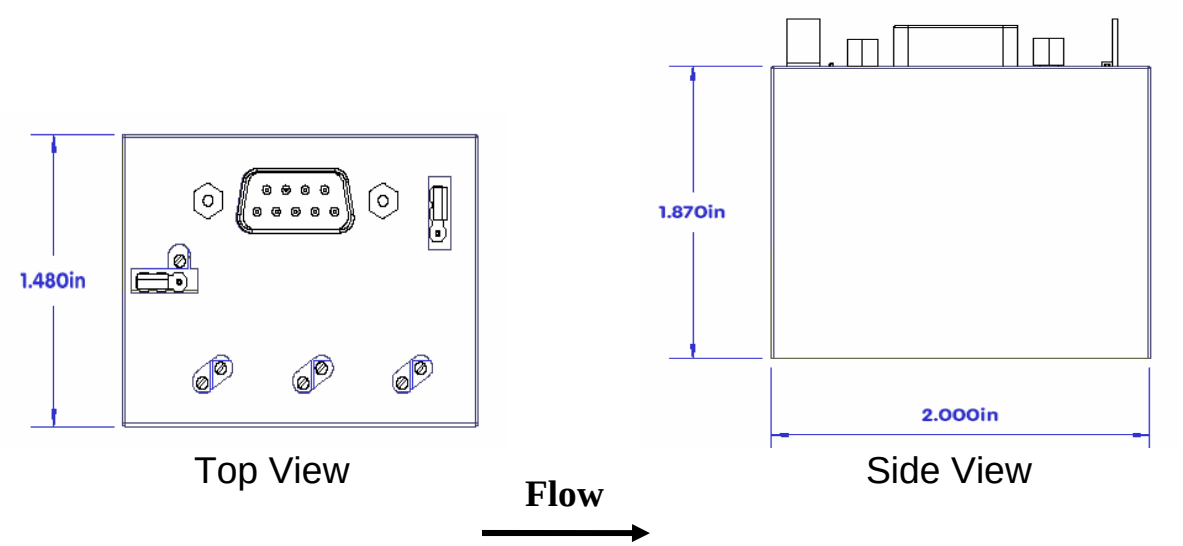
Installation

MFC Dimensions and weight:

Length: 5.08cm (2.0”) x Width: 3.81cm (1.5”) x Height: 4.7cm (1.85”)

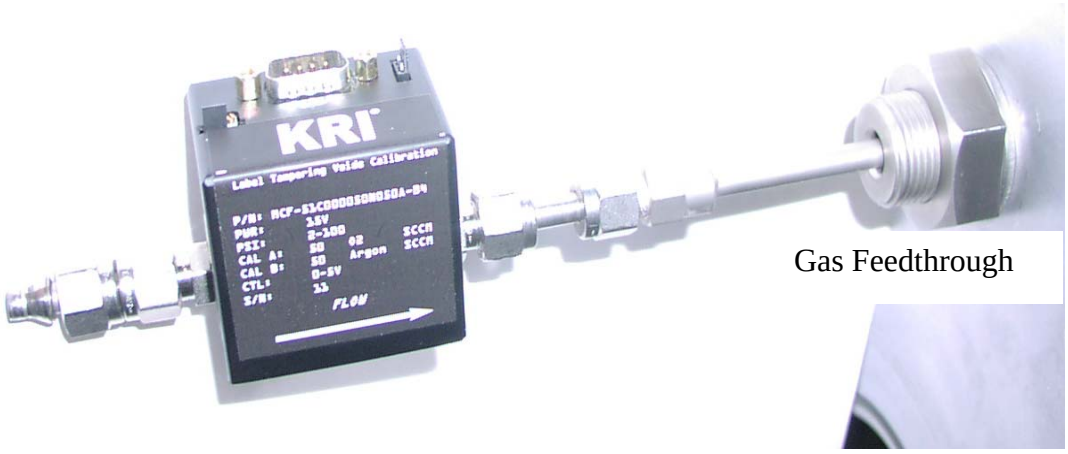
Weight: 153 grams (0.34 lbs)



Recommended installation procedures:

a. The MFC should be located in a clean, dry atmosphere relatively free from shock, vibration and excessive temperature.

b. Position the MFC as closes as possible to the gas feedthrough. Since the gas transport has a residence time in the tubing, the ion source will respond faster to a MFC set point when the residence time is small. Therefore, the shortest gas residence times will result when the MFC is closest to the gas feedthrough. Since the MFC weight is light, it can be mounted directly onto the atmosphere side of the gas feedthrough.



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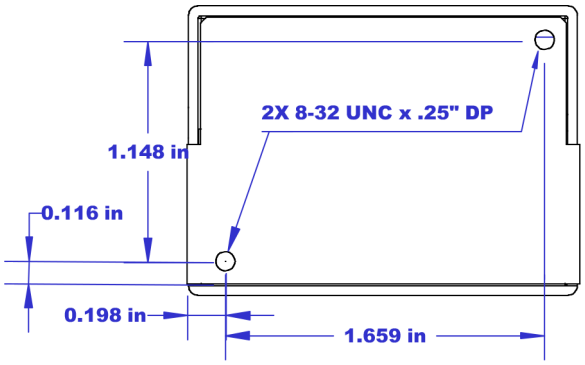
If the MFC cannot be mounted on the gas feedthrough, the below is a drawing which shows the tapped mounting holes.



Bottom View

The orientation of the MFC can be horizontal or vertical.
Install ¼" clean SS tubing to the input of the MFC. This would be the same for the output also if needed.
The input pressure to the MFC should be below 100 psig, which is typically controlled by a dual stage gas regulator. The pressure differential between the input and output should be 35 psig or higher.
Avoid installation near electrical noisy sources..
Leave sufficient room for access to the electrical components.

Gas Connections

Standard inlet and outlet connections are 1/4" compression fittings. (Optional VCR™ connections are available upon request).

Prior to installation, make certain all tubing is clean and free of obstructions. Install the tubing in such a manner that permits removal if the MFC when necessary.

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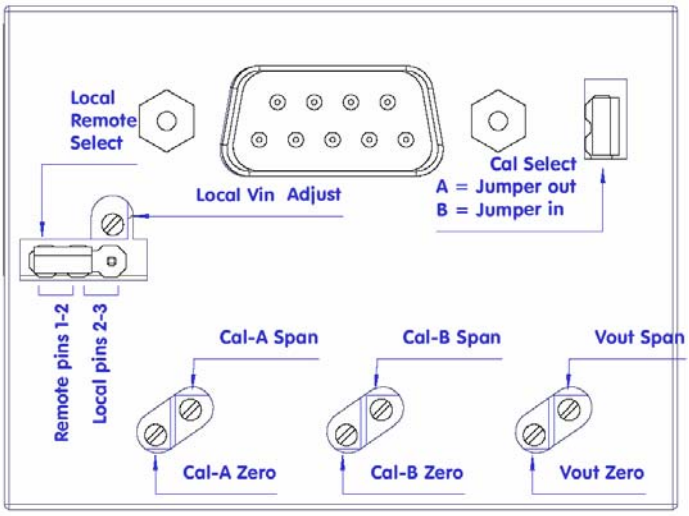
MFC connections and configuration settings



Top View

Dual Calibration:
The dual calibration feature can be selected locally from the top of the mass flow controllers enclosure. By connecting or disconnecting a 2-pin jumper located on the top of the unit, the calibration can be toggled from Cal-A to Cal-B.

Cal Select:
The mass flow controller has two signal conditioning circuits that can be calibrated for different gases. There is a default calibration and a secondary calibration that is selectable by remotely applying an "enable" signal (Signal Ground) to pin-9 of the connector or locally by re-positioning a jumper located on the MFC enclosure. This capability allows the user to select one-of-two totally different calibrations within a single MFC. So, for example, a 100sccm full scale mass flow controller can have a 100sccm Oxygen and a 100 sccm Argon calibration in the same unit. Both are accurately calibrated using the specified gas. This eliminates the 6% to 15% errors typically seen when using gas correction factors.

Local Calibration Select
Calibration A is for Oxygen. The Cal Select jumper is removed.
Calibration B is for Argon. The Cal Select jumper is installed.

Local / Remote Select
Local Set-point Adjust:
By moving an external jumper from position-one to position-two, the control signal is changed from an external (remote) source to an internal (local) source. This allows the user to set a flow rate by accessing a potentiometer located on the top of the mass flow controllers enclosure having applied only power and ground through the connector.

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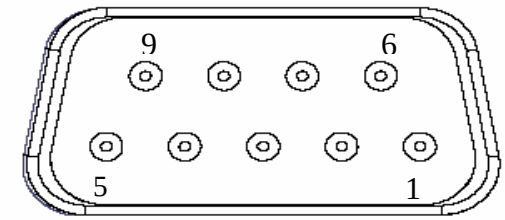
Electrical Connections

The electrical signals is supplied to on the MFC are through a 9 pin D-connector (DB-9). The signals and pin outs are given in the diagram and table below.



Pin No.	Function	Value
1	Input power	+ 15V
2	Control Signal	0-5V
3	Flow Signal Out	0-5V
4	Purge	Ground
5	Power Ground	
6	Signal Ground	
7	Signal Ground	
8	No connect	
9	Calibration select	A=open B=ground

Operating Procedure

The gases that can be used with this MFC are non-corrosive. Some examples include the following:

Ar	He
Xe	H2
N2	Hydrocarbons
O2	CO2

Start-up

a. Apply power to the MFC and allow approximately 30 minutes for the instrument to warm-up and stabilize its temperature.
b. Turn on the gas supply

Operation

a) Apply a control signal to the MFC to acquire a flow rate. Measure the output signal to read the flow measurement.
b) Adjust the control signal to achieve the desired flow rate.

Troubleshooting

1) Avoids water contamination. Excess water contamination may over time block internal filter.
2) Ensure control signal is present at MFC connector

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Warranty

Kaufman & Robinson, Inc. (KRI) warrants to the purchaser or end user of the equipment it sells that such equipment will be free from defects in material and workmanship under normal use and service. This warranty is for a period of twelve (12) months from the date of original shipment F.O.B KRI's facility in Fort Collins, Colorado. This warranty is void if the equipment is not used, operated, and maintained in accordance with the manual accompanying the equipment. KRI shall not be responsible for any direct or indirect loss or damage resulting from accident, negligence of a user, alteration, abuse, or misuse of the equipment. Upon acceptance of this Limited Warranty, purchaser waives all warranties, guarantee, or remedies not specifically stated in this Limited Warranty. This warranty does not cover ordinary wear and tear or expendable components. A list of some expendable or consumable parts is provided in the product manual.

KRI's obligation under this Limited Warranty is, at KRI's option, to repair or replace any defective equipment or parts of the equipment, without charge to the purchaser, which are returned, shipping prepaid, to the KRI facility, 1306 Blue Spruce, Unit A, and Fort Collins, Colorado, 80524 USA. For return or repair of equipment, purchaser must contact KRI for a Return Materials Authorization prior to shipment of the equipment to KRI. If KRI has designated an Authorized Warranty Service Representative in the purchaser's country, contact may be made with the Authorized Warranty Service Representative and defective equipment may be delivered to such Authorized Warranty Service Representative to service warranty claims.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranties of merchantability and fitness for any particular purpose. The purchaser acknowledges the purchaser is not relying in KRI's skill or judgment to select or furnish equipment suitable for any particular purpose.