



# MFC - P9B

## PRESSURE INSENSITIVE, MULTI-GAS/MULTI-RANGE MASS FLOW CONTROLLER FOR FAST AND ACCURATE CONTROL OF CRITICAL PROCESS GASES

The MKS, model P9B MFC, is the next generation of MKS pressure insensitive, multi-gas/multi-range MFC for critical process gas flow control. The device uses the latest in electronics and valve components enabling it to meet the most critical of process gas flow control requirements.

The performance capabilities of the P9B are quickly apparent where short process steps are required given the sub 750 millisecond control times and accuracy to within 1% of setpoint. This performance extends over the range of process gases, whether "light" gases such as helium or "heavy" gases like SF6. The P9B is a true multi-range/multi-gas MFC that enables the user to have confidence in this device's capability and minimize MFC inventory requirements.

Utilization of the multi-gas/multi-range capability is made simple through the device's embedded software and standard Ethernet interface that requires no special software, only a standard web browser and a PC. Already stored on the device are critical gas parameters for most of the gases in use today by the semiconductor industry. It is a simple matter of selecting the gas and specifying the range to configure the device. Through this interface the user can also perform device monitoring diagnostics while the device is operating.

### Features & Benefits

#### Superior Performance

- Fast response to setpoint reduces flow stabilization time for short process steps and process control
- Tightly controlled flow accuracy of process gas enables improved chamber process matching
- Insensitive to upstream and downstream pressure disturbances
  - Accurate flow control without the need for additional dedicated pressure regulators

#### Reduces Overall Costs

- Reduces MFC inventory through its multi-gas/multi-range capability

- Accurate flow control over a wide dynamic range, even when down ranged, reduces need for an additional low range MFC

#### Easy to Integrate and Operate

- Embedded configuration and diagnostics software that allows the user to check MFC functionality without device removal from the tool
- Uses a standard web browser; no special software required
- Easy viewing of flow rate, gas type and full scale flow with its bright, self orienting LED display



Flow  
& Control  
Measurement

WWW.MKSINST.COM

## Performance

|                                                                                                              |                                                                                                            |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Full Scale Flow Ranges</b> ( $N_2$ equivalent)                                                            | 5 - 50000 sccm<br>(consult factory for available flow ranges)                                              |
| <b>Maximum Inlet Pressure</b>                                                                                | 150 psig<br>(cannot exceed pressure differential requirement across MFC)                                   |
| <b>Normal Operating Pressure Differential</b> ( $N_2$ F.S.)<br>(with atmospheric pressure at the MFC outlet) | 10 to 5000 sccm; 10 to 40 psid<br>10000 to 20000 sccm; 15 to 40 psid<br>30000 to 50000 sccm; 25 to 40 psid |
| <b>Proof Pressure</b>                                                                                        | 1000 psig                                                                                                  |
| <b>Burst Pressure</b>                                                                                        | 1500 psig                                                                                                  |
| <b>Control Range</b>                                                                                         | 2% to 100% of F.S. (range on mech.)                                                                        |
| <b>Typical Accuracy</b>                                                                                      | $\pm 1\%$ of setpoint for 20 to 100% F.S.<br>$\pm 0.2\%$ of F.S. for 2 to 20% F.S.                         |
| <b>Repeatability</b>                                                                                         | $\pm 0.3\%$ of Reading                                                                                     |
| <b>Resolution</b>                                                                                            | 0.1% of Full Scale                                                                                         |
| <b>Temperature Coefficients</b>                                                                              |                                                                                                            |
| Zero                                                                                                         | $< 0.05\%$ of F.S./ $^{\circ}\text{C}$                                                                     |
| Span                                                                                                         | $< 0.08\%$ of Rdg./ $^{\circ}\text{C}$                                                                     |
| <b>Inlet Pressure Coefficient</b>                                                                            | $< 0.02\%$ of Rdg./psi                                                                                     |
| <b>Typical Controller Settling Time</b><br>(per SEMI Guideline E-17-0600)                                    | $< 750$ msec., typical above 5% F.S.                                                                       |
| <b>Warm-up Time</b><br>(to within 0.2% of F.S. of steady state performance)                                  | $< 30$ min                                                                                                 |
| <b>Operating Temperature Range (Ambient)</b>                                                                 | 10 $^{\circ}\text{C}$ to 50 $^{\circ}\text{C}$                                                             |
| <b>Storage Humidity</b>                                                                                      | 0 to 95% Relative Humidity, non-condensing                                                                 |
| <b>Storage Temperature</b>                                                                                   | -20 $^{\circ}$ to 80 $^{\circ}\text{C}$ (-4 $^{\circ}$ to 149 $^{\circ}$ F)                                |
| <b>Pressure Display</b>                                                                                      | 0 to 100 psia                                                                                              |
| <b>Pressure Readout Units</b>                                                                                | psia, kPa                                                                                                  |
| <b>Pressure Accuracy</b>                                                                                     | 1% F.S.                                                                                                    |
| <b>Pressure Resolution</b>                                                                                   | 0.1 psia                                                                                                   |
| <b>Temperature Display</b>                                                                                   | 0 to 100 $^{\circ}\text{C}$                                                                                |
| <b>Temperature Readout Units</b>                                                                             | $^{\circ}\text{C}$                                                                                         |
| <b>Temperature Accuracy</b>                                                                                  | $\pm 2^{\circ}\text{C}$                                                                                    |
| <b>Temperature Resolution</b>                                                                                | 0.1 $^{\circ}\text{C}$                                                                                     |
| <b>Attitude Insensitivity</b>                                                                                | 0.25% of FS for indicated zero, span and actual span                                                       |
| <b>Pressure Transient</b> (Inlet/Outlet Pressure Sensitivity)                                                | $\pm 5\%$ of setpoint from 20 to 100% of FS when subject to a 2 psi inlet pressure transient               |

## Mechanical

|                                   |                                                                                                                                                   |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fittings</b> (compatible with) | Swagelok® 4 VCR®, 1-1/8" surface mount (C-seal, W-seal), 1½" W-seal                                                                               |
| <b>Display</b>                    | 4 digits for value, 4 characters for unit                                                                                                         |
| <b>Leak Integrity</b>             |                                                                                                                                                   |
| External (scc/sec He)             | $< 1 \times 10^{-10}$                                                                                                                             |
| Through closed valve              | $< 1.0\%$ of F.S. at 25 psig inlet to atmosphere (range on mech.)<br>(To assure no flow-through, a separate positive shut-off valve is required.) |
| <b>Wetted Materials</b>           |                                                                                                                                                   |
| Standard                          | 316L S.S. VAR (equivalent to 316 S.S. SCQ for semiconductor quality),<br>316 S.S., Elgiloy, KM-45                                                 |
| Valve Seat                        | PTFE (Teflon)                                                                                                                                     |
| <b>Surface Finish</b>             | 10 $\mu$ inch average Ra                                                                                                                          |
| <b>Weight</b>                     | less than 3 lbs (1.4kg)                                                                                                                           |

## Electrical Analog I/O CE Compliant to EMC Directive 2004/108/EC

|                                 |                                           |
|---------------------------------|-------------------------------------------|
| <b>Input Power Required</b>     | +15 to +24 VDC @ 350mA max                |
| <b>Flow Input/Output Signal</b> | 0 to 5 VDC                                |
| <b>Output Impedance</b>         | $< 1 \Omega$                              |
| <b>Connector</b>                | 15-pin Type "D" Male, 9 pin Type "D" Male |

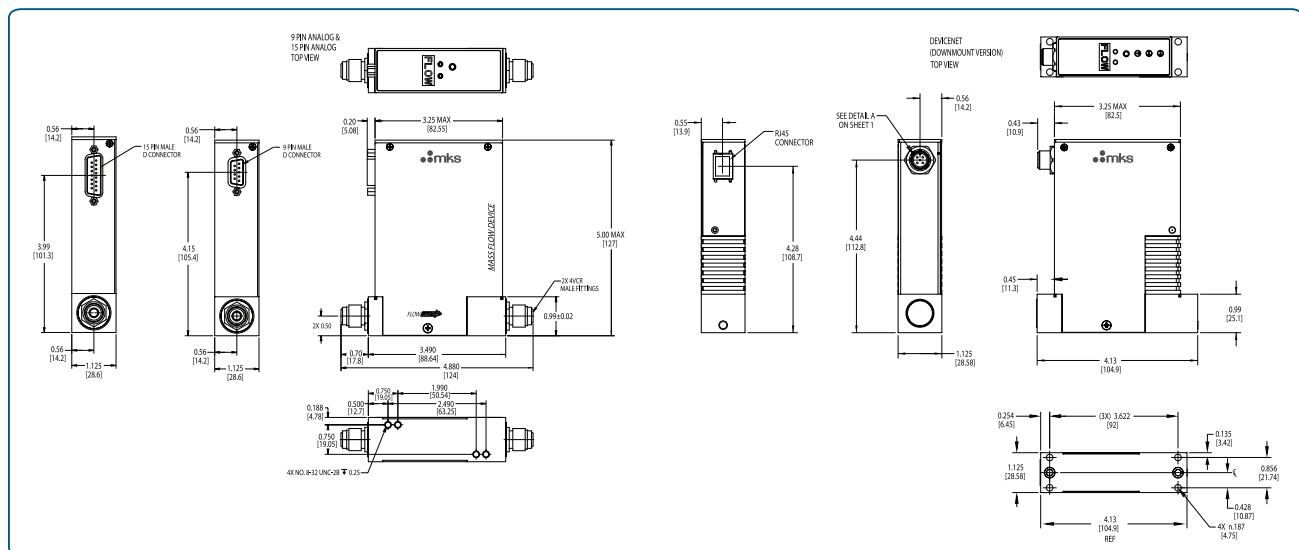


# Specifications (cont'd)

## Digital I/O CE Compliant to EMC Directive 2004/108/EC

| Digital I/O                     | DeviceNet                                                                                                                                                                         | RS-485                                                                                                                                                                 |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Power Required            | +11 to +25 VDC per DeviceNet specification (@ <3.5 watts)                                                                                                                         | +15 to +24 VDC @ 350mA max                                                                                                                                             |
| Connector                       | 5 pin microconnector (DeviceNet)                                                                                                                                                  | 9 pin Type D male                                                                                                                                                      |
| Data Rate Switch                | 4 positions: 125, 250, 500K (Default), PGM (programmable over the network)                                                                                                        | 3 positions: 9.6, 19.2, 38.4K (Default)                                                                                                                                |
| Data Rate/Network Length        | Data Rate (User Selectable)<br>125 Kbps, 500 meters (1,640 feet)<br>250 Kbps, 250 meters (820 feet)<br>500 Kbps, 100 meters (328 feet)                                            | Data Rate (User Selectable)<br>9.6 Kbps, 1200 meters (4,000 feet)<br>19.2 Kbps, 1200 meters (4,000 feet)<br>38.4 Kbps, 1200 meters (4,000 feet)                        |
| MAC ID Switches                 | 2 switches, 10 positions; 0,0 to 6,3 are hardware ID numbers; 7,0 to 9,9 are software ID numbers; (6,4 to 6,9 are unused and, if selected will default to hardware ID number 6,3) | 2 switches, 10 positions; 0,0 to 9,9. Available MAC ID's are 3,2 to 9,9.                                                                                               |
| Network Size                    | Up to 64 nodes                                                                                                                                                                    | Up to 32 nodes                                                                                                                                                         |
| Network Topology                | Linear (trunkline/dropline) power and signal on same network cable                                                                                                                | Master/slave                                                                                                                                                           |
| Visual Communication Indicators | LED network status (green/red)<br>LED module status (green/red)<br>Scrolling LED displays (MFC Type, Flow Full Scale, Gas Type, IP address, Instance Number (1 to 31))            | LED network status (green/red)<br>LED module status (green/red)<br>Scrolling LED displays (MFC Type, Flow Full Scale, Gas Type, IP address, Instance Number (1 to 31)) |

## Dimensional Drawing



### Dimensional Drawing — Analog 9 Pin D, 15-Pin D, RS-485 and DeviceNet™

Note: Unless specified, dimensions are nominal values in inches (mm referenced). Dimensions shown are for normally closed valve configuration. For normally open valve configuration dimensions, contact MKS.



# Ordering Information

## Ordering Code Example: P9B013502C6T0AA

Type MFC Mass Flow Controller (Pressure insensitive, multigas, multi-range), P9B

## Code

P9B

## Configuration

P9B

## Gas (Per Semi Standard E52-0703)

For example:

013 = Nitrogen = N<sub>2</sub>

029 = Ammonia = NH<sub>3</sub>

110 = Sulfur Hexafluoride = SF<sub>6</sub>

013

029

110

013

## Flow Range Full Scale\*

5 sccm

10 sccm

20 sccm

50 sccm

100 sccm

200 sccm

500 sccm

1000 sccm

2000 sccm

5000 sccm

10000 sccm

20000 sccm

30000 sccm

50000 sccm

500

101

201

501

102

202

502

103

203

503

104

204

304

504

502

## Fittings (compatible with)

Swagelok 4 VCR

C-seal (1.125")

W-seal (1.125")

W-seal (1.5")

R

C

H

F

C

## Connector

DeviceNet

RS485 (uses 9 pin connector)

15 pin D (Analog I/O)

9 pin D (Analog I/O)

6

5

B

A

6

## Valve

Normally Closed, Teflon®: (5 sccm - 50 slm N<sub>2</sub> equivalent)

Normally Open, Teflon: (5 sccm to 50 slm N<sub>2</sub> equivalent)

No valve (MFM)

T

P

0

T

## Reserved for MKS Future Use

Standard

0

0

## Firmware

Unless otherwise specified, MKS will ship firmware revision current to date

Alpha characters for firmware revision specify pre-production release versions

AA

AA

\* The Full Scale Flowrate is designated by a 3 digit number. The first two digits represent the significant digits of the FS flow rate separated by a decimal point. The third digit is the exponent of the power of ten.

Example Flowrate code:

254 is 2.5 x 10<sup>4</sup> or 25000 sccm

153 is 1.5 x 10<sup>3</sup> or 1500 sccm

601 is 6.0 x 10<sup>1</sup> or 60 sccm



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