

Lab 9

Mass Flow Controller Troubleshooting with a Breakout Connector

Name: _____

Purpose

The purpose of this lab is to become familiar with the use of a breakout connector and a voltmeter to perform diagnostics on a mass flow controller.

Review

By observing the voltages at the pins of a mass flow controller, it is frequently possible to diagnose problems without removing the MFC from the system. As the cabling to the MFC usually involves shielded wiring and connectors, a breakout connector may be used to access the pins.

In some cases, the problem may be due to noise (often a problem associated with rf plasma systems), ground loops, etc. In other cases the tool's a/d converter may be incorrectly calibrated, causing the wrong set point voltage to appear on the pin or a wrong flow indication to be interpreted by the host computer.

A useful indicator of the "health" of the MFC is represented by the valve drive voltage. A valve driver test point is always available for this purpose. However, different MFCs will have differing valve driver voltage vs flow characteristics. Therefore it is important to perform a baseline on each type of MFC to understand what the response is under normal circumstances. Deviations can then be used to indicate a problem.

In this exercise we will develop a baseline for three parameters: set point input, flow meter output and valve driver test point voltage. This will be done at several set points from 0 sccm to 100 sccm. A fault will then be introduced by the instructor and the measurements will be repeated. From these measurements you will determine what problem or problems might exist with the MFC.

Procedure

In this lab, the vacuum trainer is only used as a source of downstream vacuum for the MFC. Configure the system to operate in manual mode with the throttle and butterfly valves fully open. Proceed as follows:

- Ensure that the breakout connector (MKS part number TBD-15) is connected to the MFC and that the MFC is fully warmed up (power on for at least 5 minutes).
- Zero the MFC. Enter Set Up Mode and with the system at atmosphere and

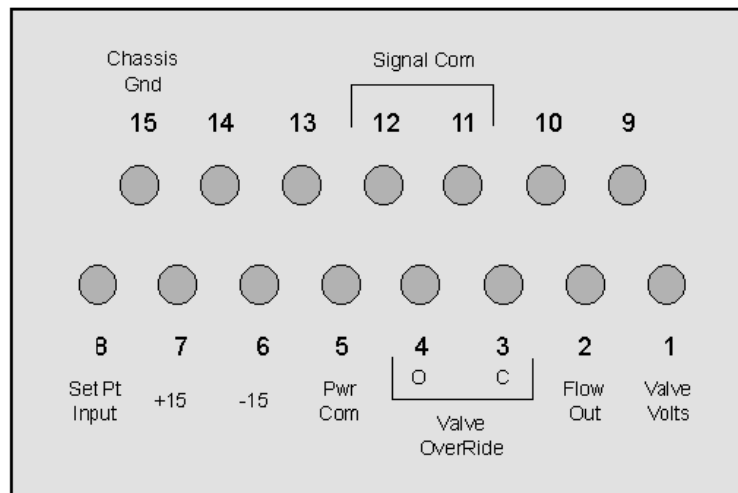
both the inlet and outlet tubes of the MFC pinched closed, give the MFC a set point of 0 sccm. Adjust the zero pot on the MFC until the flow indication (Channel 4) reads 0.0 sccm.

- Ensure that the system vent is closed and start the vacuum pump. There is no need to monitor system pressure beyond ensuring that it is below about 10 Torr at all times.

Using a Digital Volt Meter, check the power supply voltages. Refer to the figure below for the pinouts (these are also detailed on the MFC's case). Record the measured values here. Referring to the MFC's manual, are these values within the specification limits?

With the DVM set to measure AC voltage, ensure that the AC noise is less than 50 mV RMS on the plus and minus power connections. Record your measurements here.

With the DVM set to measure DC voltage, check for ground loops or stray voltages between the common and ground pins. No voltage should be present between any pair. Record your measurements here.



With pinch clamps removed from the MFC's inlet and outlet lines, and with the flow set point input still at 0 sccm, record the set point input voltage (pin #8), flow meter output (pin #2) and valve driver test point voltage (pin #1). Enter these values in the table below. (Use the upper part of the boxes - corresponding to Run 1 - for each of these measurements.)

Change the set point to 25 sccm and repeat the measurements. Do the same for 50, 75 and 100 sccm set points.

From your measurements of the set point input and flow meter output voltages, does the MFC appear to be functioning properly? Explain.

Flow Set Point (sccm)		Pin #8 Set Point Input	Pin #2 Flow Meter Output	Pin #1 Valve Driver TP
0	Run 1	-----	-----	-----
	Run 2			
25	Run 1	-----	-----	-----
	Run 2			
50	Run 1	-----	-----	-----
	Run 2			
75	Run 1	-----	-----	-----
	Run 2			
100	Run 1	-----	-----	-----
	Run 2			

What conclusions can you draw from the valve voltage measurements? Is there a trend from low set points to high set points?

At this point your instructor or lab assistant will introduce one or more faults into your MFC.

Once this has been done, repeat your measurements at set points of 1, 25, 50, 75 and 100 sccm. Enter each value in the table in the spaces corresponding to Run 2.

Compare your results for each set of readings. Note your conclusions as to the faults that have been introduced into the MFC. Explain your thought processes thoroughly.

Lab written by S. Hansen at MKS Instruments and M. Quirk at Austin Community College, based on information from the VTS-1 equipment manual written by MKS Instruments, Inc. Comments may be submitted to S. Hansen at: MKS Instruments, Inc., Six Shattuck Rd., Andover, MA 01 or by email to hansens@mksinst.com.

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