

Mass Flow Controller Calibration

- The following slides show how to calibrate mass flow controllers using a flow reference cell and a PID controller.
- This document was made for a specific station with three mass flow controllers, but the methods used are the same regardless of station configuration.
- The plumbing connections may be slightly different at your station.
- You want to calibrate the mass flow meters at standard liters per minute (SLPM) and to make sure that the standard flow is set to 0 C.

Flow check of mass flow controllers

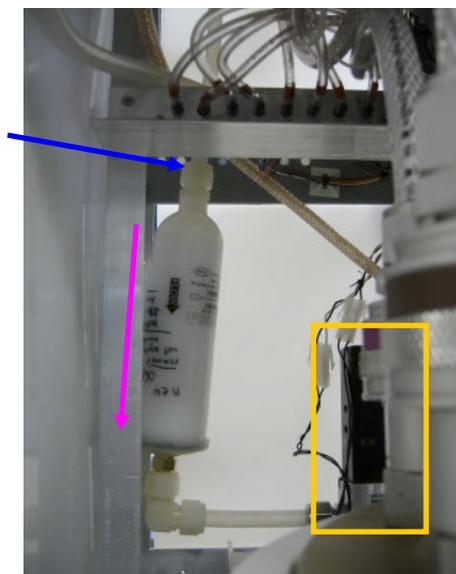
This will involve doing calibrations on three mass flow controllers. At most sites there is only one MFC – in the main aerosol rack. At BRW there are also MFCs in filter rack#1 (PMEL filter rack) and filter rack#2 (Scripps filter rack).

Please put a message in the message log before you start each flow controller calibration and after you end each flow controller calibration.

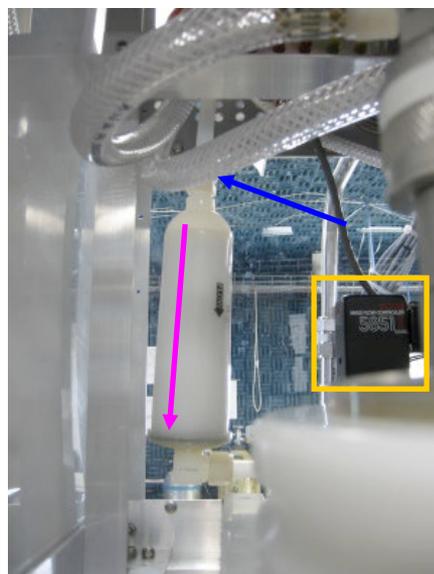
Blue arrows indicate where to disconnect tubing and attach the BIOS for a flow measurement.

Pink arrows indicate direction of flow

Yellow boxes show flow controller



Looking from front of filter rack#1

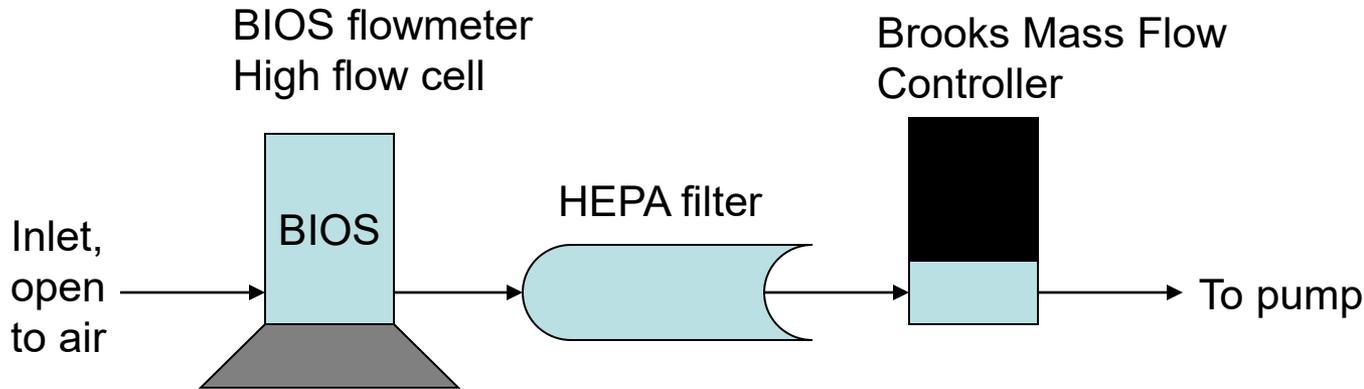


Looking from front of filter rack#2

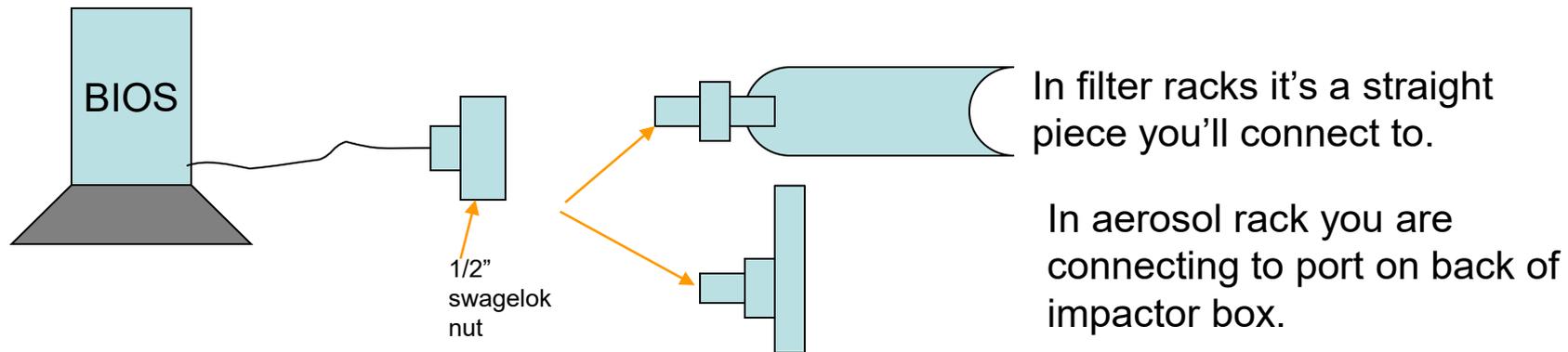


Connect flow meter to port labeled 'return flow from neph'. Flow controller and filter are in impactor box.

Flow check, cont'd



You'll need to connect the tube from the BIOS onto a 1/2" swagelok fitting connected to the back end of the HEPA filter or the back of the impactor box.



Be careful not to strip the nylon fittings if the connecting nut is metal!

Flow check, cont'd

Adjust the setpoint of the LOVE PID controller for the flow you are checking and measure the flow with the BIOS. The BIOS automatically makes 10 measurements and averages them if you choose the button that does a series. The BIOS reports 2 types of flows: volumetric and standard (mass flow).

Record the LOVE PID flow reading, and the BIOS standard flow (average of 10). Hit reset on the BIOS; adjust the setpoint on the LOVE PID and so forth. Please measure over the range from 10 to 40 in increments of 5 lpm. Put the flow back to what it was before you started the flow check. Send the numbers to Boulder and we'll take it from there.



Up arrow

down arrow

enter

How to adjust the setpoint on the love controllers.

To adjust the the flow upward hit the 'up arrow' button until the green numbers are at the value you want. Then hit the enter button. Similarly to adjust the flow downward hit the 'down arrow' until you get the flow you want and then hit the enter button.

Note: at most sites the flow is now set in the configuration program, so you'll need to change the flow there and then restart data acquisition for each flow calibration point.

Flow check, cont'd

Record the PID setting (green#) the PID reading (red#) and the **standard** flow (SLPM) from the bios.

Aerosol Rack MFC

PID setting (green numbers)	PID reading (red numbers)	Standard flow (SLPM) (from BIOS)
10	_____	_____
15	_____	_____
20	_____	_____
25	_____	_____
30	_____	_____
35	_____	_____
40	_____	_____

Filter Rack#1 MFC

PID setting (green numbers)	PID reading (red numbers)	Standard flow (SLPM) (from BIOS)
10	_____	_____
15	_____	_____
20	_____	_____
25	_____	_____
30	_____	_____
35	_____	_____
40	_____	_____

Filter Rack#2 MFC

PID setting (green numbers)	PID reading (red numbers)	Standard flow (SLPM) (from BIOS)
10	_____	_____
15	_____	_____
20	_____	_____
25	_____	_____
30	_____	_____
35	_____	_____
40	_____	_____

Use your favorite plotting code to come up with a calibration in the form $\text{BIOS_SLPM} = \text{slope} * \text{PID_reading} + \text{offset}$. Note that you actually need to set the flow so that you get 30 VLPM so figure out your typical T and P to come up with that value.