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Service Note

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How to Calibrate the NO Flow Sensor in the M265 O_3 Analyzer

I. PURPOSE:

To calibrate the very low flow of 5 cm³/min NO reactant gas in the M265A analyzer and avoid excess NO flow and gas tank drain.

II. TOOLS:

9/16" and 7/16"wrenches,
small and medium slot screw drivers
medium Phillips screw driver
Accurate flow meter for flow range 0-10 cm³/min.

III. PARTS:

1/8" cap
1/4" union fitting

IV. PROCEDURE:

CAUTION:
THIS PROCEDURE SHOULD ONLY BE CARRIED OUT BY QUALIFIED TECHNICAL PERSONNEL.
WORKING ON THE ANALYZER WHILE OPERATING IS A HAZARDOUS OPERATION AND CAN RESULT IN SERIOUS PERSONAL INJURY OR DAMAGE TO THE INSTRUMENT!

1. Remove the analyzer cover while the analyzer is running. Provide pure nitrogen from a gas tank to the NO input port at 20 psi pressure. Do not use the NO reactant, as this may drain your (expensive) gas tank and also contaminate your laboratory significantly with NO. NO at 10000 ppm is hazardous and may not be vented to the room. If no other possibility is available, vent the outlet of the reference flow meter outside the room or into a venting duct. Follow the pneumatic diagram in Figure 1 for the following procedures.

2. Disconnect the 1/8" sample tubing from the reaction cell and plug its inlet port on the reaction cell with a 1/8" cap, see Diagram on page 2.

3. Disconnect the 1/4" vacuum tube from the vacuum manifold (do not detach it from the reaction cell as this may damage the PMT through excess light) and attach the INPUT port of an accurate reference flow meter (BIOS or Rotameter) to that 1/4" vacuum tube with a union fitting. Leave the OUTPUT port of the reference flow meter open to ambient air. Note that the reference flow meter must be accurate enough to measure 0.2 cc/min flow changes in the range 0-10 cc/min.

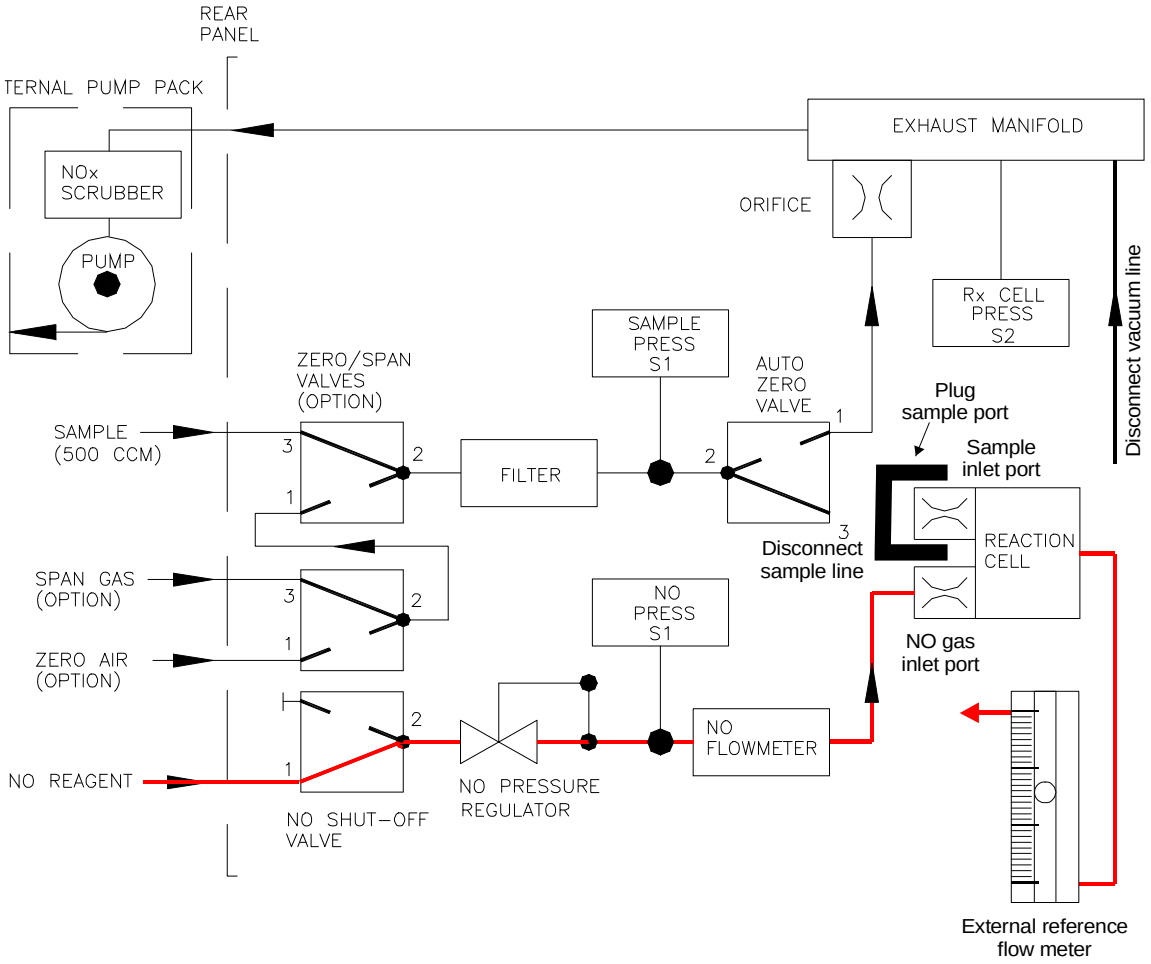

FIGURE 1

4. Confirm zero point: Select the NO FLOW test function on the front panel of your analyzer. Disconnect the NO shut off solenoid valve, which is connected to the pressure regulator on the rear panel. This will shut off the NO reactant flow stream. Allow a few minutes for the gas to drain out of the instrument. When the NO FLOW reading on the front panel is stable, read the flow and – if outside of ± 1 cc/min – note this "zero flow" for future reference. Confirm with your reference flow meter that the flow is really zero. A small offset on the analyzer's NO flow meter is normal and will be adjusted in the next step.

5. Span calibration of flow meter: re-connect the solenoid valve to start NO FLOW. Turn on the nitrogen (or NO reactant) gas and adjust the tank regulator to 20 psi or 1.4 bar. Adjust the NO pressure regulator on the back panel such that you get about 5-10 cc/min of NO flow as measured with your reference flow meter. The absolute value of the flow is not important as long as it is stable and within 5-10 cc/min. Allow the flow to stabilize. Note: some older systems run at 20 cc/min NO reactant flow (not 5 cc/min). In this case, adjust the flow to about 20 cc/min for this flow meter calibration.

6. Change the front panel TST function to read NO FLOW and compare the flow with that of your reference flow meter. Adjust the flow sensor span potentiometer (Figure 2) until you get the same reading for NO flow on the front panel and on the reference flow meter.

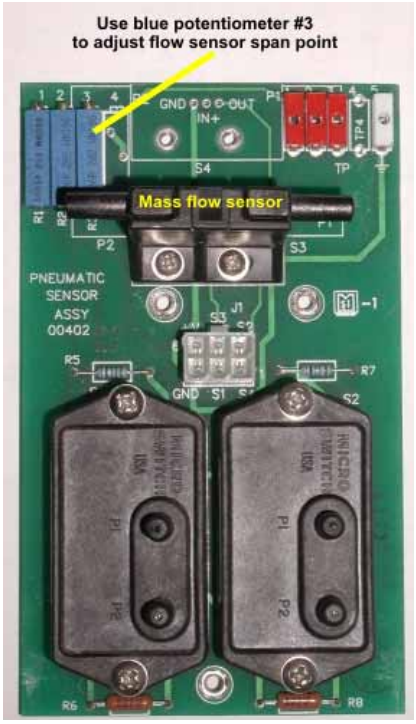

Figure 2: Pneumatic sensor board.

7. Reconnect the reaction cell sample flow and the vacuum exhaust port properly to the reaction cell and leak check the system.

8. When the system has stabilized, adjust the NO flow to about 5 ± 0.5 cc/min and make sure that the tank pressure supplies gas at a constant 20 psi (1.4 bar). Note: Some older systems run on 20 cc/min NO reactant flow instead of 5 cc/min. In this case, adjust to 20 ± 1 cc/min NO flow.

9. Carry out a zero and span calibration of the instrument. If the flow meter was significantly adjusted, the instrument response will change significantly after the calibration.

NOTES:

- It is important that you use a sufficiently accurate reference flow meter for this calibration, a the flow calibration will only be as good as the accuracy of your reference flow meter. We recommend to use an electronic flow meter such as the BIOS system or a calibrated / certified Rotameter type flow meter with a range of 0-30 cc/min. Certified accuracy to 5% or better is desired.
- Note that the flow under calibration will not be the same as the flow under operation. The gas flows across a critical orifice and the pressure difference across the orifice determines the flow rate. In the latter case, the vacuum will yield a significantly higher flow rate than when measured against ambient pressure. This is why the actual flow needs to be adjusted for normal (vacuum) operation after the calibration.
- Due to the unlinearity of the flow meter in the 265A, the flow calibration is only valid to within 5 cc/min of the set point. If the flow meter was calibrated at 10 cc/min, calibration is sufficiently accurate between 5 and 15 cc/min. Do not calibrate the flow meter at high flows (> 10 cc/min) for operation at 5 cc/min NO reactant!
- Finally, it is important to run the 265A with a constant supply pressure of NO reactant gas. The recommended 20 psi (1.4 bar) delivery pressure should be kept as constant as possible. Any change in this pressure will require you to re-adjust the NO FLOW.