UCD CSN Technical Information #402I

Flow Sensor Calibration

Chemical Speciation Network
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DOCUMENT HISTORY

Date Modified	Initials	Section/s Modified	Brief Description of Modifications

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1. PURPOSE AND APPLICABILITY

The subject of this technical information document (TI) is to describe the procedures for calibrating and verifying the flow rates of the five support gases used in the operation of the Sunset Carbon Analyzers.

2. SUMMARY OF THE METHOD

The five support gases which are integral to the operation of the instrument must have stable and accurate flows through the instrument in order for accurate results. As the gasses pass through the instrument at different flow rates, different voltages are observed through the instrument software as a function of the different flow rates. These voltages are compared with the flow measurements from an external NIST-traceable gas flow meter. From these measurements, equations and trend lines are generated and the resulting equation coefficients are used to calibrate the sensor readings of the instrument.

3. DEFINITIONS

Not applicable.

4. HEALTH AND SAFETY WARNINGS

4.1 Gas cylinders

It is recommended that the lab technicians use caution when handling all support gas cylinders and regulators, and always have cylinders properly chained to a safety rack.

NOTE: Hydrogen is a flammable gas and extra precautions should be used with the hydrogen gas lines from the supply cylinder to ensure all fittings are connected and must be leak tested each time a new cylinder is installed. The pressure of the hydrogen gas line should be kept under 15 psi at all times.

5. CAUTIONS

Not applicable.

6. INTERFERENCES

Not applicable.

7. PERSONNEL QUALIFICATIONS, DUTIES, AND TRAINING

Only trained lab personnel designated by the Laboratory Manager may perform the procedure.

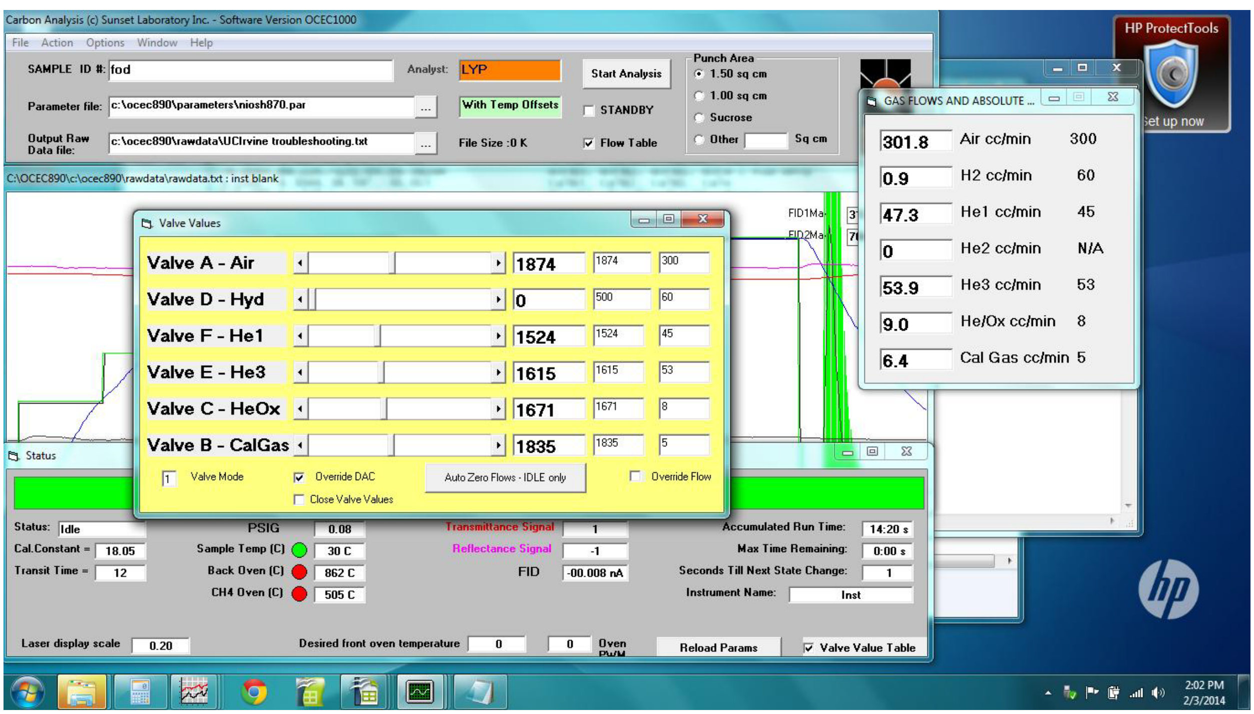
8. EQUIPMENT AND SUPPLIES

1. NIST-Traceable Gas Flow Meter
2. 7/16-inch open-ended wrench

9. PROCEDURAL STEPS

1. Turn off methanator and allow methantor oven to cool (if methanator oven is on).
2. Verify the five support gas cylinder valves and regulators are open, open them if they are closed. Verify the secondary regulators are at approximately 20 PSI (1.38 bar), adjust them if they are off.
3. Open analysis software and let the gases purge for five minutes at idle flows.
4. Open the "Valve Values Table" by checking **Valve Values Table** check box. The check box can be revealed by moving the status window up slightly and dragging the right corner down slightly.
5. After five minutes, put the instrument in "Standby" mode (all of the flow calibrations will be in standby mode).
6. Check the **Override DAC** check box to allow manual control of the gas flows via the slider bars and DAC values (second column from the left on the "Valve Values" table).
7. Calibrate the He/Ox mixture flow first. Close the helium gas at the tank or junction box.
8. Expand the bottom of the "Gas Flow" window to reveal "Display Sensor Voltages". Check the box so the flow rate display will switch over to the absolute voltage output for each flow sensor as a function of the gas flow rate.
9. Disconnect the Swageloc™ 1/8" fitting on the bottom right corner of the front of the instrument and connect the flow meter to this fitting.
10. Use the slider bar to turn the He/Ox flow rate up to approximately 100 ml/min (monitor this on your flow meter).
11. Once the flow has stabilized, record the flow rate and corresponding voltage on the table.
12. Adjust the flow downward in ~20 ml/min increments recording the flow and voltage at each step. Take a total of 6 measurements with at least two in the 5 - 20 ml/min range.
13. Close the He/Ox at the tank or junction box and allow the remaining gas in the system to leak down so there is zero flow in the flow meter. Record this voltage and zero-flow as the final reading for the He/Ox. Leave the tank closed.
14. Open the helium at the tank or junction box. Let purge for 1-2 minutes.
15. With the system in "Standby" and the He/Ox turned off, the only flow out of the front port is Helium1. Because this gas flow operates at a higher flow than He/Ox, take the initial reading in the 120 - 140 ml/min range and work down to the 10 - 15 ml/min range. Do not close the helium valve/tank. Leave space for the zero flow measurement.
16. Connect the flow meter to "To MethOv". Close the hydrogen flow at the tank and allow the flow rate to drop to zero (watch the flow table voltage drop to a minimum). With the H2 and He/Ox off, the only flow out of this port is Helium3.
17. Record a voltage vs. flow data set in a range similar to Helium1.

18. Close the helium flow at the tank and let the He1 and He3 flows drop to zero, opening the valves by sliding the bars all the way to the right to speed up the process.
19. Record the voltage for each of the zero flows for He1 and He3.
20. Record the zero flow voltage for H2, then turn on the tank at the regulator.
21. Allow the hydrogen to flow for approximately 5 minutes then record a voltage vs. flow for that gas (also at the "To MethOv" port).
22. Close the Hydrogen valve at the tank or junction box.
23. Move the flow meter to the "CalGas Vent" port and record a complete voltage vs. flow data set including the zero flow for the helium/methane tank mixture. The initial flow should be in the 80 - 100 ml/min range.
24. Move the flow meter to the "To FID" port and make a voltage vs. flow data set for air.
25. This sensor is typically not linear (third order polynomial) for its normal operating range so at least 7 points should be measured beginning at about the 350 ml/min range down, in 50 ml/min increments.
26. Take a zero flow reading.
27. Once the data are collected, generate equations and trendlines. For all gases except air the equations will be linear (y = ax + b).
28. Use the equation coefficients to replace the existing coefficients in the "InstrumentParameters.txt" file in the "OCECPAR" folder of the C:drive.



10. QUALITY ASSURANCE AND QUALTY CONTROL

Not Applicable.

11. REFERENCES

OCEC Lab Manual (Model 5L) Rev 8.051