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Tech Note: MIP-GC configuration and how to check flows on the SRI model 310 GC1000
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For the MIP detector system to operate properly the detectors need to have the correct gas flows. The SRI model 310 GC (standard in the Geoprobe Systems® GC1000) makes checking the detector system flows easier than ever. Hydrogen (H_2) and Nitrogen (N_2) tank pressure output should be set between 30-40PSI at the tank regulator to supply the proper pressure needed for the complete system. Flow from the built in air compressor is split underneath the GC between the XSD & FID. The air supply is controlled with a set screw located on the front of the GC. Below are the detector flows settings of the standard GC1000 (Figure 1) setup.

PID:

- MIP Carrier Flow (N_2) – 100% - 40ml/min
- Detector temperature setting – 150°C
- PID current 70 (0.70ma)
- Gain set on high
- PID exhaust is split between XSD & FID

Figure 1: GC1000 SRI 310 plus XSD

FID:

- Carrier N_2 MIP-PID effluent – 35-50% - 13.5-20ml/min
- Hydrogen (H_2) – 25ml/min
- AIR – 250ml/min (1:10 ratio of H_2-air)
- Detector temperature setting – 250°C
- FID ignitor set at -600 (6.0V)
- Gain set on high

XSD:

- Carrier N_2 MIP-PID effluent – 50-65% - 20-26.5ml/min
- Air – 30ml/min (split 50:50 wall & jet input of XSD)
- Detector temperature setting – 1,000°C or 1,100°C
- Gain set on High (100)

The nafion dryer is installed inside the GC Oven (Figure 3). The nafion dryer is used to remove water vapors from the trunkline carrier gas stream. In order to effectively remove water vapor, the dryer will be set to a flow rate of twice the trunkline carrier flow rate. Primary flow for the dryer is set through the GC carrier gas set screw, adjusted using a small standard screwdriver in the carrier pressure Electronic Pressure Controller (EPC) set-screw (Figure 4 shows H_2 adjustment). The needle valve on the nafion dryer (Figure 2) is used for fine adjustments to bring the dryer flow rate to 80 ml/min when the trunkline flow rate is 40 ml/min.

Figure 2: Nafion dryer and needle valve

The carrier gas (N_2) of the trunkline will always flow so long as the tank is on and the Mass regulator is on and pressurized to 20 PSI. With the trunkline connected and close coupled or connected to a probe with a membrane installed carrier flow will be returning to the GC.

The hydrogen (H_2), air and N_2 dryer gas can only be measured if the SRI GC is turned on. The H_2 tank can be turned on but if the GC is not powered up the GC's EPC will not move the gas. With the GC on the air compressor switch needs to be in the up position to pump the air to the FID and XSD.

- To check flows at the detectors (Figure 3):
    1. FID: remove the signal cable from FID exhaust port and using a digital flow meter measure flows.
    2. XSD: remove XSD detector from mounting base.
    3. Insert XSD flow measuring bayonet connector.
    4. Turn N_2 tank on and pressurize the trunkline.

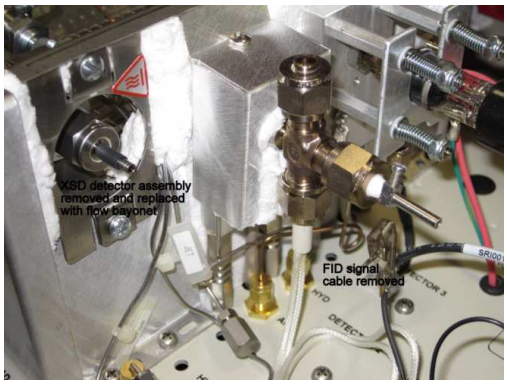

Figure 3: XSD and FID ready for flow measurement

- First check the carrier flow rate and detector split
    5. With the GC turned off, only the N_2 carrier flow will go through the detectors.
    6. First measure the trunkline (TL) carrier return on the gas line supplying the GC oven. This will be the total carrier return flow heading into the PID.
    7. Measure the flow out the FID exhaust
    8. Measure the flow out the XSD flow measuring port. The 2 flows should equal the TL carrier return flow rate.
    9. If the GC does not have an XSD or it is not connected and the flow is going from the PID into the FID the exhaust carrier flow out the FID should equal the TL return flow.
    10. If the 2 flows do not add up to within 2 ml/min, measure the flow from the nafion dryer exhaust prior to heading into the PID. Now reconnect fitting nut and measure carrier flow out the PID exhaust at the point of the detector T-splitter. Where you have the greatest difference in flow is where the leak is – the PID lamp seal or the seals within the nafion dryer. There can be some leakage (usually within 2ml/min) within the PID that will go away when the detectors and seals are heated up.

- Measuring Air flow rate on FID and XSD
    11. Power up the GC.
    12. Leave the H_2 tank turned off.
    13. Turn on the switch to the air compressor.
    14. Disconnect the trunkline carrier return input to the GC. Only the air flow will now go through the detectors.
    15. Connect the flow meter to the XSD flow measuring port. The XSD air flow should equal 20-30ml/min.
    16. Connect the flow meter to the FID exhaust port. The FID air flow should equal 250ml/min. Adjustments can be made through the set screw in the front of the GC (see Figure 4).

Figure 4 Adjusting the H_2 flow for the FID

- Measuring H_2 Flow rate on FID
    17. Turn the H_2 tank on.
    18. Turn off the air compressor switch.
    19. GC power is on and the trunkline is disconnected. Only the H_2 flow will now go through the detectors.
    20. Measure the H_2 flow out the FID exhaust. The H_2 flow should equal 25ml/min (10% of the air flow rate).

- Starting the detectors and operating the system
    21. Make sure both the N_2 and H_2 tanks are on and flow is being sent out.
    22. Turn on the switches for the air compressor and the PID lamp current (located on the front of the GC below the EPC controls and detector parameters – Figure 4).
    23. Connect the trunkline return line to the GC Inlet.
    24. Reconnect FID signal wire to FID exhaust port
    25. Remove XSD flow bayonet device and replace the XSD detector assembly.
    26. Replace the XSD signal cable on the end of the detector and the heater cable to the side of the detector.
    27. Make sure the GC top lid is down and allow the detectors to heat up to temp.
    28. When detectors are at temperature hold up the FID ignitor for 5 seconds.
    29. Verify the FID is lite with a shiny wrench at the end of the FID exhaust. The wrench will accumulate fog if the FID is lite. If it is not lite, hold up the FID ignitor switch for about 4 seconds. The baseline will rapidly increase and after it settles back down an overall increase in the baseline should be present. Perform the wrench test for fog again to verify the FID is lite.

Typical detector setup (Figure 5) for Geoprobe Systems® GC1000 configured for MIP Logging

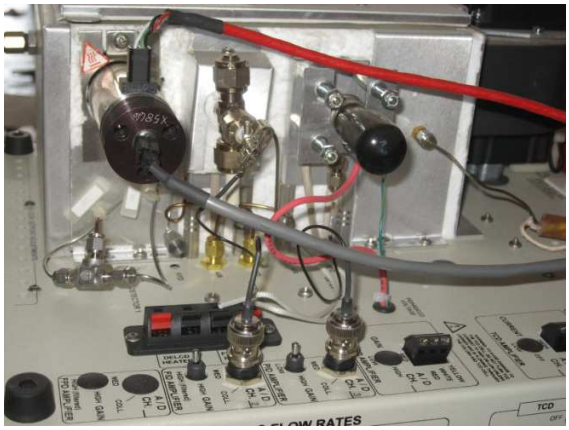

Figure 5: GC Detectors left to right: XSD, FID & PID

- SRI 310 GC detector 1 position – XSD (not controlled by GC)
- SRI 310 GC detector 2 position – FID
- SRI 310 GC detector 3 position – PID
- Nafion dryer installed inside GC oven
- GC oven set to 85°C – 100°C max temp. (Elevated temperature set)

Figure 6: GC Oven plumbing of detectors: XSD, FID & PID

Flow comes into the GC oven via a 1/16" bulkhead fitting located in the 4th detector position furthest back (See Figure 6 left side) behind the PID detector. The transfer line connects to this bulkhead and a 1/16" stainless steel line transports flow into the nafion dryer. Silco steel tubing takes this to the PID lamp which is inserted up to the lamp and backed off with a graphite/vespel ferrule seal and tightened. A 1/16" stainless steel line brings it back into the GC oven where it is split between the FID and XSD and sent to them via a silco-steel line to the XSD and a stainless steel line to the FID.