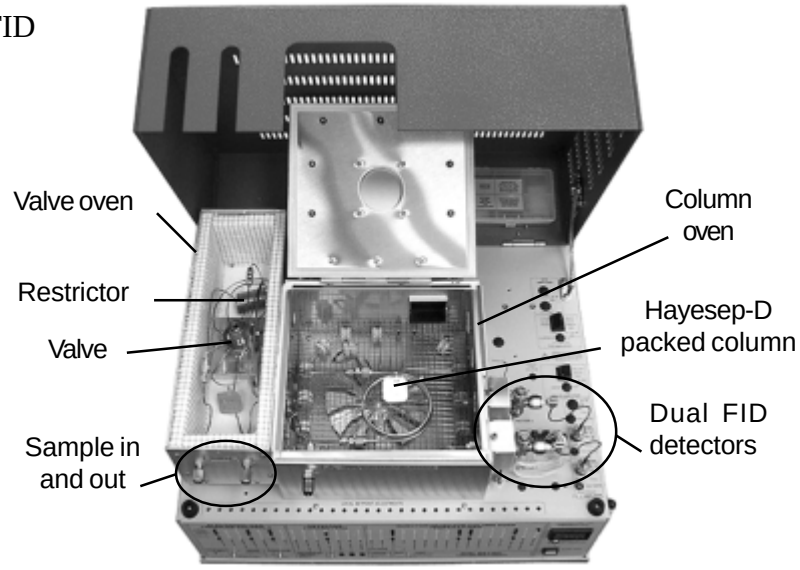
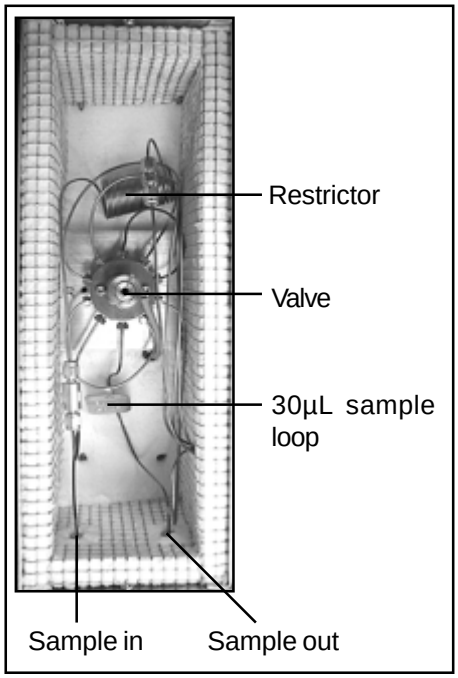
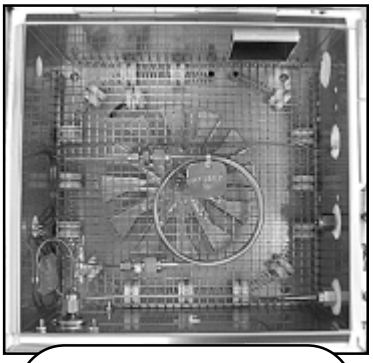
System Overview

The Mud-logger GC system is designed to provide a continous reading of total hydrocarbons in a gas stream, while periodically performing a chromatographic separation of the sample to determine the composition of the sample gas stream. This is accomplished with a flow restrictor for the monitoring FID (#2), and 10-port gas sampling valve & sample loop for the speciation FID (#1). In the temperature-programmable column oven, the 3-meter Hayesep-D packed column efficiently separates the constituent hydrocarbons peaks (C_1-C_6).

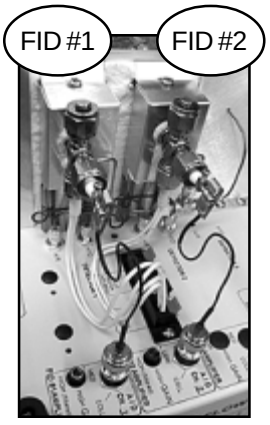




In the heated valve oven, the sample inlet is split between the 10-port gas sampling valve and the restrictor. The restrictor controls the sample flow rate for the hydrocarbon monitoring FID (#2). The gas sampling valve periodically injects the contents of the sample loop onto the column for speciation by FID #1. In the temperature-programmable (ambient to 400°C) column oven, the 3-meter Hayesep-D packed column efficiently separates the hydrocarbons up to C_6. Valve injections are automated by the built-in PeakSimple data system, and the timing is determined by the user.



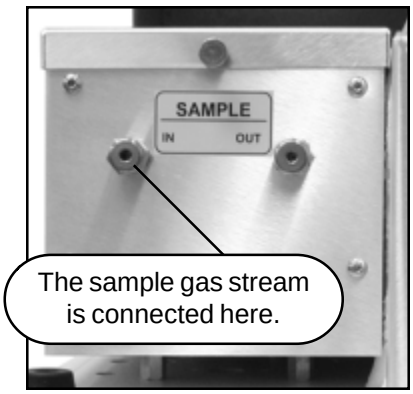
3-meter Hayesep-D packed column

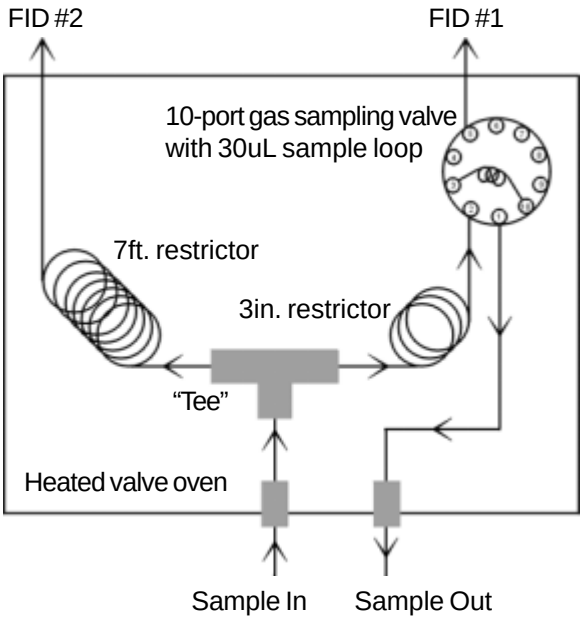


Designated as FID #1, the speciation FID signal occupies channel 1. FID #2, the total hydrocarbon monitor, is displayed on channel 2. Using Data logger mode, PeakSimple will display a scaled and calibrated result in large numbers for at-a-glance visibility. PeakSimple has an alarm function which you can set to alert you when the system receives out-of-range readings. A built-in, "whisper quiet" air compressor supplies the combustion air for both FID detectors.

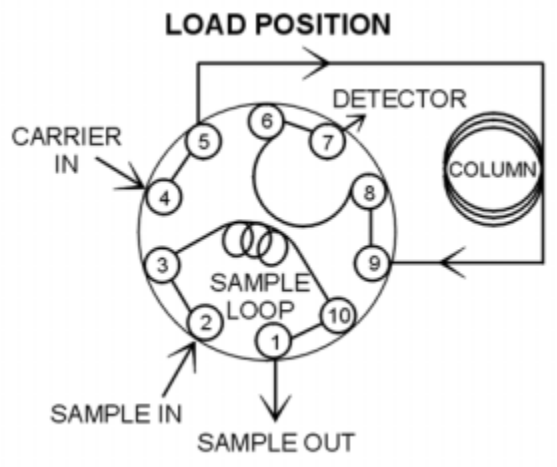
Theory of Operation

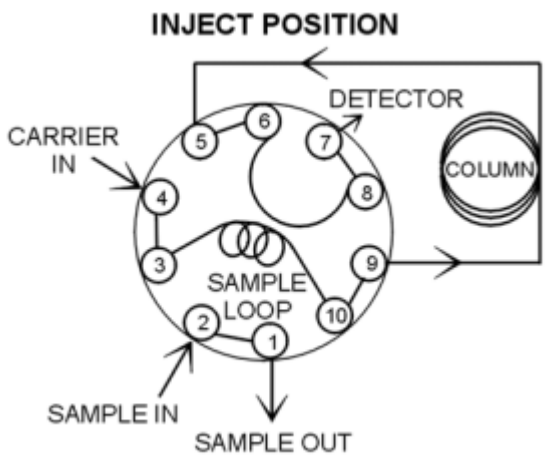
The sample gas stream is connected to the bulkhead fitting on the front of the valve oven. Inside the valve oven, the sample flow is split through a "T." On one side of the T, the flow is directed through a restrictor, through the sampling loop on the 10-port valve, and on to the column and FID #1 for separation and detection. The other side of the T directs the sample gas stream through a much longer restrictor, and on to FID #2.





The 10-port gas sampling valve is plumbed to backflush the column to the detector. At an automatically repeating time interval controlled through the built-in PeakSimple data system, the gas sampling valve injects the contents of its 30µL sample loop into the Hayesep-D column. There, it is separated into the constituent hydrocarbon peaks, which are detected by FID #1. In the LOAD position, the carrier gas flows into the column while sample gas flows through the sample loop and out to vent. In the INJECT position, the carrier gas flows first through the sample loop, then sweeps the sample into the Hayesep-D column.



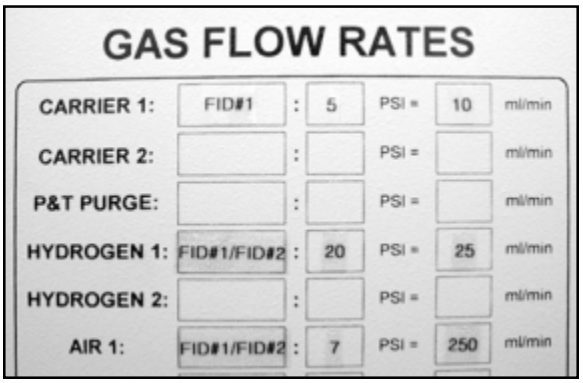


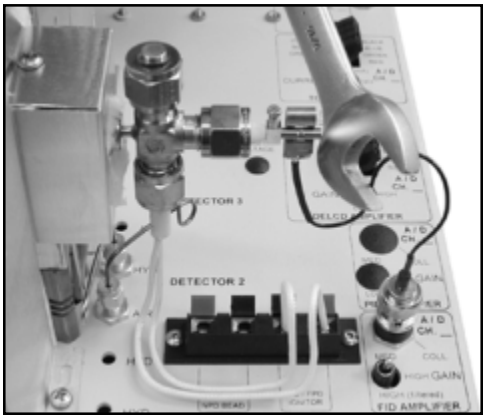
General Operating Procedure

1. Set the valve oven temperature to 90°C.

2. For FID #1, set the amplifier gain switch to MEDIUM. For FID #2, set the gain switch to LOW.

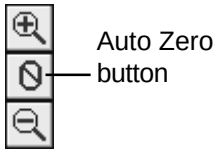
3. Set the FID hydrogen flow to 25mL/minute, and the FID air supply flow to 250mL/minute. The approximate pressures required to achieve these flow rates are printed on the right-hand side of your Mud-logger GC.





4. Ignite each FID by holding up the ignitor switch for a couple of seconds until you hear a small POP. The ignitor switches are located on the front panel of the GC. Verify that the flame is lit by holding the shiny side of chromed wrench directly in front of the collector outlet/FID exhaust vent. If condensation becomes visible on the wrench surface, the flame is lit. To prevent flameout, set the ignitor voltage to -750 by adjusting the trimpot on the "FLAME IGNITE" zone with the supplied screwdriver.

5. Connect zero gas to the sample inlet at 10psi. (Zero gas has no hydrocarbons). Zero the FID #2 signal by clicking on the Auto Zero button on the left side of the channel 2 chromatogram window.

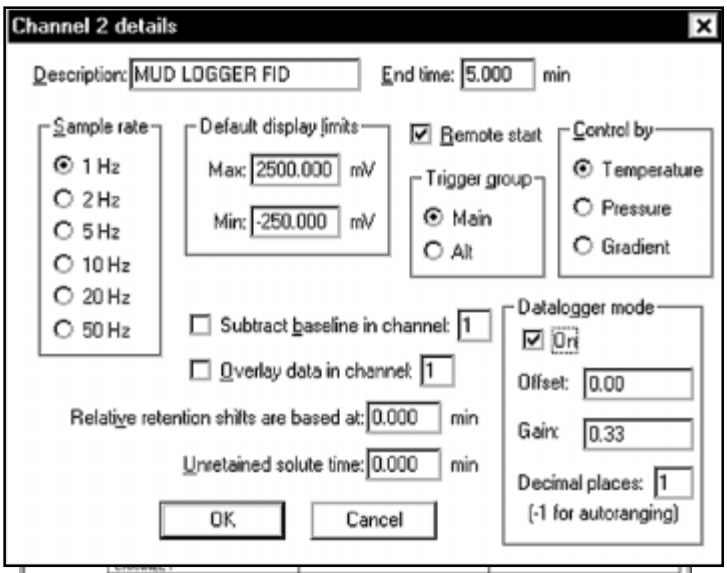


6. Disconnect the zero gas, and connect calibration gas standard (typically 100% methane) to the sample inlet at 10psi. The FID signal should increase approximately 300 millivolts while running 100% methane.

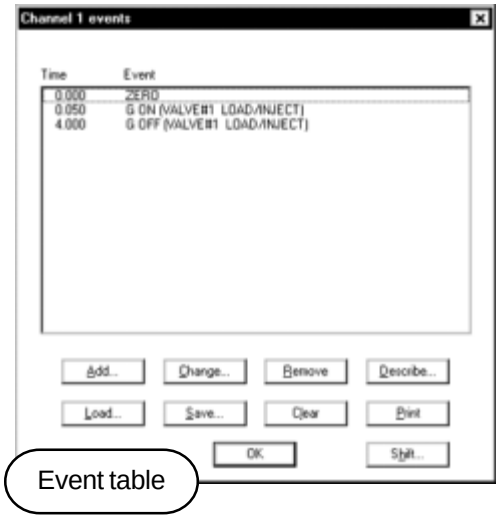
General Operating Procedure continued

7. In PeakSimple, open the Channel details dialog box for channel 2. The Datalogger mode area is in the lower right corner of the Channel details dialog box. Click in the checkbox to activate Datalogger mode, then enter the gain factor which will multiply the 300 millivolt signal to produce the desired concentration unit. For example:

300 x .33 = 100 if the desired unit is percent; or
300 x 3333 = 1,000,000 if the desired unit is parts per million (ppm).



The FID #2 signal times the gain factor will display in the channel 2 chromatogram window.



Event table

8. Enter an isothermal temperature program in the Temperature Program dialog box. For example:

Initial Temp	Hold	Ramp	Final Temp
180°C		15.00	0.00 180°C

9. Type in an Event table. Example:

Time	Event
0.00	Zero signal
0.050	G ON
4.00	G OFF

10. Start the analysis by pressing the spacebar on your computer keyboard, or by pressing the RUN button on the front of the GC.

11. In PeakSimple, input the retention windows ("Add component") to identify the individual hydrocarbon peaks (methane, ethane, propane, butane, etc.) Calibrate the individual hydrocarbon peaks.

NOTE: The Mud-logger GC system is plumbed for backflush. This gives you the option to set the valve program to backflush the heavier hydrocarbons after the desired peaks have been separated. For example, if your application required separation of hydrocarbons up to C_5, you could set the valve to backflush after the elution of the C_5 component(s), and all the heavier hydrocarbons would together produce one large peak. See the "Expected Performance: Column Backflush to FID #1" page.

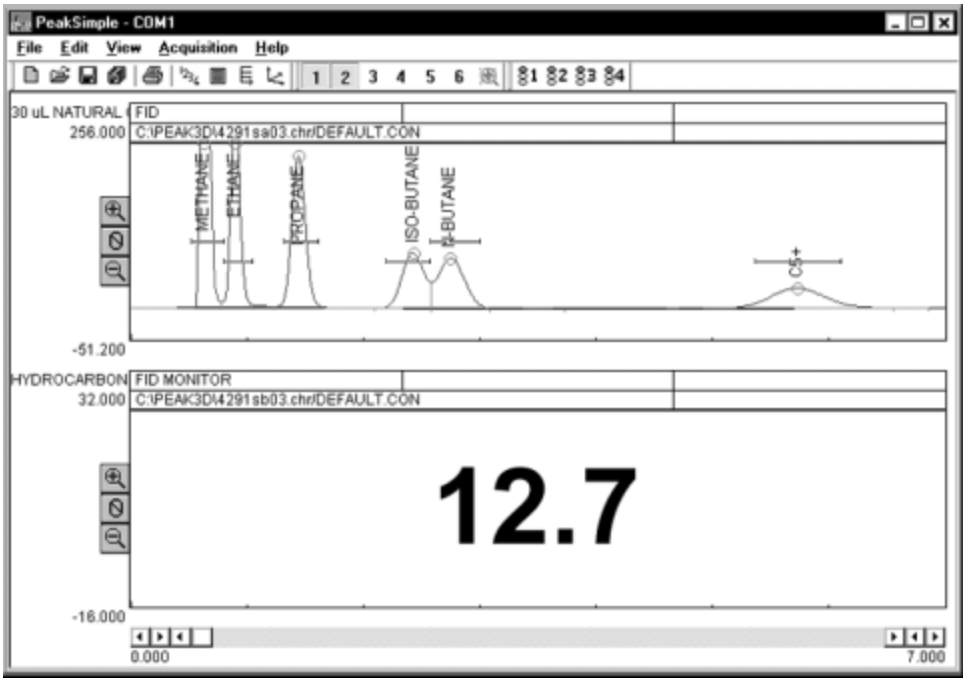
Expected Performance

Total Hydrocarbon Monitoring with Simultaneous Chromatographic Separation

The top chromatogram window is channel 1, displaying the FID #1 signal response to a valve injection of natural gas standard. The bottom chromatogram window, in Data logger mode, shows the concentration of hydrocarbons in the desired unit. Designate the unit in the Channel details dialog box, in the Data logger mode section.

FID #1 gain = MED
FID #1 temp = 150°C
FID #1 ignitor = -700
Valve temp = 90°C

FID #2 gain = LOW
FID #2 temp = 150°C
FID #2 ignitor = -700



Events:

Time	Event
0.000	Zero
0.050	G ON
4.000	G OFF

Temperature program:

Initial	Hold	Ramp	Final
180°C	100.00	0.00	180°C

RESULTS:

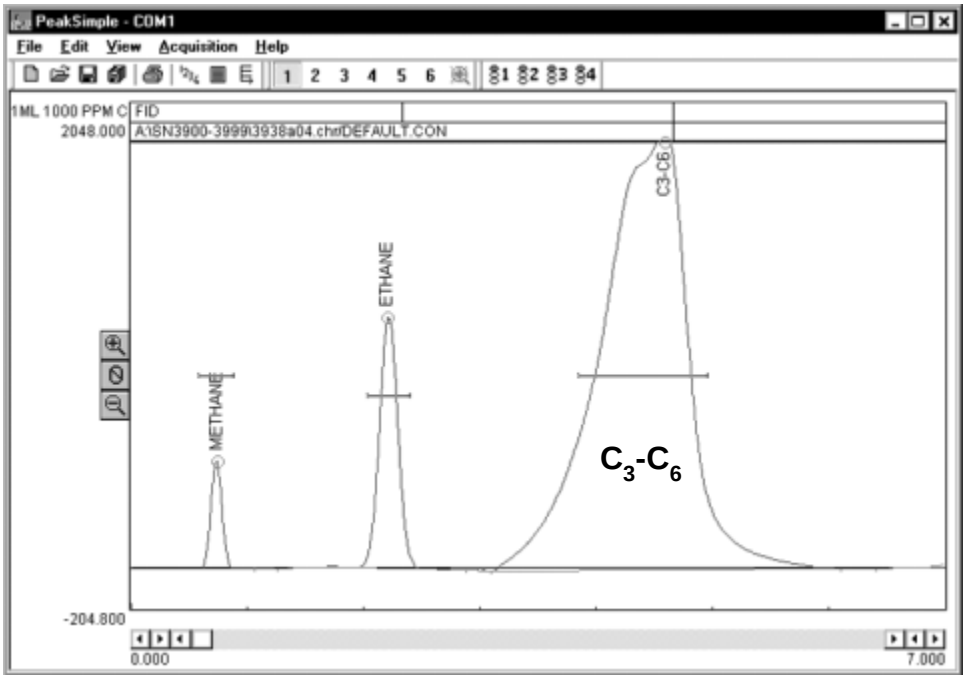
Component	Retention	Area
Methane	0.616	7175.4520
Ethane	0.900	1836.1900
Propane	1.500	1864.8260
Iso-butane	2.566	1186.8560
N-butane	2.916	1258.8330
C_5+	7.533	989.2620

Expected Performance

Column Backflush to FID #1

The Mud-logger GC system is plumbed for backflush. This gives you the option to set the valve program to backflush the heavier hydrocarbons after the desired peaks have been separated. In the example below, the valve was set to backflush after the elution of ethane, and the C_3-C_6 produce one large peak.

Sample: 1mL 1000ppm C_1-C_6 standard
FID gain = HIGH
FID temp = 300°C
FID ignitor = -600
Valve temp = 90°C



Events:

Time	Event
0.000	G ON
3.000	G OFF

Temperature program:

Initial	Hold	Ramp	Final
70°C	1.00	10.00	220°C
220°C	5.00	0.00	220°C

RESULTS:

Component	Retention	Area
Methane	0.733	3530.1805
Ethane	2.200	13632.4805
C_3-C_6	4.583	111209.5330