



Toledo Mudlogging Services, Inc.
Chromatography & Total Gas Calibration

Toledo Mudlogging Services uses RayGas panels for chromatography and total gas readings.

Test Gases Used:

Total Gas
Methane 2%
Methane 20%

Total Gas detectors are normally calibrated to these standards:

1% = 50 Units
1% = 100 Units

Chromatography

Methane 1%
Ethane 1%
Propane 1%
Iso Butane 1%
Normal Butane 1%

Chromatography detectors are normally calibrated to these standards:

Methane 1% = 100 divisions/units
Ethane 1% = 120 divisions/units
Propane 1% = 100 divisions/units
Iso Butane 1% = 80 divisions/units
Normal Butane 1% = 60 divisions/units

If the methane reading is set (+/- gain) to read 100 divisions/units on the methane peak the other gases readings will approximately follow the numbers shown above.

Since a chromatograph must trap and isolate a sample to push the gases through a column to break out/separate each gas this process takes a 3 minute cycle time.

We are using a known test gas amount (1% of each) the calibration cycle readings give the amounts for each gas in divisions or units which can be used to draw on the mudlog as divisions, units or converted to percentages.

At this point we have the data needed to convert any chromatograph cycle we have from the well while drilling into the percentage of each gas present. The cycle is 3 minutes so we can use the Total Gas readings and the Chromatograph data to calculate the gas percentages for C1 – NC4 for each foot by using the amount of Total Gas present at the start of the chromatograph cycle. This method works by calculating percentage ratios of each gas in a read in a cycle. Formula is percentage of each gas divided by the Total Gas reading of the chromatograph sample for that cycle.

(C1% / TG = C1 Ratio value)
 (C2% / TG = C2 Ratio value)
 (C3% / TG = C3 Ratio value)
 (NC4% / TG = NC4 Ratio value)
 (IC4% / TG = IC4 Ratio value)

C1 Ratio x TG = C1% in that TG reading
 C2 Ratio x TG = C1% in that TG reading
 C3 Ratio x TG = C1 % in that TG reading
 NC4 Ratio x TG = IC4% in that TG reading
 NC4 Ratio x TG = NC4% in that TG reading

Ratio value for each gas can be used to multiply by the Total Gas to calculate the amount of each gas present for each foot lagged up.

Calibration and calculation spreadsheet setup page

Chromatograph Calibration Table						
Max Divisions	Max Volts	Constant	Column Pressure	Total Gas Panel Test	2% Methane Panel Read	20% Methane Panel Read
2000	5.000	400	3 lbs	Panel Tested OK	100 UNITS	1000
Test Date	1/19/2013					

Test Gas 1%	Volts Read During Test	Actual Divisions Read	Percent Per Division
C1	0.096	38	0.02604
C2	0.094	38	0.02660
C3	0.063	25	0.03968
IC4	0.044	18	0.05682
NC4	0.036	14	0.06944

Enter Your Voltage Readings Below To Calculate Max % of Gases					
Type Gas	Max Voltage Read In Show	Divisions From Show	Max Gas In Percent	Enter Max Gas Units	Gas % Per Unit/Div. Ratios
C1	0.096	38.4	1.000	300	0.00333
C2	0.094	37.6	1.000		0.00333
C3	0.063	25.2	1.000		0.00333
IC4	0.044	17.6	1.000		0.00333
NC4	0.036	14.4	1.000		0.00333

We record the gas data to a chart file for analysis, calculation, and monitoring while drilling. The chart file software allows us to browse the recorded gas data from the Total Gas detector and the Chromatograph. The software has numerous options for displaying the data. The example below shows a well with the chart data compression set to X10. Example shows how each gas being read on each cycle will increase and decrease in relation to the Total Gas being read. The ratio calculation (C1-NC4 Ratios x TG) method is the best way to calculate chromatograph gases for each drilled foot. This is the same mathematics the Mainlog program utilizes to calculate these gases. Mainlog software and hardware integrates the Chromatograph voltage outputs to the software with 1% test gas using the amounts of gases read for each vs the amount of Total Gas read to do the same mathematics as the above spreadsheet.

Chart file example compressed x10

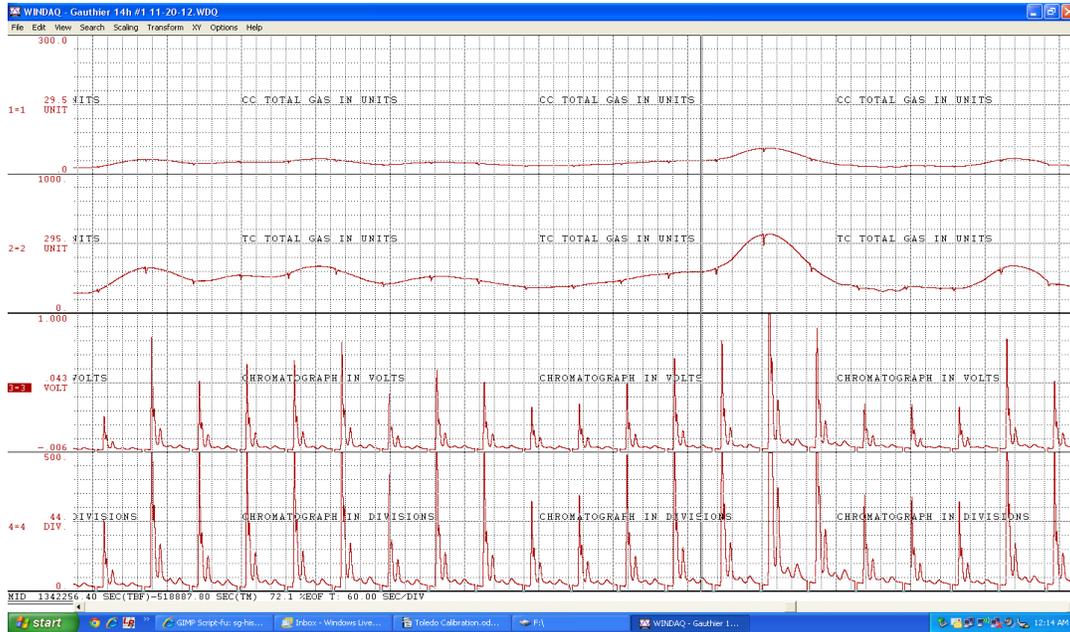
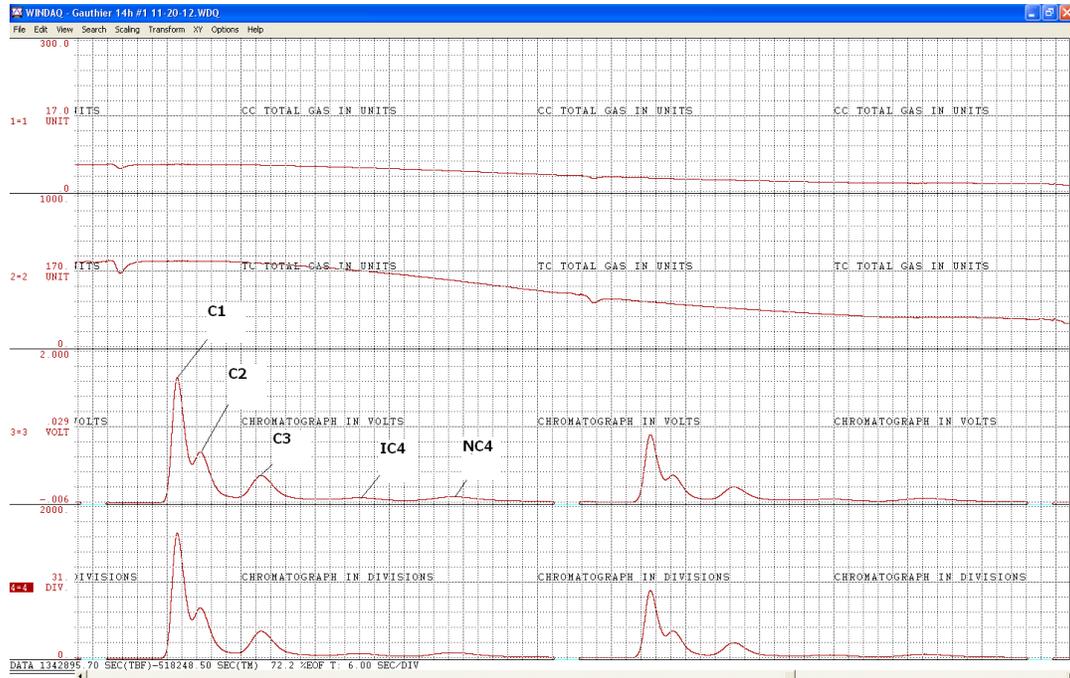


Chart file example uncompressed



Mainlog Software Gas Monitor Setup Screen

Elution Times	Drift	Ratio's
C1	110	0.00
C2	32	5.00
C3	46	5.00
IC4	68	5.00
NC4	89	5.00
C5	109	5.00
Chrom Zero	5	(Seconds)

Mainlog uses chromatograph voltage outputs and elution times for each gas to record the divisions/units read and generate the ratios for each gas read on a cycle. The software will retain the highest ratio numbers it records and stores them for calculation to fill in drilled feet between chromatograph cycles. The clear ratios button is used to clear stored ratios in the software. After the clear ratios button is clicked new ratios will be calculated and stored after the next chromatograph cycle.

You must enter test gas values in Mainlog software for program to calculate gas percentages.

Mainlog Test Gas Values Screen

The data entered here is used to convert chromatograph readings to a percentage value.

This is the same data used to perform the math on the calibration spreadsheet to convert chromatograph cycle data to a percentage value.

Terry Young
Toledo Mudlogging Services, Inc.

Gas Calibration Steps:

CC:

- 1) Set flow rate for 2.5
- 2) Set gas detector to CC mode and zero gauge.
- 3) Add a source of 2 % methane to poly flow tube labeled "SAMPLE IN".
- 4) Adjust R8 Potentiometer "CC CAL" to make gauge indicate 100 units

TC:

- 1) Set flow rate for 2.5
- 2) Set gas detector to TC mode and zero gauge.
- 3) Add a source of 20 % methane to poly flow tube labeled "SAMPLE IN".
- 4) Adjust R16 Potentiometer "TC CAL" to make gauge indicate 1000 units.

Chrom:

- 1) Add a source of compressed air to poly flow tube labeled "AIR"
- 2) Zero chromatograph gauge
- 3) Add a source of 1% C1-NC4 to poly flow tube labeled "SAMPLE IN"
- 4) Set gas detector sample switch to Auto
- 5) Adjust column pressure till NC4 peaks out at 2.000 minutes
- 6) Adjust R35 potentiometer "CHROM CAL" so C1 peak is equal to 100 units.

TOLEDO MUDLOGGING GAS DETECTOR

The TOLEDO MUDLOGGING gas detector is a state of the art, total combustible hydrocarbon, monitoring system. The system uses two detectors, a catalytic bead sensor (CC) and a thermal conductivity sensor (TC). Each sensor has its own amplifier so that each sensor can be zeroed with no interaction with the other sensor. The gas detector has two outputs one to a strip chart recorder and the other to the data acquisition computer.

The design has been refined over the years and the accuracy and reliability is second to none. Calibration is simple and straightforward and can be easily accomplished in the field by the mud loggers.

CC AMPLIFIER

The CC amplifier is used in the range of 0 to 10% combustible gas in air. The sensor is a catalytic bead sensor. This sensor is a coil of wire coated with glass or ceramic material, which is coated with a catalyst. The coil is electrically heated to a temperature that will allow it to burn (catalyze) combustible hydrocarbons. When burned, all combustible hydrocarbons liberate heat proportional to the concentration of the combustible hydrocarbons present. This heat increases the temperature of the wire coil, increasing its resistance. The increase in resistance is measured electrically and is the source of the signal. This signal is amplified and sent to the front panel meter, the strip chart recorder and to the data acquisition computer.

TC AMPLIFIER

The TC amplifier is used in the range of 10 to 100% combustible gas in air. The sensor is a coil of wire that is platinum coated. The coil of wire is electrically heated to a temperature that is just below the combustion point of combustible hydrocarbons. When combustible hydrocarbons are present they will carry off heat from the filament increasing the resistance of the coil of wire. The increase in resistance is measured electrically and is the source of the signal. This signal is amplified and sent to the front panel meter, the strip chart recorder and to the data acquisition computer.

SPECIFICATIONS:

CC CATALYTIC BEAD DETECTOR
DETECTION RANGE 0 - 10% (0 - 500 UNITS)

TC THERMAL CONDUCTIVITY DETECTOR
DETECTION RANGE 10 - 100% (500 - 5000 UNITS)

TOLEDO MUDLOGGING GAS CHROMATOGRAPH

The TOLEDO MUDLOGGING gas chromatograph is a state of the art combustible hydrocarbon identification system. It will detect and indicate the amounts of methane, ethane, propane, iso-butane and normal butane. The separation of the individual is accomplished with a coiled tube filled with special granules. The gasses, once separated are sent one at a time to a catalytic bead detector. The output of the detector is amplified and sent to the front panel indicator, a strip chart recorder and is available for connection to an integrator.

The design has been refined over the years and the accuracy and reliability is second to none. Calibration is simple and straightforward and can be easily accomplished in the field by the mud loggers.

SPECIFICATIONS:

DETECTS METHANE THRU NORMAL BUTANE
CATALYTIC BEAD DETECTOR
AIR CARRIER
SINGLE HEATED COLUMN
EASILY MAINTAINED