GEOSPECT ML-08

USERS GUIDE

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GEOSPECT ML-08 USERS GUIDE

Thank you for purchasing the Geospect ML-08. You have made an excellent choice. Your new state-of-the-art mudlogging instrument should give you trouble free service for years to come.

WHATS NEW FOR ML-08

WITS
Geospect can now communicate with third party Electronic Drilling Recorders (EDRs) via Wits.

MAX GAS LOGGING
Geospect now captures the maximum total gas, as well as, the maximum component gases during all lagged intervals. This works for all logged intervals (1', 2' and 5').

MAX CHROMATOGRAPH PERCENTAGES TOTAL EQUALS TOTAL GAS PERCENTAGE
New algorithm ensures total gas and component gases give consistent readings. Volume is actually determined by the TG detector as the ratios between the gases are determined by the chromatograph. The sum of all of the component gases will always equal the total gas percentage. Note: Total gas percentage is determined by calibrating to a known concentration of total gas.

AUTOMATIC ON/OFF BOTTOM INPUT
Geospect can now accept input from an on/off bottom switch. You may also change the NO / NC switch status settings right from your screen.

LAG ALARMS
You can now be alerted by Geospect as to when events "lag up" by setting an alarm to trigger to a particular lag stroke count or to lag depth.

SAMPLE ALARM
Set your starting depth and Geospect will alert you every time a sample is due.

INTUITIVE MOUSE CONTROL BUTTONS
You can now navigate Geospect screens via mouse control.

INTEGRATION TO ONE USB DAQ MODULE
Geospect now uses only one usb based DAQ device instead of two.

TABLE VIEW
You can look at a table that displays the last several data sets from within Geospect.

INTEGRATION WITH AUTOMATIC DAQ FOR SOME LOG PLOTTING PROGRAMS
Some log plotting programs can now periodically probe Geospect data files and plot a log almost automatically.

MORE STABLE BASELINES
Separate programs for 1V and 5V systems allow for smoother baselines on both the Total Gas Detector (Hotwire or IR) and the chromatograph.

USB BASED SECURITY KEY
A USB based hardware key is now required for running Geospect software.

INSTALLATION

PLACEMENT OF THE INSTRUMENT
You should locate the instrument in close proximity to the computer, the dropout jar (bubble jar) and your computer.

TRANSPORTING GEOSPECT
The instrument should be secured during transport so that it stays in place during travel and in a way that keeps vibration to a minimum.

PLUMBING
Your new Geospect ML-08 comes pre-plumbed and includes a built-in sample pump. The bulkhead fittings (brass polyflow fittings) are located on the back of the unit and are labeled as follows: CARRIER AIR, GAS IN, EXHAUST, EXHAUST.

CARRIER AIR
Hook an external air source here ONLY if you have a chromatograph. If you do not have a chromatograph just leave it disconnected.

GAS IN
Connect polyflow from this fitting to your dropout jar. Connect polyflow from the other side of your dropout jar to the gas trap (agitator).

EXHAUST
There are two exhaust ports on the back of the unit. Run a **separate** polyflow line from each exhaust port to outside of the mudlogging unit. **DO NOT TEE THE TWO EXHAUST LINES.** Teeing the exhaust lines can cause undesirable instrument readings because of backflow from one tube into the other.

WARNING!
EXHAUST LINES CARRY FLAMABLE GAS. IT IS VERY IMPORTANT FOR SAFETY REASONS THAT EXHAUST LINES BE ROUTED OUTSIDE OF THE MUDLOGGING UNIT. NOT HOOKING UP EXHAUST LINES COULD CAUSE SERIOUS INJURY OR DEATH.

ELECTRICAL

POWER SUPPLY (ML-08CC)
The power supply provided with the Geospect ML-08 has a selector switch to select voltages. **KEEP THE POWER SUPPLY ON 3V**. Any other voltage setting WILL burn out the filament and could cause further damage to your Geospect system.

POWER SUPPLY (ML-08IR)
The power supply provided with the Geospect ML-08IR has a selector switch to select voltages. KEEP THE POWER SUPPLY ON 12V. Any other voltage setting WILL burn out the IR circuitry,

and could cause further damage to your Geospect system.

POWER SUPPLY (ML-08 Chromatograph)
The power supply provided with the Geospect ML-08 has a selector switch to select voltages. KEEP THE POWER SUPPLY ON 3V. Any other voltage setting WILL burn out the filament. NOTE: Some chromatographs are not equipped with a separate power supply.

FILAMENT
The Geospect ML-08cc and the Geospect chromatograph use a Delphian 3V Catalytic Bead filament. You can get this filament by calling a Delphian Sales Rep at 713-462-6200. The Geospect ML-08IR does not require a filament.

DEPTH AND PUMP STROKES

There is a wire terminal block located on the back of the Geospect Unit. The terminal is labeled Depth, P1, P2, and Com. Some newer units may also have a terminal labeled OB. This is for the on/off bottom connection.

DEPTH
Connect your depth line to the common (COM), and DEPTH terminals. Jumping the terminals while Geospect is in the ON BOTTOM MODE should result in the Geospect ML-08 advancing one foot. NOTE: When set on SHORT DELAY, there is a 2 second delay until the Geospect will advance another foot. When set on LONG DELAY the delay is 8 seconds.

PUMP STROKE COUNTERS
From the calibration screen you can select either Real Strokes, Simulated Strokes, or Real Strokes ML-08 or newer. If you have only one USB Data Acquisition board in your Geospect, select ML-08 or newer if you require real strokes.

SIMULATED MODE
In simulated mode the user manually enters the SPM. Geospect uses the user specified SPM to simulate the counting of pump strokes at the rate entered by the user.

REAL MODE
In real mode the computer gets the SPM from actual pump strokes from a sensor located on the pumps. Geospect uses the real SPM to count strokes.

REAL STROKES HOOK-UP
Connect PUMP 1 to the P1 and COM terminals located on the back of the Geospect unit. Respectively, connect PUMP 2 to the P2 and COM terminals located on the back of the Geospect unit.

AUTOMATIC ON/OFF BOTTOM
If your unit has an on/off bottom connection, you would hook the wires to OB and COM. If you do not have an On/Off bottom connection, please call Geospect to purchase a retrofit for this input.

SENSORS
Whether using a donut, microswitch, or pigtail (line provided by Totco, Pason, Petron, etc.) Geospect will respond by advancing a foot when the circuit is closed. Basically, all of the above are nothing but switches. When the switch is closed a PULSE is generated and returned to

Geospect. The Geospect responds by advancing a foot.

SETTING UP THE COMPUTER

NOTE: DO NOT INSTALL THE HASP USB BASED HARDWARE KEY UNTIL HASP SETUP IS COMPLETED.

1. **Run** the **setup** program on the disk that came with the Geospect System. It is also recommended that you copy the setup program to your computer's desktop in case you need to repair the program for some reason.
2. Go through the installation wizard (This has been simplified in ML08).
3. When finished, go to your computer's desktop. Right Click on the Geospect Icon. Choose **OPEN WITH**
4. Select **CHOOSE DEFAULT PROGRAM**
5. Choose **BROWSE**
6. On the Left Pane, choose COMPUTER, → Local Disc (C:) → Gspect (yellow folder) → Gspect.exe.
   Note: Gspect.exe has a red "Z" for an icon.
7. Also check the text box that says "**Always use this program to open this type of file."**
8. Click OK.
   NOTE: For future setups and repairs you will not have to do steps 3 through 8.
9. Install your hardware key. We recommend installing it inside the Geospect Case itself, in a spare outlet on the internal USB Hub, so if you have to change computers, you will not have to worry about having to swap hardware keys.
10. Wait for hardware key to be recognized by the computer. You will see a yellow bubble in the lower left corner of your screen indicating your key is ready to use.

OPERATING INSTRUCTIONS

1. Make sure the power supply is set to 3V for ML-08CC or 12V for ML-08IR.
2. Plug the Geospect unit into a 110V receptacle.
3. Plug the USB cable into a computer loaded with Geospect software.
4. Double-Click The Geospect Icon. You should see the GEOSPECT MENU Screen.
5. Navigate to your desired screen using your mouse.
6. Check the Filament Voltage to ensure it is between 2.6 and 3.4 for the ML-08cc model. The filament voltage display is not functional on the ML-08ir model.

FLOWRATER SETTINGS

TRAP FLOWRATER
The trap flowrater should be set between 5 and 8. Under normal circumstances the gas flowrater should be on 2 and the air should be on 0 (or off). On the ML-08ir model, set the trap flowrater to 3 or 4.

FILAMENT OPERATION (ML-08cc model only)
The 3V catalytic bead filament will read up to about 8% gas before saturating. The filament contains a platinum bead that is heated electrically to several hundred degrees. The bead's resistance to electricity changes as it is heated. When gas flows over the bead it gets even hotter. Basically, more gas means a hotter bead and the more electricity that is allowed to flow out of the circuit.

SATURATION (ML-08cc model only)
When the gas/air mixture reaches about 8% (350-400 units calibrated at 50 units=1%), the mixture actually has a cooling effect rather than a heating effect. At this point the filament is cooled rendering it useless for measuring gas. The point where the heating stops and the cooling begins is called saturation. There are two ways to deal with reading gas that is above the saturation point. Some systems use a TC filament that changes resistance based on the cooling effect of coiled platinum coated wire. Geospect uses a method called dilution.

DILUTION (ML-08cc model only)
Dilution is the method used by the Geospect to allow monitoring of high gas without filament saturation. The air and gas flowraters can be used to precisely control dilution. Both the air and gas flowraters control the air/gas mixture that flows into the filament chamber. The thing to remember is that you **must always have 2 SCFH of air/gas mixture flowing through the filament chamber at all times.** It can be 2 SCFH of gas and 0 SCFH of air, or 1 SCFH of each. A chart should be posted in the unit for easy reference to the different dilution settings, however the following formula works as well: 2/gas=dilution factor. Therefore if your gas flowrater is set on 1, then your air flowrater must also be set to 1 to equal 2 SCFH of total flow. Simply divide 2 by 1 and you are on X2 dilution. Please see the chart below to further illustrate this formula.

FLOWRATER SETTINGS: WHERE AIR + GAS = 2 and 2/GAS = DILUTION FACTOR

AIR	GAS	DILUTION FACTOR
0	2	X1
1	1	X2
1.5	0.5	X4
1.8	.2	X10

If saturation occurs simply remove the rubber stopper from the dropout jar and dilute. Wait for the baseline to return to normal and replace the stopper.

LOGGING SCREENS

Most of the time while mudlogging you will be on one of the three Geospect logging screens. The three logging screens are Feet per Hour, Minutes per foot, and WITS.

These screens display drilling data, gas and chromatography. The following are displayed on the logging screens. DEPTH, ESTIMATED TVD, LAG DEPTH, SIMULATED DRILL AND LAG STROKE COUNT, FILAMENT VOLTAGE, ON/OFF BOTTOM CONTROL, DELAY CONTROL, SPM INPUTS, LAG TIME, ROP 1', ROP 5' AVE, DILUTION INPUT, ROP GRAPH, GAS GRAPH, ETC.

There are a few controls and displays on these screens you should know about.

INPUT NEW DEPTH

1. Click DEPTH (When you move the cursor over a changeable variable, the cursor changes into a HAND).
2. Input the new depth into the blank
3. Click OK

CHANGE ON/OFF BOTTOM STATUS

Click on ON BOTTOM button. You can see the status of ON/OFF BOTTOM on screen.

CHANGE SPM (Simulated Mode Only)
You can change the SPM setting on Pump 1 or 2 by clicking on SPM #1 or SPM #2. Input the new variable and click OK.

CHANGE DILUTION SETTING (ML-08cc model only)
When you change the dilution factor via flowraters you should also change dilution on screen. For example if the flowraters are set for X2 then setting DILUTION to X2 will display the correct gas reading onscreen.

1. Click DILUTION
2. Enter new variable
3. Click OK

RESET PUMPS
You can zero the pump strokes by clicking RESET PUMPS. Resetting pumps will result in the drill strokes being reset to 0. Be aware when you reset the pumps the correct lagging will not resume until the lag strokes count back up to ZERO. It is not recommended that you zero the strokes frequently while drilling or during short downtimes (connections).

ROP SCALE
This is the horizontal scale on your ROP graph. It can be adjusted by simply clicking the current scale and inputting a new variable. When changing the scale the numbers across the bottom can change font size depending on what number you input. Try to input a scale with readable numbers. For example, 250 is more readable than 200.

GAS SCALE
Follow the directions for the ROP scale.

CLEAR ROP
When entering a depth that is lower than a previous depth, the ROP graph can become unreadable, because curves will be entered twice for the same depth. If you want to clear the entire graph of all curves and start over, simply click CLEAR ROP. You will also have to re-enter the depth after clearing ROP.

CLEAR GAS
This will clear the history on the Lagged Gas Chart.

NOTE: Clearing ROP or GAS has no effect on exported log files.

DISPLAYED LAG DEPTH
The lag depth is displayed on screen.

ROP CHART

The light blue line represents 1' ROP.

LAG CURVE IN CHART
It should be noted that the gas displayed on the chart in just a snapshot of the gas when the lag point occurred. It is not the max gas that you should put on your log.

MAX GAS

Although the chart still displays a snapshot in time of the Total Gas. **Geospect now logs the MAXIMUM gas** to the spreadsheet files. The maximum gas is calculated for 1, 2, and 5 foot intervals for lagged depth. This is a more accurate way of logging gas than just logging the "snapshot"

GAS CHART (Right of screen)
This chart is a gas only chart that can be scaled differently than the ROP chart.

GAS VS. TIME CHART (Lower Left)
Even though you can scale all charts within Geospect, The gas curve is automatically attenuated and color-coded. For example when the RED LINE (X1) goes off screen, the BLUE LINE (X5) follows automatically. See attenuation chart below.

COLOR	ATTENUATION
RED	X1
BLUE	X5
GREEN	X10
PURPLE	X20
ORANGE	X50

CALIBRATION SCREEN

To calibrate the gas detector click CALIBRATE → CALIBRATE GAS. Note: if you have a chromatograph, you can also calibrate the total gas detector on the CALIBRATE Chromatograph screen.

CALIBRATION PROCEDURE FOR THE TOTAL GAS DETECTOR

For the purpose of this procedure we will assume 1% methane in air is used for calibration gas, and we are calibrating to 50 units = 1% methane in air.

1. Set Dilution to X1
2. Remove top from dropout jar
3. Set Gas Flowrater to 2 (ML-08cc model only)
4. Set Air Flowrater to 0 (off) (ML-08cc model only)
5. Set Sensitivity to 250 for CC and 17 for IR.
   NOTE: You can either use the slide bar or simply click the variable under the slide to change the value.
6. Set FINE ZERO to 0 (Note: you can use the slider or simply click the number and enter 0).
7. Adjust the Manual ZERO until the gas reading gets to as close to 0 as possible.
8. Use FINE ZERO to adjust the baseline to a desirable position.
9. Introduce 1% methane into the gas stream via dropout jar
10. Wait for gas curve to peak and level off (For more sensitivity some companies like to use a one second burst of gas)
11. Turn off gas
12. Adjust sensitivity until gas curve is at 50 units
13. If baseline moves then adjust the FINE ZERO slider and the SENSITIVITY slider until you have a 50-unit peak and your desired baseline. NOTE: An adjustable curve will stay onscreen for 4 minutes after test gas is turned off. This should allow plenty of time to calibrate. If not, repeat steps 8-13.

CALIBRATION IS COMPLETE

ALTERNATE CALIBRATION METHOD

1. Some mudlogging companies calibrate their instruments to where a 2 second burst of 1% gas = 50 units or 100 units. This makes for an extremely sensitive gas detector and could be useful in areas that do not typically contain a lot of gas.

For Chromatograph operation please view the Chromatograph Operation document on your desktop.

CHANGE DELAY

WHY CHANGE DELAY? Sometimes during slow drilling a bouncing effect takes place. This is especially true when using a donut or microswitch. The switch presses and depresses at such a slow rate rig vibration can cause the switch to send erroneous pulses to the Geospect that result in extra feet. If this occurs switching to LONG DELAY (8 seconds) will usually fix the problem.

WHY NOT JUST LEAVE DELAY ON LONG? Long delay is fine as long as you do not expect the ROP to exceed 450 f/h for any giving foot. SHORT delay can handle drilling up to 1800 f/h.

To change the DELAY setting, simply click the setting you require.

DATA ENTRY SCREEN

Press 3 or click Data Entry to get to the data entry page.

This is the page where you enter all of the data the computer needs to calculate lag and TVD. To modify any of the entries, simply click the entry, enter the correct variable, and click OK. The computer handles the calculations.

WASHOUT FACTOR

We included a washout factor to the lag calculation for ML-08.

NOTE: On this screen neither the DEPTH or BLUE variables may be changed. This is because these variables are already either calculated or they are available from entries on other screens.

VOLUME CALCULATION RESULTS

Press 4 to get to this page.
You can simply view the calculation results from the DATA ENTRY SCREEN on this page.

VIEWING LOGGED DATA

WHAT PROGRAM DO I USE TO OPEN MY FILES?

Just about any spreadsheet program should work to view and manipulate data stored by Geospect. We use Microsoft Excel or Word Perfect Quattro Pro. You may also use other brands.

LOCATION OF FILES

Geospect ML-08 currently is capable of logging data into several different files. These files are located in C:\Geospect and are as follows: OneFootROP.csv, OneFtLagGas.csv, FiveFootROP.csv, and FiveFtLagGas.csv. ROP can be logged in either “feet per hour” or “Minutes per feet.” “TVD ROP” and “Date/Time with Gas” can now be logged as well. To select which files you wish Geospect to log, go to the preference page.

Geospect Setup places a shortcut to the above folder on your computer's desktop so your data files are easily accessible.

OneFootROP.csv
This file logs every foot, and contains depth in negative integers as well as, ROP for that depth.

OneFtLagGas.csv
This file logs every foot, and contains depth in negative integers as well as, LAGGED GAS for that depth.

TwoFootROP.csv
This file logs a two-foot average, and contains depth in negative integers as well as, ROP for that depth.

TwoFtLagGas.csv
This file logs a two-foot average, and contains depth in negative integers as well as, LAGGED GAS for that depth.

FiveFootROP.csv
This file logs a five-foot average, and contains depth in negative integers as well as, ROP for that depth.

FiveFtLagGas.csv
This file logs a five-foot average, and contains depth in negative integers as well as, LAGGED GAS for that depth.

GasTime – Exports many useful values based on time rather than depth.
GasTime in a spreadsheet that contains the following data columns. This spreadsheet is useful when using some log plotting software. Please see your log plotting software manual for details and support.

Column A.	Time and Date
Column B.	DEPTH
Column C.	LAG DEPTH
Column D.	Real Time Gas (Not Max)
Column E.	One Foot Rop MF
Column F.	One Foot Rop FH
Column G.	Two Foot Rop MF
Column H.	Two Foot ROP FH
Column I.	Five Foot ROP MF
Column J.	Five Foot ROP FH

There are many other useful data files and we continue to add them. You can choose which files are logged on the Geospect "Export" screen (Formally, part of the Preference Screen).

You should now have a folder on your desktop with the log files. NOTE: If no data has been acquired all or some of the files may be missing. Geospect will create the files automatically when it has data to write to them.

EDITING WHILE DRILLING (OR LAGGING)
Geospect **cannot** write to a file while the user has that file open. Because the user may find it

necessary to have a file open while drilling is in progress the user can simply open the file and save it as something else (or somewhere else). This allows Geospect to keep recording to the original file, while at the same time allowing the user to have access to the data.

If you open a file and find it contains missing data, it was probably caused by opening the file and leaving it open while Geospect was trying to write the missing data.

STARTING A NEW WELL OR STARTING WITH FRESH DATA
To clear out the data in a file, simply delete the file itself. Geospect will start a new file with fresh data once the data is acquired. NOTE: Remember the files that are lagged will not show up until data is lagged up.

EXPORT SCREEN

From this screen you may select which files to export to the Geospect folder and enter your alarm settings.

SELECTING FILES
Simply check the checkbox by the files you want Geospect to export.

GAS AND TIME
This file records the gas reading during regular intervals next to the current date and time. If you select the Gas and Time file, you must also select an interval in seconds that you wish the file to be written to.

ALARMS SCREEN

ALARM SETTINGS
Geospect now allows for numerous high and low alarm settings. Simply check the desired checkbox. Now enter a value in the corresponding blank. If a high alarm is checked, the alarm will be triggered if the value of the selected parameter is greater than the value you entered. If a low alarm is checked, the alarm will be triggered if the value of the selected parameter is less than the value you entered.

NOTE: The alarms include an audible alarm that utilizes the computers speakers. If the speakers aren't hooked up and turned on, the alarm will not sound.

LAG ALARMS
Lag Alarms are a new feature of Geospect for 2008. There are eight separate lag alarms. The user can set for either pump strokes or lag depth. The user can also enter a short not by the lag alarm. The lag alarm will be triggered by either lag strokes or lag depth. You can use this for setting to notify you of expected bottom's up for trips, connections, carbides, driller picks up, pumps get shut off, etc.

SAMPLE ALARM
This will notify the user of when a sample is due to be caught. Simply set the starting depth and the interval and Geospect will notify you of when to catch your regular samples. TIP: You can set the lag alarm a couple of feet early so that by the time you walk to catch your sample you will be closer to the actual interval.

HYDRAULIC SCREEN

Screen shows a graphical depiction of mud pump activity. You also set the pump stroke method on this screen. Note there are now two Real Stroke methods. This is for backward compatibility

for hardware versions prior to ML-08. If you bought an ML-08 or newer you should select “ML-08 or newer” otherwise select “ML-08 or Older.” Simulated strokes will work regardless of which hardware version you have.

WITS

As of this writing Geospect has been tested with Pason systems. We will soon test our connection with other EDRs.

CONNECTION

To connect to an EDR you must have a serial port on your computer and a NULL modem 9-pin serial cable. Both ends must be male. We DO NOT recommend using USB to Serial adapters, as some of them do not work properly.

1. Plug one end of your null serial cable into the workstation and the other into the computer that is running Geospect.
2. Go to Calibrate →Wits Configuration.
3. Some EDRs require you to send data before it sends data back to you. You should check with the EDR Company on this. You can select send only, receive only, or send and receive.

ACQUISITION METHOD

Of course the acquisition method should be set to WITS.

COMMUNICATIONS

To change your communications settings, click the CONFIGURE button. Although you may change any setting here you should usually only change the COM ports and then only if necessary.

Default settings are Com 1, Baud 9600, Byte Size 8, Parity None, Stop Bits 1, Timeout 1000 (msec) Flow Control None.

To determine if you are receiving data, go to the Wits logging screen and see if data is changing. NOTE: Depth cannot be left blank. You must set it to a number before it will begin receiving WITS.

WITS and ACQUISITION METHOD

Wits Total Stroke Method

Sometimes an EDR is not configured to send Total Strokes, but it will send SPM for both pumps one and two. You can select CALC FROM SPM if you want Geospect to calculate the total strokes based on the SPM. Because of the timing lag involved in sending WITS the actual count may slightly vary from the EDR’s count, but it should be close enough for an accurate lag. The preferred method would be to just import the total strokes from the EDR. If the EDR is sending total strokes just check RECEIVE FROM EDR.

TOTCO ROP

When configuring Totco to work with Geospect you must use CUT FT ROP rather than ROP Ft/Hour, ROP Min/Ft or ROP AVE. The other settings will not give you ROP every foot, and cannot be used with Geospect. Totco may have to be called out to the location to set this up properly.

HOW TO DETERMINE WHAT DATA IS BEING SENT FROM THE EDR

The best way to determine what data the EDR is sending is to open Geospect and look at the WITS screen, however you might want to verify that the EDR is sending information independent from Geospect. To do this we recommend using HYPER TERMINAL.

HYPER TERMINAL

Hyper Terminal is a program that comes installed with Windows. It is located at START → PROGRAMS →ACCESSORIES →COMMUNICATIONS → HYPERTERMINAL

Note: Hyper Terminal is NOT bundled with Windows Vista. You can go to www.hilgraeve.com to obtain a copy of it.

USING HYPERTERMINAL TO VIEW RAW WITS DATA

1. Open Hyper Terminal.
2. Type something in the name field.
3. Go to FILE →PROPERTIES
4. Choose whatever com port your computer uses in the dropdown menu by CONNECT USING.
5. Click CONFIGURE and choose 9600 for Port Speed
6. Click inside the terminal area (where you would expect to see data) and type anything. If the correct com port is chosen, you should see raw WITS data streaming.
7. If the above settings are correct

NOTE: You cannot have two programs communicating over the same serial port, so make sure Geospect is not running when using Hyper terminal or vice versa.

GEOSPECT REMAINS RUNNING IN WINDOWS PROCESSES

NOTE: Sometimes Geospect will remain running in Windows processes. This is especially true if Geospect has been running for a long time. If this happens you will not be able to use Hyper Terminal or Geospect WITS. To see if Geospect is in still running in the processes go to Task Manager (CTRL ALT DELETE) . Select the PROCESSES tab. Look for gspect.exe. If Geospect is running one instance of gspect.exe is normal and should not be shut down, however if you see more than one gspect.exe you should close Geospect, shut down all gspect.exe instances that are running in the processes, and restart Geospect.

USING HYPER TERMINAL TO DETERMINE THE CORRECT COM PORT ON YOUR COMPUTER

On most computers, Geospect uses COM 1 to communicate over its serial port, however this is not always the case. A quick way to determine the correct COM port for your computer and determine if WITS is being sent from the EDR is to use Hyper Terminal.

1. Try viewing raw data with Hyper Terminal using the instructions provided above.
2. If you cannot view the data, try a different COM port.
3. After you determine the correct COM port, make sure you configure Geospect to that port.

GEOSPECT CHROMATOGRAPH OPERATION

INTRODUCTION

The Geospect chromatograph is both powerful and user friendly. It easily and continuously breaks out methane through normal butane. After breaking out the hydrocarbons the powerful

Geospect software identifies each gas peak. After the peaks are identified they are converted into percent by volume. Finally, the percentages are exported into a spreadsheet next to their lagged depth and total gas.

It should be noted that even though the chromatograph takes a sample every four to five minutes, the gases are manipulated up and down according to fluctuations in total gas. Geospect does this while preserving the ratio between the individual hydrocarbons at the point of the last chromatogram. The sum of the percent of component gases will always equal the total gas percentage. We call this Total *Gas Enhanced Chromatography*.

VIEWING

Chromatographic information can be viewed on four screens within Geospect. They are the Minutes Per Foot Screen (MPF Screen), the Feet Per Hour Screen (FPH SCREEN), the WITS screen and the Chromatograph Calibration Screen. On the first three screens the chromatograph is viewed by clicking the "SHOW CHROM" button.

GEOOSPECT CHROMATOGRAPH VIEWING

MPF, FPH, AND WITS SCREENS

The three main logging screens include chromatography. All three screens are identical when it comes to the chromatograph. On these screens you can view the last chromatogram both digitally and graphically. You can adjust the scale of the "last chromatogram" graph by clicking on "scale" in the upper left hand corner of the graph. The graph is in "chart divisions" where the digital display is converted into "percent by volume."

CALIBRATION VIEW

The calibration view screen is where you calibrate the chromatograph to known concentrations of test gas, adjust the sensitivity of the instrument, adjust the peak threshold, and set other parameters.

LAST CHROMATOGRAM

The Geospect converts chromatographic chart divisions to percent by volume at the beginning of each cycle. When a new cycle begins, the Geospect software takes a snapshot of the previous chromatogram and analyzes it. You must wait for the new cycle to begin before receiving the analysis of the last chromatogram. Please note that charts display chart divisions and they are converted to percentages at the next cycle. The percentages are then compared to the percentage of total gas and adjusted to that percentage for logging purposes.

MAX GAS LOGGING

Just as the maximum total gas is logged for a particular interval, the maximum percentages of each component gas is also calculated and logged. If you look at the log files you will see that the maximum is logged and the maximum percentage will equal the percent total gas. NOTE: Total gas is logged in units, where the user specifies how many units is equal to one percent.

RED X's

After turning on Geospect you may see a red X through the digital chromatographic displays. This is normal. Geospect is doing this because there is insufficient data to complete the calculation. After the first cycle passes then the second cycle begins, the red X's will be replaced with calculated data.

DISPLAYS AND SETTINGS ON CALIBRATION SCREEN

There are many parameters that can be set on the calibration view screen that pertains to the chromatograph.

CYCLE TIME AND SAMPLE TIME

The Geospect software controls the timing of pneumatic valves inside of the chromatograph. The chromatograph injects a sample of gas behind the column at user specified intervals; usually every 4-5 minutes. Then carrier air (from the air compressor) is sent behind the gas and is used to push the gas through the column. During this phase the chromatograph is said to be cycling. You can set the cycle time by clicking “Cycle Time” in the upper left hand corner of the chromatograph chart. After the cycle runs its course, another sample of gas is injected. The time the chromatograph spends sampling usually around 5 seconds, is called sample time. You can set the sample time by clicking sample time in the upper right hand corner of the chromatograph chart. Geospect recommends setting your cycle time to five minutes (300 seconds) and your sample time to five seconds.

ELUTION TIME

Elution time refers to the time it takes a particular gas or all of the gases to reach the end of their journey through the column. We refer to elusion time in this writing to mean the complete elusion time of all of the gases.

CYCLE TIME VS ELUSION TIME

Many inexperienced mudloggers set their cycle time to a setting that is just beyond the elusion time. They do this thinking they are getting faster samples, which they are. The problem arises during periods of high and/or heavy gases. Sometimes during these situations, residual gases are still present in the column even as the next sample is making its way through. This situation results in a constant upward trend in the chromatographic baseline, or extra peaks in the chromatogram. To resolve this give the chromatograph plenty of time to clear out its column before the next sample is taken.

CARRIER AIR PRESSURE AND COLUMN PACKING

The user has some control over the elusion time by adjusting the carrier air pressure. Carrier air pressure can be adjusted by adjusting the regulator inside the chromatograph. A good starting point when trying to determine proper carrier air pressure is 7 psi. The range that the carrier pressure should stay within is 4 and 10psi for proper operation. It should be noted that all columns are not always packed in exactly the same manner. Some are more tightly packed than others. For this reason carrier air should be adjusted to the optimal setting for your column. The column should allow for good separation, while allowing for the fastest possible elution time.

TEMPERATURE AND ELUTION TIME

Elution times may be affected by the temperature of the column and/or gases passing through the column. Generally speaking, cooler temperatures result in slower elution times, whereas warmer temperatures result in faster elution times.

AIR COMPRESSOR SETTINGS

The air compressor should be set to an output of no more than 20 psi. This is plenty of pressure to run your chromatograph. Higher settings can cause damage to the vinyl hoses inside the unit.

TOTAL GAS ENHANCED PANEL

The Geospect chromatograph takes the percentages from the last chromatogram and enhances

them to track with the total gas. By using this method the relationship between the individual gases are not lost. EXAMPLE: If you are in a chromatograph cycle and your total gas increases, C1 through NC4 will also increase. These fluctuations occur in along with the total gas while maintaining the integrity of the hydrocarbon ratio from the last chromatogram. As stated above, if you added up the percent of each of the component gases, it will equal the percent total gas.

TOTAL GAS CALIBRATION STANDARD
This is where you enter units equal to 1% gas in air. This is usually set to 50 units in the Gulf Coast and 100 units where there is a predominance of carbonate rock. It is important that you set this to whatever standard you use. Geospect uses this setting to correlate the chromatograph to the total gas detector for estimating between chromatographic cycles.

PEAK THRESHOLD
The Geospect identifies the various hydrocarbon peaks by measuring peak heights against the baseline. The peak threshold setting allows for the user to ignore the background noise peaks and focus in on the chromatographic peaks. In other words, the chromatograph has to "push through" the threshold in order for Geospect to consider it to be a valid peak. Five is a good starting setting for this; however you may want to tweak this to reach the optimal setting for your unit. The peak threshold must be slightly higher than background noise but less than the lowest expected peak height for Geospect to properly identify all of the gases.

NOTE: It is worth mentioning that it really doesn't matter to Geospect where the baseline is set to. Geospect will measure from baseline to peak, regardless of where the baseline begins.

FINE ZERO AND SENSITIVITY
The fine zero and sensitivity settings for the chromatograph are useful for viewing purposes. Use fine zero to make fine adjustments to your baseline. Use sensitivity to adjust the span of the chromatograph curves. For calibrating purposes set the sensitivity to where you can see the curves. The percentages are calculated by taking the percentages of the known concentrations for each gas and dividing them by the chart divisions obtained for each gas.

TOTAL GAS AND CHROMATOGRAPH LINEARITY
This is a new feature for ML-08. Chromatographic gas volume is now determined mathematically by total gas volume. The chromatograph merely samples the gas and creates a ratio between the individual gases. These ratios are then acted upon by the total gas. This means that chromatographic output will always be equal to the percentage of total gas. This eliminates the mudlogger's need to constantly calibrate the chromatograph to produce linearity with the total gas detector.

LOGGING THE MAX
This is a new feature of ML-08. Just as the Total Gas Detector will log the maximum gas between specified intervals, the chromatograph also logs the maximum volume during a specified interval. This sum of the maximum percentages will equal the maximum total gas percentage during the specified interval.

CHROMATOGRAPH CALIBRATION PANAL
This is where you enter your known concentrations of test gas (usually 1% of each gas.) You can also manually enter the chart divisions that were obtained when each gas passed through the column.

CALIBRATE BUTTON
You can automatically enter the chart divisions obtained by each gas in the last chromatogram by waiting for the analysis at the next cycle time and clicking the “calibrate” button (see calibration).

LAST CHROMATOGRAM % BY VOLUME PANEL
This is simply a digital display of the percentages obtained during the last chromatographic cycle.

MANUAL SAMPLE BUTTON
Clicking this button will result in the chromatograph taking a sample and starting a new cycle. It will also terminate the current cycle. This should only be done when the column is cleared of gas. After clicking manual sample, the chromatograph will take a sample, then resume normal continuous operation based on the sample time and cycle time settings. NOTE: You will not get a last chromatogram by clicking MANUAL SAMPLE. The last chromatogram can only be calculated as a result of a sample being taken automatically.

REAL-TIME CHROMATOGRAPH DISPLAY
The graph in the lower left hand corner of the calibration view screen displays real time chromatographic gases in chart divisions.

CHROMATOGRAPH FILAMENT VOLTAGE
The chromatograph filament voltage is displayed just below the Real-time display.

CALIBRATION PROCEDURE

To output useful data, you must calibrate your chromatograph. You should calibrate the chromatograph by introducing test gas into the chromatograph. This will give Geospect enough information to properly convert the gases into useful percentages. The entire calibration procedure is listed below:

TEST GAS
Before calibrating, you will need to obtain test gas. The test gas should contain a known concentration of each gas (C1-NC4). This concentration is usually close to 1% for each gas.

RECOMMENDED SETTINGS BEFORE CALIBRATING
You will probably adjust these settings more to your liking after becoming more experienced, but these settings will get you started.

TOTAL GAS SETTINGS
Dilution = 1
Fine Zero = 0
Sensitivity = 1500 to 2000
Total Gas 50 units = 1% gas in air
Zero Knob Adjustment - Adjust until gas = ZERO (+-)30 units
Now adjust the on-screen fine zero slider control to the desired baseline setting.

As stated above the chart divisions will be converted to percentages by Geospect. Volume is controlled by the Total gas detector, so sensitivity is not critical to the chromatograph. What does matter is that Geospect measures the ratios between each component gas. This can be achieved by clicking calibrate after you see the calibration chromatogram show up on the last

chromatogram graph.

In other words, after Geospect displays the last chromatogram (from your test gas). Click calibrate. This will automatically enter the chart divisions of each gas into Geospect. Geospect uses these numbers for the calculation of future readings.

CHROMATOGRAPH SETTINGS
C1 – NC4 % Known Concentrations = 1% (if they equal 1%)
Chart Divisions = Just wait until you get a LAST CHROMATOGRAM that you are happy with and click the CALIBRATE button. The chart divisions will automatically update.
Fine 0 = 0
Sensitivity = 1500
Last chromatogram scale = 200
Peak Threshold = 5
Carrier Air Pressure = 7 psi
Trap Flowrater = 4-6 scfh
Gas Flowrater = 2
Air Flowrater = 0 (Off)

Zero Knob – Turn until chromatograph gas reading = 0 (+-30)
Now adjust to zero onscreen with the chromatograph fine zero slider.
SAMPLE SWITCH (Front panel of Geospect) = Calibrate
Return to normal after calibrating.

CALIBRATION

1. Connect test gas to the bulkhead fitting on the front of the chromatograph using a piece of ¼" polyflow and brass fittings.

NOTE: A regulator should be used with your test gas bottle.

2. With regulator closed, open valve on the test gas bottle.

3. Open regulator until trap flowrater ball moves to 4-8 scfh.

4. Let the total gas max out.

5. Using the gas detectors on-screen sensitivity slider, set the max gas peak to 250 or 500 depending on the required calibration standard.

6. Click the on-screen manual sample button.

7. Turn off test gas bottle (to conserve your test gas).

8. Wait for the cycle to complete. You should be observing a chromatogram forming on the lower left graph.

9. When the next cycle starts Geospect will analyze and give a digital readout of the last chromatogram. This is a still picture of the sample you just took.

10. After you see the last chromatogram, click the calibrate button.

Your calibration is now complete.

NOTE:
You may want to repeat the above procedure. The second calibration is usually better than the first, because the chromatograph tubing probably contained air during the first calibration.

NOTE: If using a blend of five gases at 1% for each gas, you can calibrate the total gas detector at the same time as calibrating the chromatograph. For example, if you want to calibrate the total gas to 50 units = 1% gas in air, then a blend of five gases at 1% each is actually 5% total gas and would be equal to 250 units. In other words, while calibrating the chromatograph set the total gas to 250. If you are calibrating to 1% = 100 units, set the total gas to 500.

LOGGING

From the CHROMATOGRAPH CALIBRATION SCREEN you can set the Geospect system to log C1-NC4. Simply check the interval you would like the gases logged. You may select 1', 2' or 5' intervals. Logging will output to a .csv file that can be opened from most spreadsheet programs. The location of the file is c:\geospect. A shortcut to this directory is on your computer's desktop. After opening the log file you will see a series of numbers in the cells from left to right on the spreadsheet. The cells from left to right are as follows:

LAG DEPTH, TOTAL GAS, C1, C2, C3, IC4, NC4

Total gas is logged in units. C1 through NC4 are logged in percent by volume.

APPENDIX A
BASICS OF MUDLOGGING CHROMATOGRAPHY

By: Mike Cunningham Jr.

INTRODUCTION

Many of the mudloggers we have hired from other companies through the years have not understood the basic concepts of mudlogging chromatography. Some of these mudloggers were excellent in other areas of mudlogging. I decided to write this short article to help our customers and employees take the mystery out of mudlogging chromatography.

WHAT IS A MUDLOGGING CHROMATOGRAPH?

The mudlogging chromatograph is an instrument located on a mudlogging unit that analyzes the chemical makeup of gas that comes from the well bore. Gas is mechanically separated from drilling fluids near the drilling rig's flow line by an agitator. The gas is then pumped into the mudlogging unit. It is from this stream of gas that the chromatograph takes its samples. The mudlogging chromatograph injects a sample of this gas into a loop. Carrier air is used to carry the gas through a tightly packed column. The column is a long tube that is packed with a granular material and is coiled so that it will fit inside the instrument. As the gas is carried through the column it separates into component gases. The gases will come out of the column in order from lightest to heaviest. When the separated gases exit the column they go one at a time through a gas detector. The detector quantifies the separated gases by charting the peaks. The chart divisions are then converted to percentages.

ORDER THAT THE HYDROCARBONS EXIT THE CHROMATOGRAPH

The gases that the chromatograph separates and detects are known as hydrocarbons. That is because the gas molecules are made of hydrogen and carbon atoms. Mudloggers and other oilfield professionals usually refer to the gases by name or by their carbon content. The gases are as follows from lightest to heaviest:

Methane CH4 commonly referred to as just C1.
Ethane C2H6 commonly referred to as just C2.
Propane C3H8 commonly referred to as just C3
Isobutane C4H10 commonly referred to as just IC4
Normal Butane C4H10 commonly referred to as just NC4

Note: Isobutane and normal butane have the same chemical formula but a different molecular structure. Isobutane will exit the column before normal butane.

Just for review the hydrocarbons exit the column and are read in the following order: C1, C2, C3, IC4, and NC4.

WHY DO OIL COMPANIES REQUIRE A CHROMATOGRAPH ON MUDLOGGING UNITS?
A petroleum reservoir is made up of three fluids; gas, oil, and water. Gas rises above the oil which floats above the water. The points at which the reservoir fluids touch each other are called the contact points. Using various hydrocarbon ratios, oil companies can attempt to determine these contact points. Specific hydrocarbon ratios are beyond the scope of this article. Most mudloggers know when they see “heavies” (C2-NC4) that it indicates a show and possible oil. Heavies should always be reported and logged by the mudlogger.

CONVERTING CHART DIVISIONS INTO PERCENT BY VOLUME
New mudloggers often ask the question; Why do you have to convert the hydrocarbons to percent by volume? Why not just log the chart divisions. The answer is that if the percentages of each gas were equal they would not generate equal peak heights in the detection phase. Lighter gases tend to produce taller peaks while heavier gases produce wider peaks. For this reason we calibrate the instrument using test gas. Test gas with a known concentration of each hydrocarbon is introduced into the chromatograph. When the peaks are detected you can find the percentage of a particular gas per chart division by using a formula.

The following calibration formula must be used for each hydrocarbon:

Where: P = Peak height of a particular hydrocarbon in chart divisions
K = Known concentration of test gas in % by volume
E = Percent by volume of each chart division for a particular hydrocarbon

$E = K/P$

After calibration you should have E for C1 through NC4.

Now when you see a chromatogram all you have to do is multiply the chart divisions generated by each gas by E for each gas. This formula gives you the percent by volume for each gas.

RECORD AT REGULAR INTERVALS
Chromatographic percentages should be recorded at the same intervals that you record total gas. If you are plotting a 5” mudlog you should have a data point every foot for each gas. If you are plotting a 1” mudlog you should have data points every 5’ for each gas. These percentages should be lagged to their proper depth.

ESTIMATING DURING FAST DRILLING
During fast drilling it will become necessary to estimate percentages between chromatographic cycles. This is because a chromatographic cycle occurs roughly every 4-5 minutes. If the rig is

drilling too fast the chromatograph cannot keep up. To do this, convert the total gas to percent. Divide each of the component gases percentages by the total gas at the time of sample injection. This creates a constant. Now simply multiply the constant by the total gas in real time for each hydrocarbon. By using this method of estimation you will preserve the chromatographic ratio while maintaining a linear correlation between the total gas detector and the chromatograph. This method has recently become practical with the advent of mudlogging chromatography software such as Geospect (www.geospect.com). Geospect does a similar, but proprietary calculation automatically.

CONCLUSION
Hopefully this article has shed some light on one of the most misunderstood areas of mudlogging; mudlogging chromatography.

APPENDIX B

LOGPLOT MULTICURVE
Many Geospect users also use Logplot. Logplot has a feature called multicurve. A multicurve allows the user to plot several curves in within the same tab. Using a multicurve is the logical choice when transferring data from Geospect to Logplot. This is because you can simply highlight, copy, and paste the lag depth, total gas, and chromatography into Logplot at one time. See Logplot's help section for instructions on setting up a multicurve.

TROUBLE SHOOTING

GEOSPECT REVERTS TO A BLANK DOCUMENT (OR ANY OTHER FILE CORRUPTION)
When the power goes off on the rig and the computer does not have time to properly shut down, a file corruption may occur. This happens because Geospect is constantly saving data. It is advisable that a battery backup is used on your computer on the rig. If Geospect reverts to a blank document or otherwise simply run Geospect setup and choose repair. This will get you back up and running.

Now Geospect should work fine.

NOTE: It is a good idea to have both a CD of the Geospect Setup file on the unit, as well as a copy somewhere on the computer (Desktop is always a good place).

NOTE: When you use the above procedure you will lose any data inputted into the program. Your pipe data, depth, etc. must be re-entered. It is advisable to copy your data somewhere so that you can enter it when Geospect restarts.

BACK-UP COMPUTER
We recommend keeping a back-up computer on your mudlogging unit. This computer should be preloaded with all needed software (EX: Logplot or Wellsight, Geospect, Geospect Setup, your spreadsheet program, etc. This is a pretty cheap backup in case the computer crashes for any reason.