# The Pason Gas Analyzer: The Spectrometer Advantage

## OVERVIEW

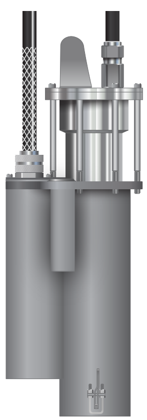
The Pason Gas Analyzer offers a unique advantage—the first of its kind in the industry. It operates as a standard total gas system by measuring and reporting the quantity of total gases exiting the wellbore. But when more detail is needed, it provides a real-time, on-demand breakdown of the quantity of individual C1 to C4* hydrocarbon gases, as well as CO2, using a spectrometer and new patented technology. This detailed analysis provides crucial information about the drilling formation that can save company time and money. And with a sampling rate of less than one second, the gas analysis readings are more consistent and reliable than any previously offered in the industry.

## EFFICIENTLY INTERPRET TRENDS AND LOCATE FORMATIONS

The Pason Gas Analyzer's individual gas breakdown can be displayed on the Pason Electronic Drilling Recorder (EDR) as a grouping of up to nine separate compositional traces. Knowledgeable personnel, such as geologists and mud loggers, can use the compositional traces to interpret trends and quickly locate target formations, such as productive oil reservoirs either at the wellsite or remotely. Because there is virtually no lag time in the gas reading intervals, the data can be used effectively in geosteering operations, eliminating the cost of running multiple logging while drilling (LWD) tools.

## VIEW GAS TRACES LIKE NEVER BEFORE

As the well is being drilled, the Pason Gas Analyzer reports gas quantities which are displayed on the Pason EDR interface as individual traces. By examining the values, relationships, and separation of the gas traces, geologists can gather important information about the type of hydrocarbon fluid in the formation and whether it will be a productive source.

**The following gas-related traces can be displayed on the Pason EDR:**

- Total gas (Pason Gas)
- Individual hydrocarbon gases:
    - Methane (C1)
    - Ethane (C2)
    - Propane (C3)
    - Iso-Butane (iC4)
    - N-Butane (nC4) (includes C5)
    - Butane (C4) (includes iC4, nC4, and nC5)
- Carbon dioxide (CO2)
- Wetness ratio
- Balance ratio

*C4 also includes nC5.

## CHALLENGE

Pason customers need access to fast, reliable gas analysis that provides more useful data.

## SOLUTION

The Gas Analyzer provides real-time total or individual gas readings displayed on the EDR. This data provides immediate and detailed data about the drilling formation.

## RESULTS

- Total gas analysis or individual gas breakdown
- One-second sampling rate
- Consistent readings
- Compositional gas analysis
- Easy to use and maintain
- No transportation required
- No air or consumables needed

## HYDROCARBON GASES

**C1:** Methane
**C2:** Ethane
**C3:** Propane
**nC4:** N-Butane
**iC4:** Iso-Butane
**nC5:** N-Pentane

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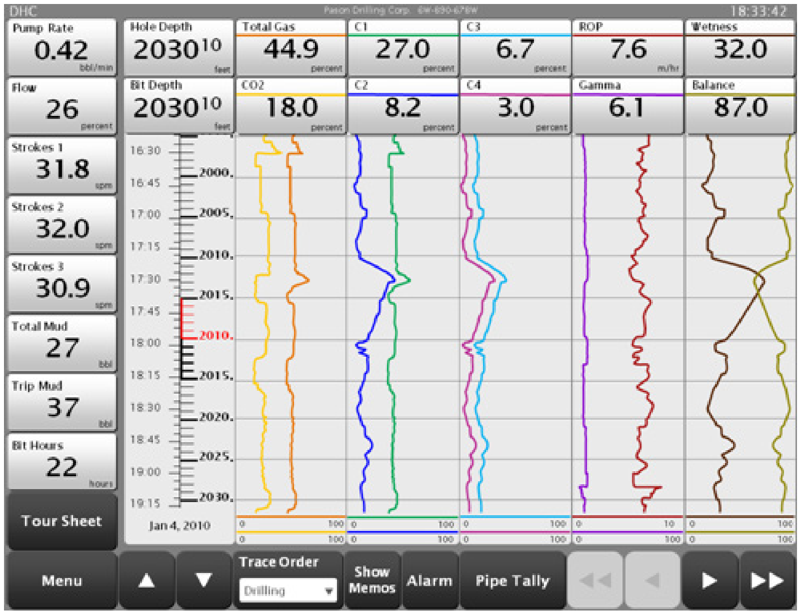


Figure 1: Compositional gas traces on the Pason EDR

## TOTAL GAS

The total gas reading is an important starting point for analyzing the fluids in a formation. When there is a spike in the total gas reading, it may indicate formation with productive hydrocarbon gases. This is the point where additional compositional traces can be used to access more detailed gas analysis about the formation. For example, a co-existing spike or dip in the wetness and balance ratio readings could confirm the fluid density of the formation.

## HYDROCARBON GASES

With the display of individual traces for hydrocarbon gases C1 to C4* on the spectrometer, geologists can easily detect the increased presence of lighter to heavier hydrocarbons in the formation. If the drilling target is the heavier hydrocarbons, a spike in C3 through C4 gas readings could be a positive indicator.

## CO2

Carbon dioxide (CO2) detection is important because CO2 decreases the BTU content of the natural gas and is costly to remove. Carbon dioxide can also cause some drilling mud to increase in viscosity which can be expensive to treat.

## WETNESS, BALANCE, AND CHARACTER RATIOS

For interpretation, the wetness and balance ratios are used together. Both involve a comparison of light to heavy hydrocarbons.The increasing and decreasing ratio trends provide important information about the fluid density of the formation.

**Wetness Ratio =** $\frac{(C2+C3+C4^*)}{(C1+C2+C3+C4^*)} \times 100$

**Balance Ratio =** $\frac{(C1+C2)}{(C3+C4^*)}$

**Character Ratio =** $\frac{(C4^*)}{(C3)}$

Figure 2: Wetness, balance, and character ratios

For example, as gas and oil density increase, the wetness ratio shows an increasing trend. That is, as the wetness ratio increases, the heavy gas components would be greater than the lighter gases.The reverse is true for the balance ratio. As gas and oil density increase,the balance ratio shows a decreasing trend. In other words, the balance ratio is higher when the formation contains lighter hydrocarbons and lower when there are heavy hydrocarbons

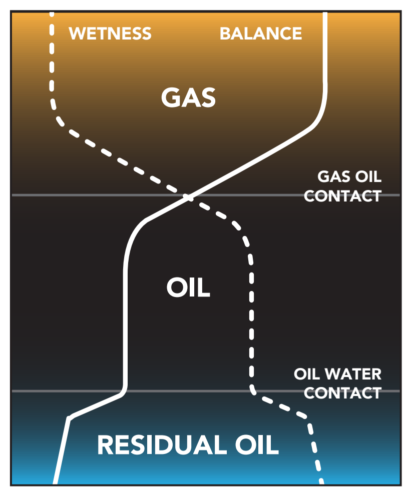


Figure 3: Relationship between wetness and balance ratios

In the compositional data, the relationship of these two traces helps to determine changing fluid type and contact points. If the balance ratio (Bh) is greater than the wetness ratio, the formation is more likely to contain lighter gases. If the wetness ratio (Wh) is greater than the balance ratio, the formation is more likely to contain oil. The closer the two traces are to each other, the lighter the oil will be. The greater the separation of the traces, the heavier the oil. The gas-oil contact point (GOC) occurs when the two traces cross each other. The oil-water contact (OWC) occurs when there is a sharp increase in the wetness ratio and a greater separation of the two traces. Figure 4 demonstrates these relationships.

*C4 includes iC4, nC4, and nC5.

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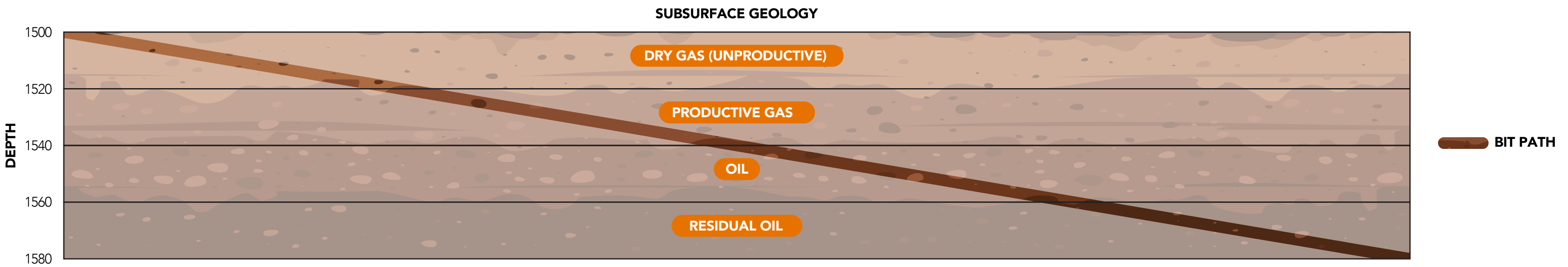


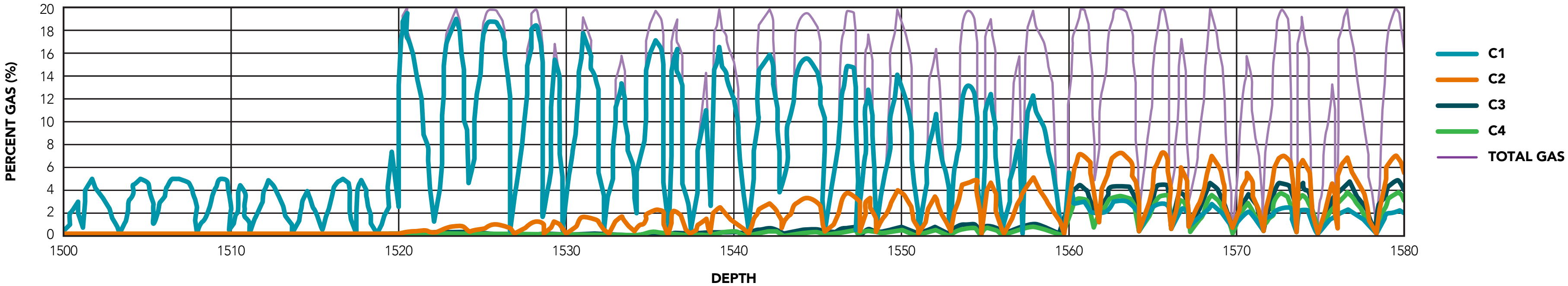


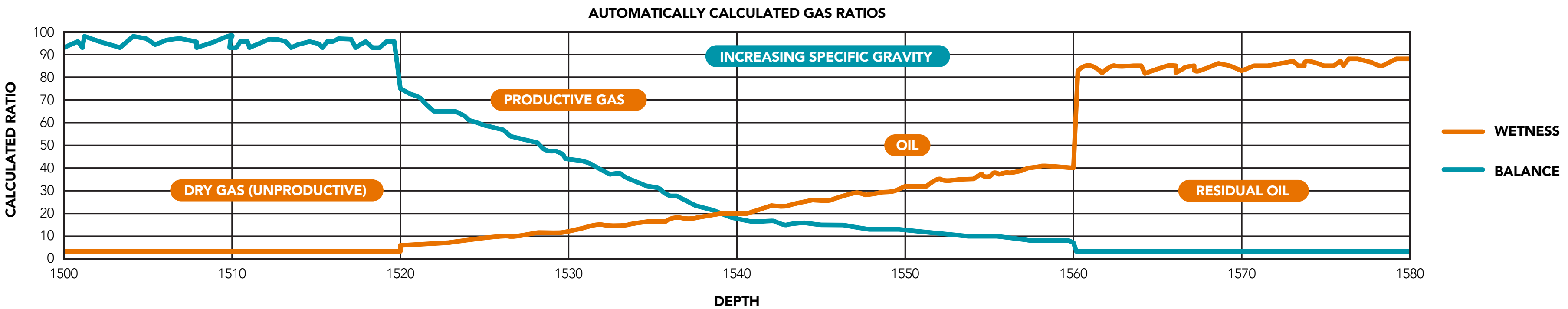

## READING THE COMPOSITIONAL DATA

Figure 5 below displays real data from a Pason Gas Analyzer test well. It demonstrates how compositional data is used to interpret fluid formations. The left column shows the balance ratio (purple) and wetness ratio (green). The right column shows the total gas (blue) and C4 or butane (red). The balance and wetness ratio curves begin to separate significantly at 4280 feet. At around 4270 feet, the total gas and C4 curves begin to increase, but the balance and wetness curves are still fairly close together. The greater separation of the balance and wetness curves at 4280 feet and the following increase in total gas and C4 around 4285 feet indicate a greater potential for oil.


Figure 5: Gas Analyzer compositional data example

## SUMMARY

The compositional data generated by the new Pason Gas Analyzer provides a distinct advantage to drilling operations. Geologists can use the system's compositional data to predict fluids in the formation more quickly and efficiently, saving company resources. With a one-second sampling rate, the compositional data is reliable, consistent, and immediate. In short, it's currently the best available gas analyzer in the industry.