

AC Vacuum sampling device

- Automated introduction of (sub-)ambient pressure samples
- Excellent repeatability
- Standard RGA & NGA functionality
- Multiple sample sequential analysis option

Keywords: Sub ambient gases, Hi-speed RGA, repeatability, vacuum



Introduction:

Most refineries and petrochemical plants routinely analyze their various process and fuel gases to determine its composition. This information is not only used to optimize processes but can also be used to calculate properties like heating value or carbon content. Typically, GC systems called "refinery gas analyzers" are used for this purpose. The AC Hi-speed RGA, being one of the analyzers in AC's extensive analyzer portfolio for the Hydrocarbon Processing Industry, is in use around the globe for this purpose. It has set a new benchmark for gas analyzers with respect to its unsurpassed reliability, superior performance and short analysis time.



Generally gases to be analyzed are delivered to the laboratory in a steel cylinder where the contained gas is above atmospheric pressure. These gases can be introduced into the system without any further handling. The repeatability of the sample introduction is guaranteed due to the use of the so-called sample shut-off. This has been described in our application note: "*AC Hi-speed RGA repeatability*".

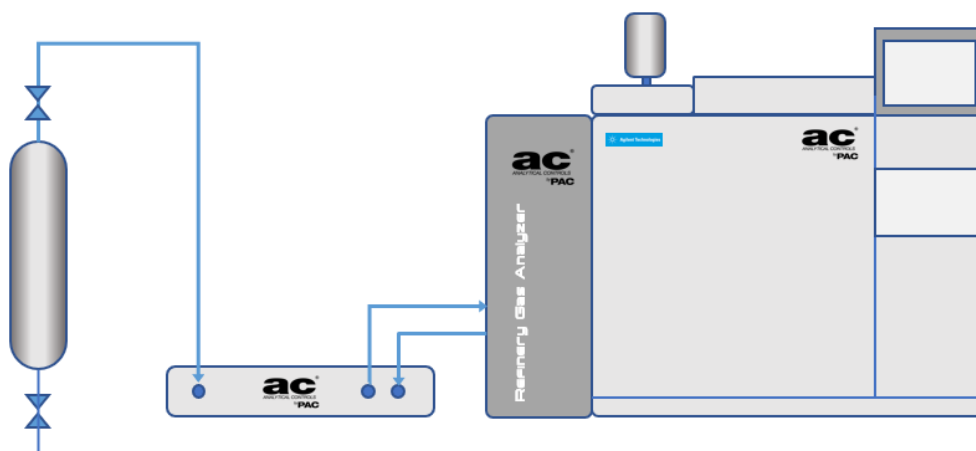
There are however occasions where the gas sample is delivered at a pressure close to or at atmospheric pressure. For a repeatable and trouble-free introduction of these gases into the analyzer, AC Analytical Controls offers the "**AC Vacuum sampling device**". It is a sampling system for the introduction of gaseous samples at (sub)ambient pressure into the AC Hi-speed RGA, or other AC gas analyzer configurations.

System description

For most gases to be analyzed, the pressure of the sample itself is sufficient to ensure an adequate flushing of the sample flow path and sample loops inside the gas analyzer. Proper flushing is needed to ensure that there is no carry-over from the previous sample, and to get rid of air or other gases that may have been introduced during the connection of the sample to the analyzer.



For samples delivered at sub-ambient pressure, the AC Vacuum sampling device ensures a proper flushing. A high-quality oil free vacuum pump in combination with an integrated valve configuration, is controlling the flow of sample through and the pressure inside the sample loop at a very repeatable and accurate level.



The sample introduction is as simple as connecting the sample cylinder (or any other type of gas sample container) to the vacuum sampling device, open the cylinder and start the run. Then system will perform the following actions:

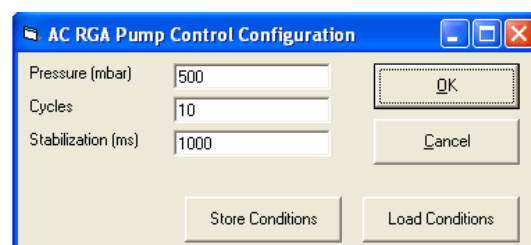
- The vacuum pump will lower the pressure to a predefined pressure (usually around 500 mBar).
- Valves inside the device will open and close sequentially, allowing the loop to fill with sample and empty again.
- After a pre-defined number of flushing the valves will close, meaning that the sample loop is filled with sample at the predefined pressure.
- Finally, the Gas sampling valve(s) will be activated, thereby transferring the sample into the carrier gas stream for separation on the various columns.

To calibrate the RGA, the calibration gas is introduced using the same procedure. This is essential as the calibration gas needs to be introduced at the same pressure as the sample(s), this to ensure that the found results before normalization are at the same level.

To extend the capacity of the system, it can be equipped with a stream selection valve, allowing to connect multiple samples and analyze them using a sequence. One of the stream selection valve ports can be dedicated to a calibration gas.

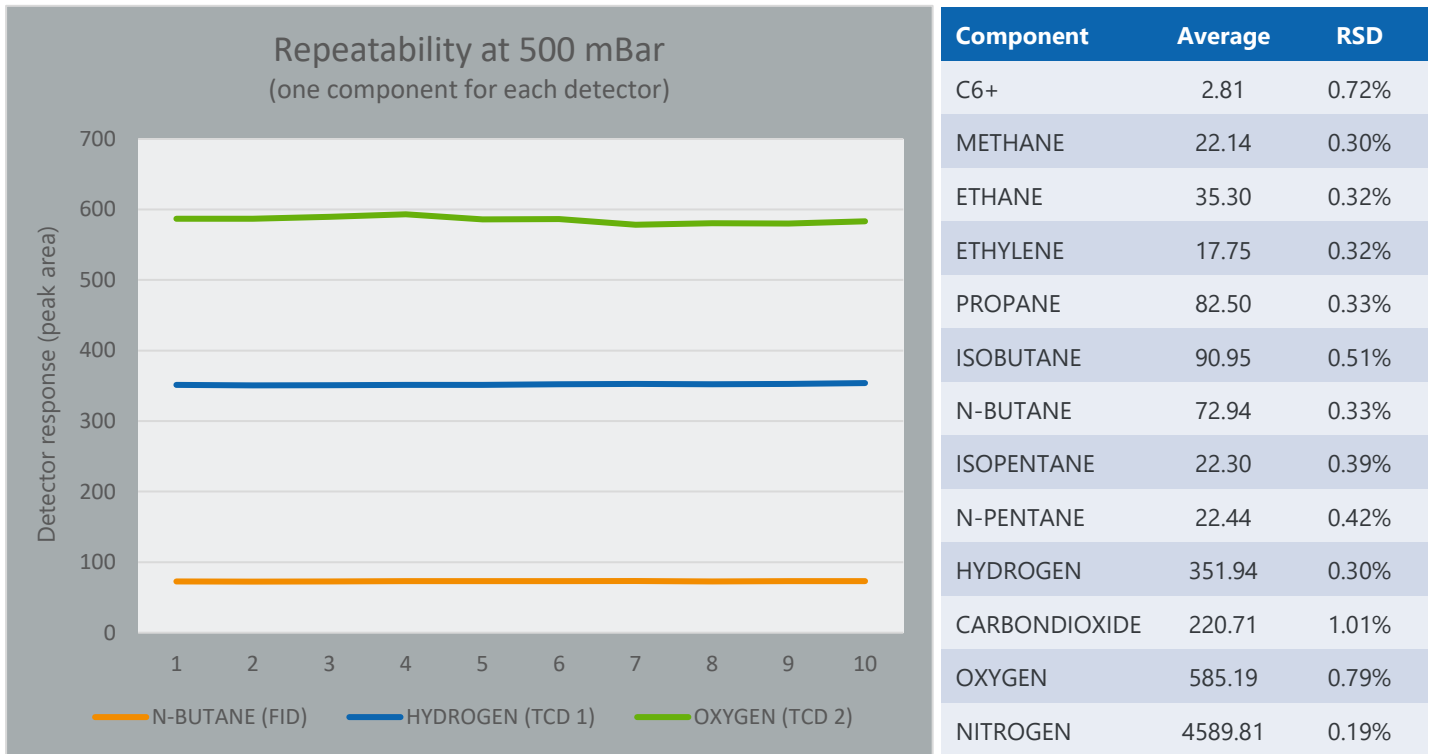
The device (including vacuum pump) is fully software controlled, allowing the user to define settings like pressure, number of flush cycles and stabilization time. Macros in the chromatography data system (Agilent OpenLab ChemStation) are automatically started and control the vacuum pump as well as the control device box.

The actual pressure in the sample loop(s) just before sample introduction, is recorded and stored in the final analysis report.

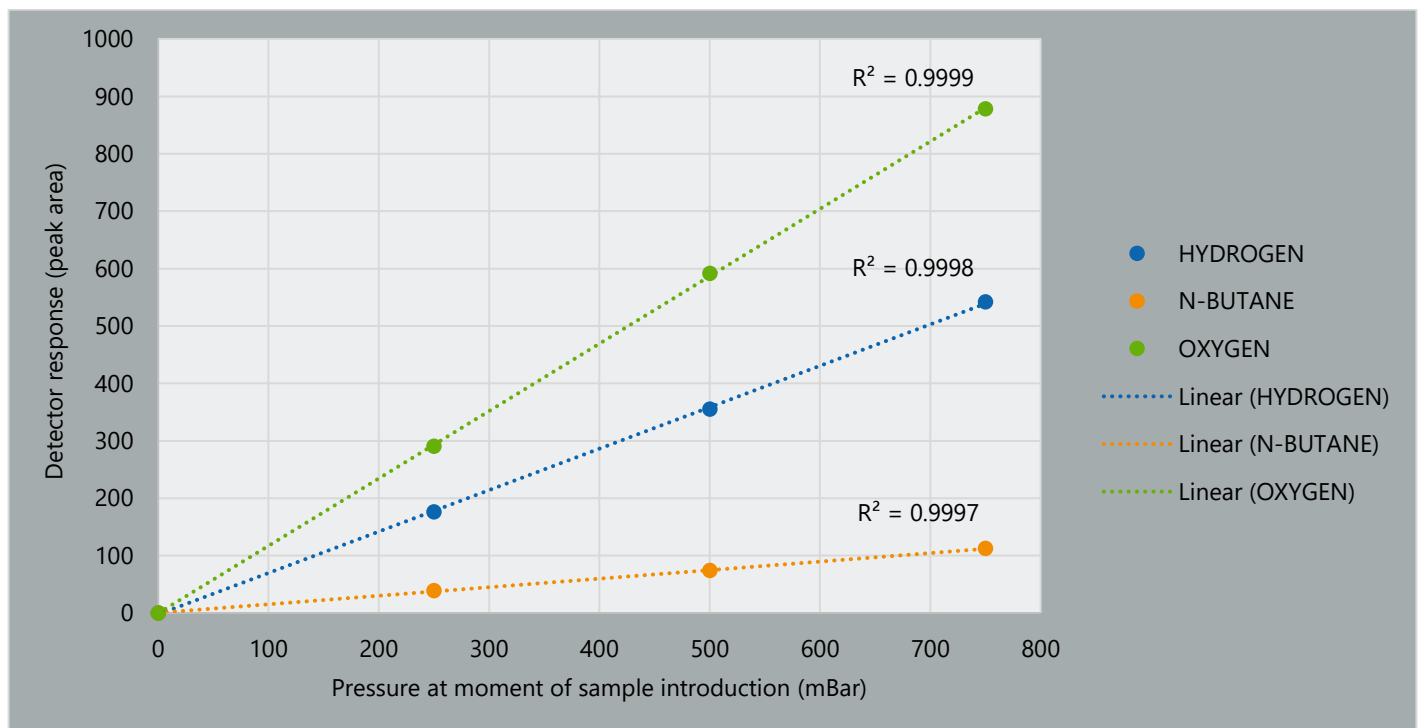


Analytical results

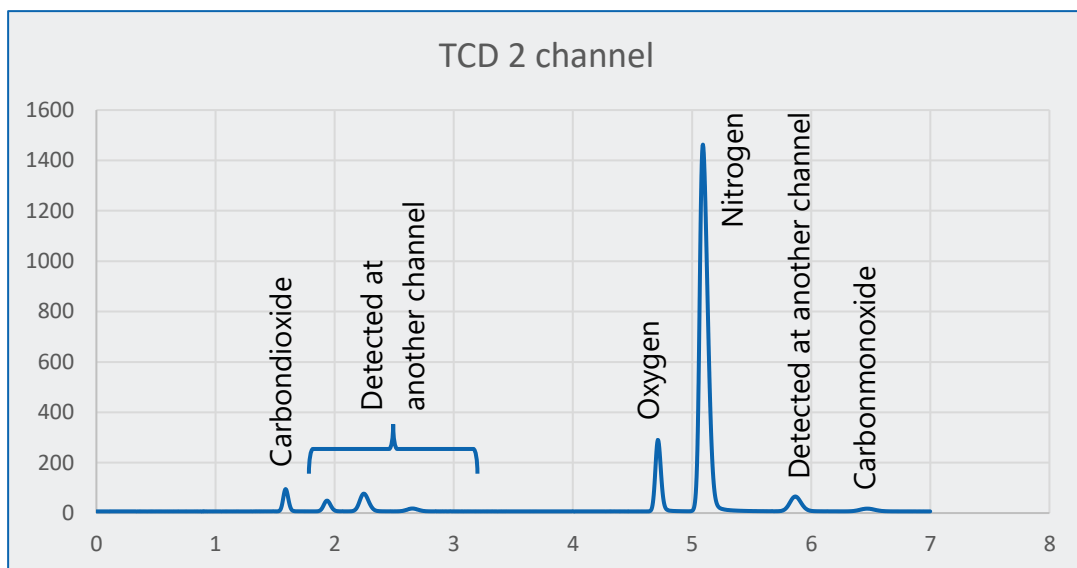
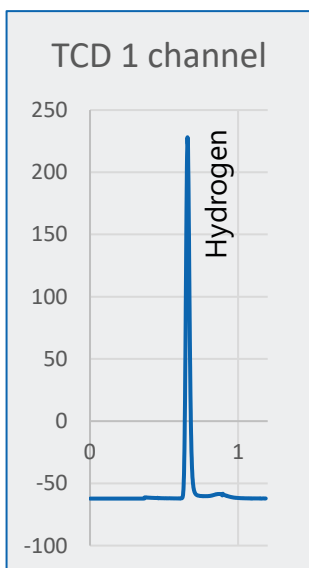
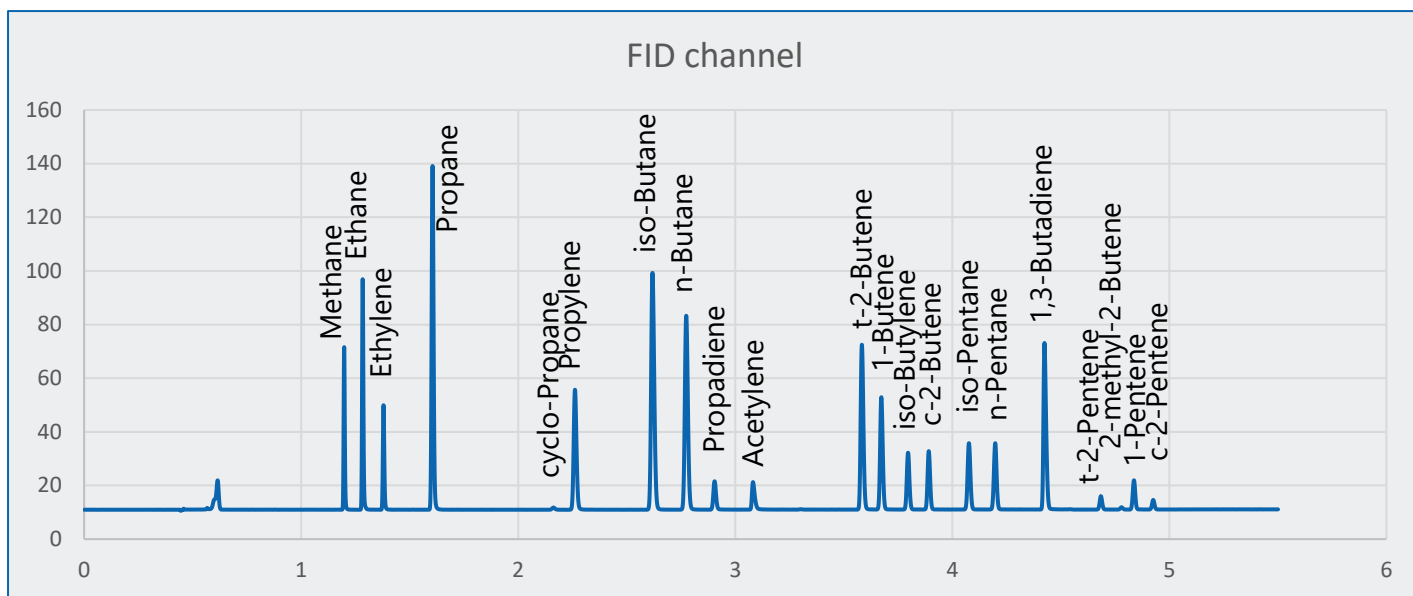
Repeatability of the system has been checked by analyzing the calibration standard 10 times at a set pressure of 500 mBar. Below graph shows the areas for multiple components as detected on the three detectors.



Performance of the device can be verified by analyzing a sample or calibration standard at various pressure settings.



The actual analysis on the AC Hi-speed RGA and other AC gas applications remains the same. Below an example of a sample analyzed using the AC Vacuum sampling device.



Conclusion

The AC Vacuum sampling device in combination with the sample shut-off valve of an AC Hi-speed RGA or AC NGA ensures repeatable injections of gas samples at (sub)ambient pressure. The automated process incorporates sufficient flushing of the sample loop(s) and can be used in combination with a stream selection to automate the sequential introduction of multiple samples. The device is fully software controlled, saving valuable operator time.