The modern world would be quite unimaginable without a secure energy supply. This supply in turn depends on the trading activities of energy providers. In the face of rising energy prices, these companies are increasingly focused on cutting unwanted giveaways and wastage – and for this, they are seeking better metering technology.

Whereas traditional gas-metering is content with measuring the volume of gas moved, both supplier and customer should be more interested in the energy value of the gas. This value depends on its chemical make-up. On-line gas chromatography permits an exact analysis of the composition of the gas – data that can be used to accurately establish the heating value. The principle is not new, but the challenge is to produce a device that meets the demands of mass-deployment – robust and safe yet practical and accurate. Just the job for ABB’s NGC 8200!

ABB has made a technological breakthrough in on-line gas chromatography – a technology that is very useful when analyzing the heating value of natural gas.

Most natural gas custody transfer contracts today have a heating value rather than gas volume specification – often measured in MMBtu. The financial benefit for keeping track of energy rather than just flow rate is substantial. Most major (large volume) interconnects have on-line Btu measurement of some sort today. It is anticipated, that in the future a larger number of smaller volume stations will use this technology as the costs of GC’s (gas chromatographs) are reduced by new developments.

The general philosophy of ABB Totalflow has been to work toward a standardization of chromatographic techniques so that the GCs can be manufactured as instruments rather than hand-built requiring trained techni-
cians in their installation, operation and maintenance. Several manufacturers have targeted such standardization, and various approaches tried. The analytical team at ABB’s Bartlesville, OK, plant in cooperation with ABB’s corporate R&D department effected a thorough study of micro-electro-mechanical system (MEMS) methods. As a result of this, the decision was taken to develop a highly integrated manifold-based module using conventional materials – raising on-line chromatography to the next level of technology in terms of modularity and field repairability. The result is a new GC, the NGC 8200 that is just as powerful and innovative as it is small in size.

Extensive testing on the prototypes and pre-production units has shown unmatched linearity, repeatability, temperature stability as well as low-level component detection ability.

**A pedigree of excellence**

The foundation for this revolutionary new on-line GC was laid over a decade ago when the Model 8000/8100 Btu/CV Transmitter was developed.

This product has a time-proven track record that boasts over 1200 units working as natural gas analyzers all over the world. The design included several breakthrough innovations that were unmatched in the industry until recently. Some of these placed chromatographic analysis into applications with the natural gas industry where its use was not previously practical. The Windows-based user interface, which has since become common-place, permitted ease of use despite the complexity of the underlying instrument. The self-contained computer controller lowered installation costs while allowing the GC to be deployed in explosion prone hazardous locations. The weatherproof enclosure and airless oven permitted the GC to be installed close to the sample point, reducing sample transport tubing and dew point problems. The four serial digital communication ports enabled multiple participants at gas custody transfer sites access to vital quality and heating value data. These data links also made the on-site calculation of energy flow possible by linking to computerized flow computation units. The built-in stream switching solenoids allowed the monitoring of several gas sources without calling for additional hardware.

However, all these engineering “firsts” are insignificant when compared to the modular concepts that were developed with this product. For the first time in history, the “chromatography” part of the GC became a “spare part”. This means companies can stock spare GC modules locally permitting analyzer repair to be effected in hours rather than days. The key to this GC Module was a highly integrated manifold containing the columns, valves and detectors. This module could be used on any Model 8000 ever produced. Such modularity had never been achieved before.

This product has a time-proven track record that boasts over 1200 units working as natural gas analyzers all over the world.

Once proven, the manifold concept on the GC Module was expanded to include the other mechanical parts needed to make a multi-stream GC.

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**Footnotes**

1 A manifold is a device that regulates flow in a hydraulic system.

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**Btu**

The energy that can be obtained by burning gas depends on its chemical composition. The greater the energy per unit volume (calorific value), the smaller the volume of gas needed to heat a home hot water tank. Total flowing energy is defined as:

\[ E = H \times Q \]

Where:
- \( E \) = Energy flow rate (MMBtu’s)
- \( H \) = Heating Value/unit volume or mass (Btu or CV (calorific value) per unit volume or mass.
- \( Q \) = Volume or mass flow rate (SCF or cubic meters or mass flow rate)

One Btu is the quantity of heat required to raise the temperature of one pound of water from 58.5 °F to 59.5 °F (equivalent to about 1055 Joules in SI).

In North America, the prevalent unit for energy measurement is the MMBtu or the dekaTherm (in Europe Joules are often used). The thermal energy stored in gas is calculated by:

\[ \text{thermal energy (MMBtu)} = \text{calorific value (Btu/cf)} \times \text{gas volume (MMcf)} \]

1 MMBtu = 1 dekaTherm
module on the NGC 8200 can be replaced with the use of a single hex-wrench. The design incorporates the strength of its predecessors further. The built-in controller has much more capability without consuming more power. The device is smaller but retains the explosion and weather-proof durability of its predecessor while gaining in ruggedness. Like the earlier models, it is still a multi-stream device, but can additionally handle multiple calibration streams.

With the addition of a multivariable transmitter to provide inputs, the GC is a flow computer and a chromatograph in one.

It also has some features that have not previously been developed on an explosion proof on-line GC.

The true value of this new design lies in the powerful combination of improved performance at a much lower installed cost. Regarding this improved performance, for example, the repeatability over a wide range of ambient temperatures sets a new industry standard.

The NGC 8200 does more than provide first rate on-site analysis. It presents a highly versatile platform integrating many of the functions that pipeline operators need to deliver greater productivity.

**Operational testing**

The result of operational testing allows a published specification of

- $+/-0.125$ Btu at 1000 Btu at ambient,
- $+/-0.25$ Btu at 1000 Btu over 0 to 130°F.

While the Model 8000 made it practical to interface an analyzer to a flow computer to provide energy measurement, the NGC 8200 integrates both functions into the same instrument. With the power of the GC controller’s 32-bit microprocessor and the object oriented XSeries software framework (ported from Totalflow RTUs and Flow Computers), direct energy measurement is a reality. With the addition of a multivariable transmitter to provide inputs, the GC is a flow computer and a chromatograph in one.

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