THE ENCAL 3000 GAS CHROMATOGRAPH

Outstanding measurement performance using the latest high technology

Gas chromatographs have been used for the energy measurement of natural gas since the early seventies. The first available systems were derived from gas chromatographs that had been used in industries other than the natural gas industry, for example the petrochemical industry.

However, the features of these systems were not focused on a targeted measurement like the BTU analysis and, as a consequence, these systems did not fully meet the demands of the natural gas industry. An example of this was that these gas chromatographs had electronics compartments which where protected against explosions in hazardous areas using overpressure protection methods (Ex-p). To create this overpressure, instrument air was used which is **readily available** in most petrochemical factories but **not** in the average gas station.

With the growing demand for energy measurement systems, the suppliers of gas chromatographs recognised the potential of the natural gas market and started developing new dedicated analysers that, at the same time, became more accurate and reliable. Ex-d protection was used instead of overpressure and specifications with regard to accuracy and repeatability were improved to meet the requirements of the highly demanding natural gas market.

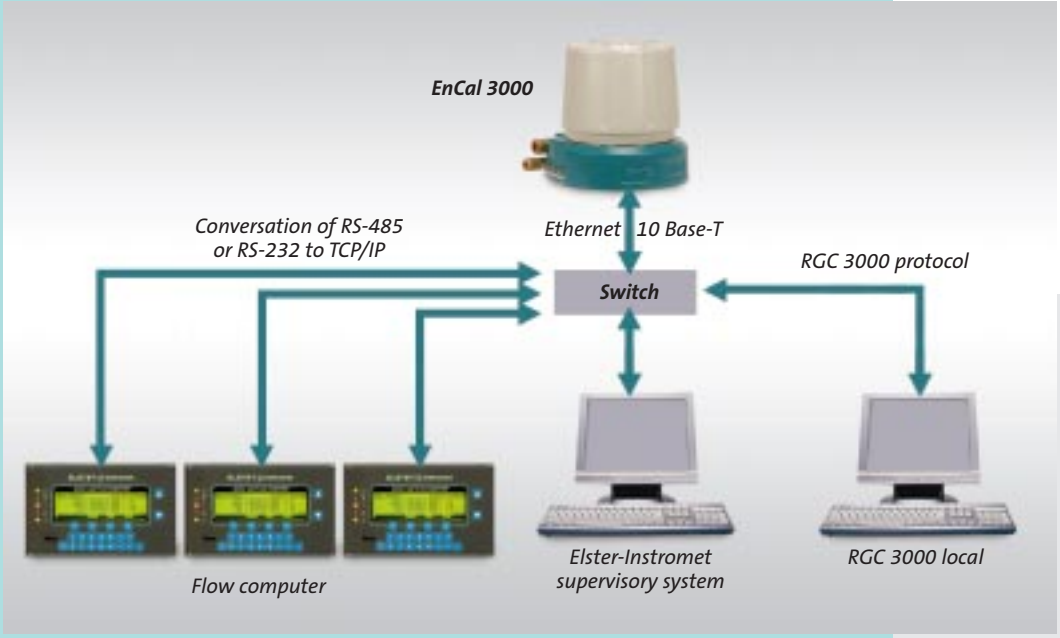
However, most energy meter systems are still assembled from separate modules with their own functionality. There is the gas chromatograph, a separate control unit or even PC (performing the calculations), sometimes a data storage unit or printer, a sample conditioning unit and all kinds of stream selection valves to support automatic calibration and stream switching. As a result, gas chromatograph systems are complex and not always user-friendly.

The EnCal 3000 is the result of a new step in the development of a fully dedicated energy meter for natural gas applications. The analytical modules are based on the latest technology like MEMS (Micro Electro Mechanical Systems, see excerpt from Wikipedia), e.g. sample injectors and detectors are manufactured in silicon technology, and, to a great extent, auxiliary system components like sample conditioning, stream selection and electronics are also integrated in the compact explosion-proof housing.

A display unit or control unit is not required to operate the EnCal 3000. However, it is available if prescribed by country-specific or customer regulations or if additional I/O is required. Since the EnCal 3000 is often used to give a live input of the gas data to a flow computer, the functionality of the display unit can be combined with the FC 2000 or a gas-net F1 flow computer. A dedicated display unit based on the gas-net series is also available. This unit provides additional data storage

The basic unit consists of:

- The analytical channels containing the injector, the separation column and the detector and electronic pressure control
- Electronics unit where all calculations and signal integration are performed
- A double block and bleed stream selection block for 5 streams and 1 calibration gas
- Basic gas conditioning unit in which the gas inlet pressure is reduced and the gas filtered
- An integrated sample bypass (used for multi stream applications or in case of long sample lines)
- Data storage facilities for 35 days of data and alarms
- Communication interfaces like Modbus and TCP/IP



facilities, communication interfaces (several Modbus and DSfG digital interface) and I/O boards. These boards offer a variety of analogue/digital I/Os and integrated Ex barriers.

For communication with DCS systems or flow computers, the EnCal 3000 features two Modbus outputs and one TCP/IP output. The TCP/IP communication interface enables the user to connect the EnCal 3000 in a network where several units can have access to the EnCal 3000. By using the "Modbus over TCP/IP" protocol, it will also be possible to send the data directly over TCP/IP to the Ethernet port of the FC 2000 or gas-net F1 flow computer.

The EnCal 3000 concept is clearly a step forward in the integration of energy measurement system components. Users will benefit from this since all system parts concentrate on the measurement of the energy content of natural gas and the compact outdoor design makes for a more economical total energy measurement solution.

But the one thing that really matters in energy measurement is accuracy! We can assure you that this new EnCal 3000 is not just an implementation of fancy technology. The MEMS detectors in the EnCal 3000 feature a very fast response and high sensitivity, and this enables us to use the much more efficient capillary columns instead of traditionally used packed columns. Since exact separation of the natural gas components is an essential prerequisite for accurate analysis, the use of these capillary columns results in higher accuracy. Another advantage of the MEMS detector used in the EnCal 3000 is its linearity. Over a broad range of gases, the EnCal 3000 measurement uncertainty is less than 0.1% after single point calibration! Together with an unmatched 0.01% reproducibility, the use of the latest technology really pays off!

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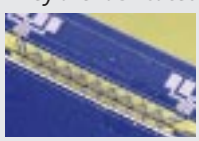
Text from Wikipedia, the free encyclopedia:
Microelectromechanical Systems (MEMS) is the technology of the very small, and merges at the nanoscale into "Nanoelectromechanical Systems" (NEMS) and Nanotechnology. In Europe, MEMS are often referred to as Micro Systems Technology (MST). It should not be confused with the hypothetical vision of Molecular Nanotechnology or Molecular Electronics. These devices generally range in size from a micrometer (a millionth of a meter) to a millimeter (thousandth of a meter). At these size scales, a human's intuitive sense of physics does not always hold true. Due to MEMS' large surface area to volume ratio, surface effects such as electrostatics and wetting dominate volume effects such as inertia or thermal mass. They are fabricated using modified silicon fabrication technology (used to make electronics), molding and plating, wet etching (KOH, TMAH) and dry etching (RIE and DRIE), electro discharge machining (EDM), and other technologies capable of manufacturing very small devices. MEMS sometimes go by the names micromechanics, micro machines, or micro system technology (MST).



Picture of a channel in a MEMS TCD detector