

## EnCal 3000 with enhanced features:

# 1 + 1 = Quad

The gas industry is undergoing change and thus new requirements are being placed on gas measurement, particularly on gas quality analysis. The new EnCal 3000 Quad from Elster addresses these increased analytical challenges.

The global energy industry is facing growth and change at the same time, driven by economically developing regions and the energy policy to reduce CO<sub>2</sub> emissions. These trends mean challenges, but also chances for the gas industry that is well-prepared for both – the growth and the change.

On the one hand, new natural gas resources have been found over the past few years in the form of unconventional deposits such as shale gas. On the other hand, the gas industry is compatible with new alternative energy sources such as biogas, syngas and so-called e-gas, which is produced by electrolysis using electricity generated from renewable sources of energy and which can be fed back into the gas grid. The gas industry thus presents promising bridge and target technologies. These concepts all require appropriate gas measuring equipment for the management and billing of future energy flows. In this, innovative gas quality analysis solutions are the key to turning the change into a real opportunity for gas measuring technology.

### Standard and extended tasks of gas quality analysis

Gas trading is based on energy billing. Hence the primary task of gas quality analysis is the determination of the calorific value and gas properties to calculate the gas compressibility. These measurements can be provided by gas analysis with a standard gas chromatograph comprising the components N<sub>2</sub>, CO<sub>2</sub> and

the hydrocarbons ranging from methane to C<sub>6+</sub>, which means the sum of hexane and higher hydrocarbons.

Besides these key gas parameters, other measurement tasks are required relating to individual substances and properties such as oxygen (O<sub>2</sub>), hydrogen (H<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), sulphur, particularly H<sub>2</sub>S, odorants and also the dewpoints of water and hydrocarbons which indicate the amount of these substances present in the gas. The water content is critical for the integrity of the whole transportation process, especially in terms of damage to instrumentation and pipeline corrosion. Hydrocarbon condensate is also critical for pipeline instrumentation and especially for various gas utilization processes.

The changes in the gas industry mean new gas types, e.g. shale gas, biogas, e-gas, are now being introduced, with new gas components and properties that need to be analyzed. Growing international gas trade requires standardization of a wide variety of gas quality parameters. One of the institutions dedicated to standardization work is EASEE-gas, the European Association for the Streamlining of Energy Exchange ([www.easee-gas.org/](http://www.easee-gas.org/)). It develops common business practices, e.g. for gas quality (CBP 2005-001-02 Gas Quality Harmonisation). These business practices can be referred to in gas trading contracts. However, there are also national standards for gas quality specification, e.g. DVGW G 260 or G 262 in Germany.



In order to serve the growing demand for extended gas quality analysis, Elster is presenting its new high performance field gas chromatograph EnCal 3000 Quad. This device comprises two standard EnCal 3000 housings with 4 gas chromatography modules in total, hence the attribute "Quad". The EnCal 3000 Quad provides a wide variety of applications ranging from standard C<sub>6+</sub> analysis to C<sub>9</sub> or C<sub>12</sub> analysis with corresponding hydrocarbon dewpoint calculation in addition to the measurement of various individual gas components.

### EnCal 3000 Quad: device and applications

The standard version of the EnCal 3000 is a gas chromatograph that uses so-called "parallel injection". This means that the GC contains two injectors, two analytical columns and two detectors. At the start of

The EnCal 3000 Quad consists of two coupled Ex-d housings with a maximum of 4 analytical GC channels.



each analysis run, the sample gas is injected simultaneously into the two columns, each of which is optimized and configured to measure different components of the sample gas. The information from both measurements is then combined to give a single analysis result.

Technically, the EnCal 3000 Quad is a combination of two EnCal 3000 gas chromatographs. GC A is considered to be the main GC and is the intelligent one of the

Furthermore, the complexity of the whole measurement system is reduced as compared to two individual units because connection to the measuring periphery is provided by a single interface.

The days when the heating value of natural gas was the only parameter of interest when it comes to gas quality are a thing of the past. More and more parameters such as oxygen, hydrogen, H<sub>2</sub>S, odorants, as well as the water and hydrocarbon

not be neglected in the calculation. To increase the accuracy of the hydrocarbon dewpoint calculation, these components must be measured as well. The EnCal 3000 Quad enables analyses all the way up to C12 within just 4 minutes. As with the hydrocarbon dewpoint analysis up to C9, the calculation is performed by the EnCal 3000 control unit.

The main GC of the EnCal 3000 Quad will measure hydrocarbons up to C8. A third

**EnCal3000 Quad in a biogas grid injection plant**

**Fiscal gas quality analysis**

- C1-C4 (methane up to butanes)
- N<sub>2</sub>           • H<sub>2</sub>S
- CO<sub>2</sub>           • H<sub>2</sub>
- O<sub>2</sub>             • THT

**Odorization**

Fully automated, flow controlled THT odorization

**Fiscal flow metering**

- Rotary meter
- Recirculation of off-spec gas
- Pressure reduction
- Entry point for odorization
- Entry point for propane blending

**Control system**

- Flow computer
- Panel PC for displaying process parameters
- Gas quality checking
- Remote reading/operation

two. It serves as the interface for communication and performs all the internal calculations. GC B contains one or two analytical channels and the corresponding power supply unit. The data of the channels from GC B are transferred to the processor board in unit A where all measurement results are compiled into one.

By developing the EnCal 3000 Quad, we are offering more than just the sum of two EnCal 3000 units. The analytical results of up to 4 different GC channels (1 channel = injector + column + detector) are combined in a single evaluation, which results in higher accuracy and better repeatability.

dewpoints must be determined. The increasing gas quality variations due to global trade and injection of new gas types, e.g. biogas, mean that gas quality analysis must supply a great deal more analytical information. The EnCal 3000 Quad offers analytical solutions for these new applications.

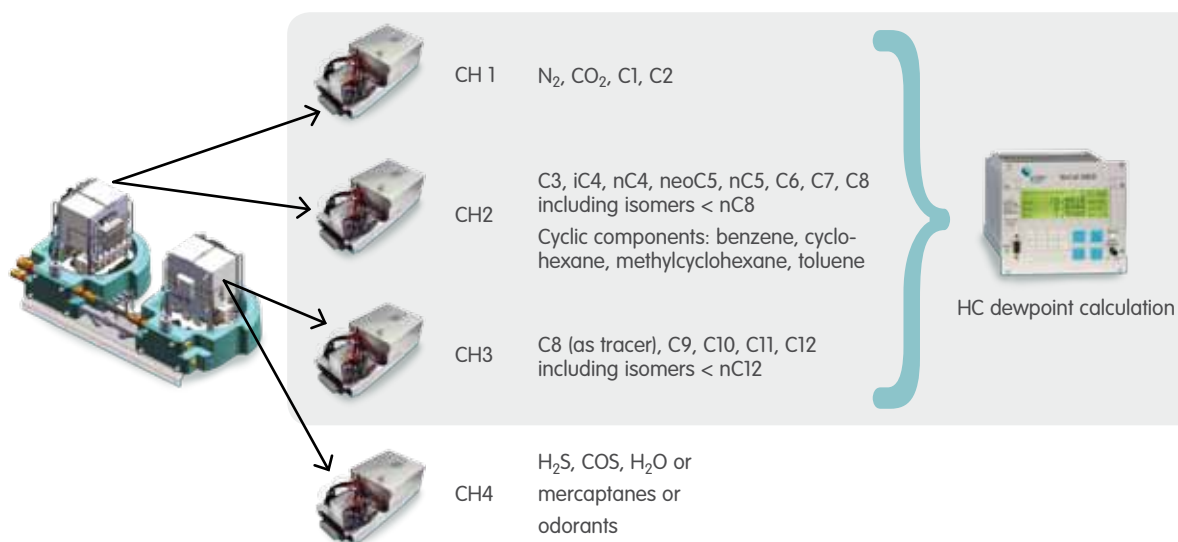
**C12 analysis + hydrocarbon dewpoint calculation**

With the standard EnCal 3000 that analyzes up to C9, it has already been possible to calculate the hydrocarbon dewpoint for some years now. Some gases, however, contain concentrations of higher hydrocarbons such as C10 to C12 that should

channel in the second housing of the Quad is dedicated to the measurement of C9 up to C12. Thanks to the highly sensitive thermal conductivity detector (TCD), it is possible to measure concentrations down to 1 ppm! These are levels that are completely out of reach on the traditional miniature TCDs used in most field-mounted gas chromatographs for fiscal measurement.

The hydrocarbon dewpoint is calculated with an accuracy of approx. 3 degrees, which is similar to the accuracy offered by measuring principles such as manual or automatic cooled-mirror measurement. By using a gas chromatograph, however, much more information can be obtained

### Example of a GC application with C12 analysis, hydrocarbon dewpoint calculation and sulphur measurement



than just the dewpoint. Thanks to the full analysis up to C12, the cause of a change in dewpoint can be determined. If, for example, an increase in the benzene concentration caused the dewpoint to increase, this would be clear from the gas composition report.

In addition, it is possible to calculate the hydrocarbon dewpoint at any desired pressure or at line pressure, provided this pressure is available as an input to the control unit.

Since a fourth channel position in the second housing is still free, this channel can be used for measurement of one or more additional parameters such as H<sub>2</sub>S with a detection limit of 1 ppm.

#### Biogas + H<sub>2</sub>S and odorants

Another application made possible by the EnCal 3000 Quad is the analysis of biogas combined with H<sub>2</sub>S and THT measurement using a highly sensitive detector. One of the components measured by our standard biogas GC based on the EnCal 3000 is hydrogen.

Since the heat conductivity of hydrogen is close to the heat conductivity of helium, hydrogen cannot be measured with the standard carrier gas, helium. By using argon as a second carrier gas, it is possible to quantify low hydrogen concentrations in biogas. H<sub>2</sub>S measurement is required to allow biogas to be injected into the gas grid. Pipeline integrity can be compromised by H<sub>2</sub>S levels exceeding the allowed maximum. Concentrations down to 2 ppm can be detected on the standard biogas GC. For lower concentrations down to 1 ppm, a separate channel in the second GC housing of the EnCal 3000 Quad offers a solution.

The fourth available position can be used for analysis of the odorant THT. Biogas often requires odorization before it can be injected into gas distribution grids. In many cases, it is accepted to base the injected amount on the volume of gas passing the gas flow meter. However, some customers require continuous monitoring of the odorant concentration in order to make sure that it lies within the correct concentration bandwidth. With a dedicated analytical channel, the EnCal 3000 Quad can measure levels of THT down to 2 ppm in natural gas or green gas.

With the EnCal 3000 Quad, chromatography applications that seem too complex to be performed on a single device are now within reach.

Be creative ... and let us know what kind of application you can think of that would solve your analysis problem – it may well be that we can come up with a solution.

Addy Baksteen      addy.baksteen@elster.com  
Dr. Joachim Kastner      joachim.kastner@elster.com