EnCal 3000

Energy measurement analyser

Applications

- Fiscal Energy measurement
- Quantitative measurement of natural gas components
- Gas quality control measurement

Brief information

The EnCal 3000 is a gas chromatograph specially designed for natural gas energy measurements. This state-of-the-art analyser uses chromatography components based on the latest micro electro-mechanical systems (MEMS) and capillary column technique. This results in highly repeatable and accurate analysis results. The compact, explosion proof design includes the analytical hardware, stream selection and all required electronics for standalone operation.

The capillary column technology used in the EnCal 3000 has a superior performance compared to the conventional used packed column technique. Optimum peak separation in combination with a very sensitive and linear TCD detector results in a system with a high accuracy over a large range of gases. Since the carrier gas pressure is electronically controlled ambient temperature changes have no influence on peak retention times. The design of the EnCal 3000 is such that the unit can be placed outdoors close to the sample point without the need of an expensive temperature controlled environment.

Communication with the EnCal 3000 can be established using the TCP/IP connection and two Modbus ports. The configuration of the EnCal 3000 is carried out with the help of the software package RGC 3000. This software package can be used to configure the (freely programmable) Modbus listing, the analyser method, alarm settings, and all other available parameters in the analyser. RGC 3000 is the only user interface to the EnCal 3000, which means a separate control unit is not required to operate the instrument or to change any configuration parameters. The TCP/IP connection offers a lot of communication possibilities, like networking capabilities. By using Modbus via TCP/IP multiple instruments such as flow computers can be connected to the EnCal 3000. Besides the RGC 3000 software package, the unit can be supplied with a powerful diagnostic software tool, which can be used to analyse the internally stored data. 35 days of data is stored in the EnCal's solid state memory in accordance with the API 21.1 standard. With the help of the "History logger" software, this data can be retrieved, presented and transferred to HTML based reports.

The modular design of the EnCal 3000 enables the servicing of the analyser by non-specialist personnel and keeps instrument down-time very short. The use of the MEMS based components results in far lower consumption of utilities like the Helium carrier gas. All of this contributes to lower operational costs compared to traditional gas chromatographs.

Main features

- C_{6+} within 3 minutes*
- C_{9+} within 5 minutes*
- Repeatability < 0.01 %
  Double block and bleed
  Stream select for 5 streams
- TCP/IP communication
  Data storage in accordance with API 21.1 standard
- IP 66 outdoor housing
- Calculations in accordance with ISO 6976, GPA 2172 or GOST 22667

* Detailed analysis up to n-C_8 (C_{6+}) respectively n-C_9 (C_{9+}) including all isomers and other hydrocarbons, no backflush

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Configuration software

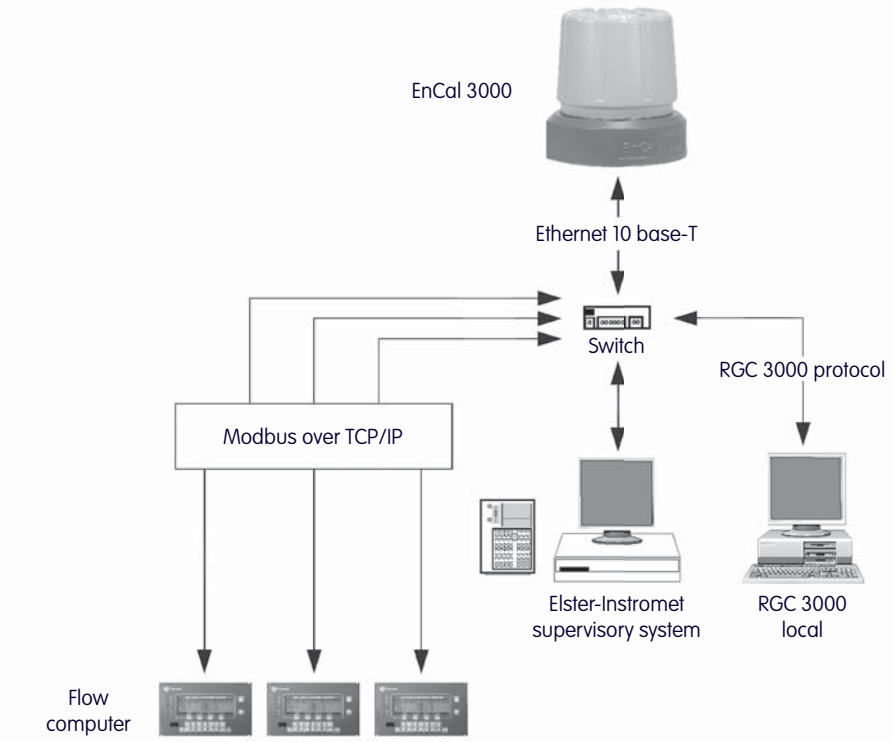
The main functions of the RGC 3000 configuration software are:

- Configuration of the analyser method and application
- Setting of alarms + limits
- Printing of chromatograms, configuration and analysis results
- Performing manually activated calibrations

A special feature of the RGC software is the "recalculation" option that enables the user to change an integration parameter and check the effect of this change without performing a new analysis. The EnCal 3000 simply recalculates the analysis results based on the raw data of a previously performed analysis. This is a time-saving option, whenever the operator needs to optimize the analysis.

The RGC 3000 software can also be used to update the embedded software of the gas chromatograph, should any new software releases become available. This can be done locally or remotely, provided the EnCal 3000 is connected to a network, which can be accessed remotely. Because all analyser parameters are available electronically, the remote control capabilities are much more valuable than with traditional gas chromatographs. The column head pressure and temperatures of the analytical components, for example, can be changed or checked remotely.

The Modbus configuration of the EnCal 3000 is freely programmable. It can be customized to the application and to the equipment communicating with the analyser. Both the serial Modbus and the Modbus via TCP/IP can be tested using the WINDCS software tool.



API data storage

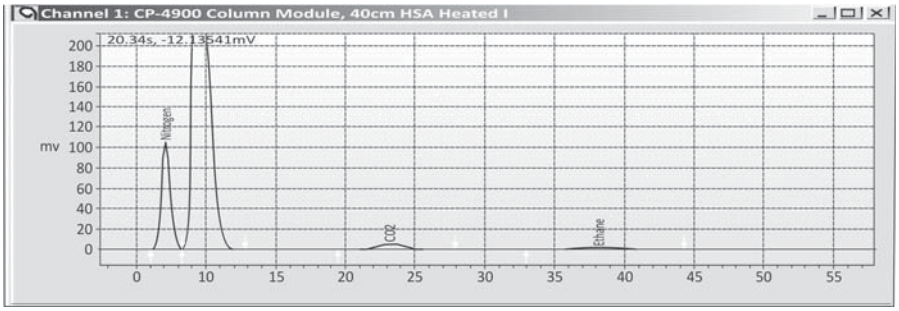
In today's natural gas market it is becoming increasingly important to have reliable energy measurement data concerning the gas transported through the pipeline. To secure the analysis data of the EnCal 3000 the analyser is equipped with an internal data storage of 35 days. This means that all analysis and calibrations performed during this period can be retrieved, even if all communication between the instrument and external devices such as flow computers has failed for a certain period of time.

This data is stored in accordance with the API 21.1 standard and can be retrieved with a software tool called "History logger". Using this software tool the internally stored data can be retrieved, viewed, stored on a PC and printed out in configurable reports.

Data communication

Communication with the EnCal 3000 can be established using the TCP/IP connection and two configurable (RS 232/485) Modbus ports. If a PC is connected running the RGC 3000 software package, this always uses the TCP/IP connection. This PC with the RGC 3000 software is the only user interface with the gas chromatograph. This means a separate control unit is not required to operate the instrument or to change any of the instrument's configuration parameters.

The TCP/IP connection offers a lot of communication possibilities, like networking capabilities. By using Modbus via TCP/IP, multiple instruments such as flow computers can be connected to the EnCal 3000.



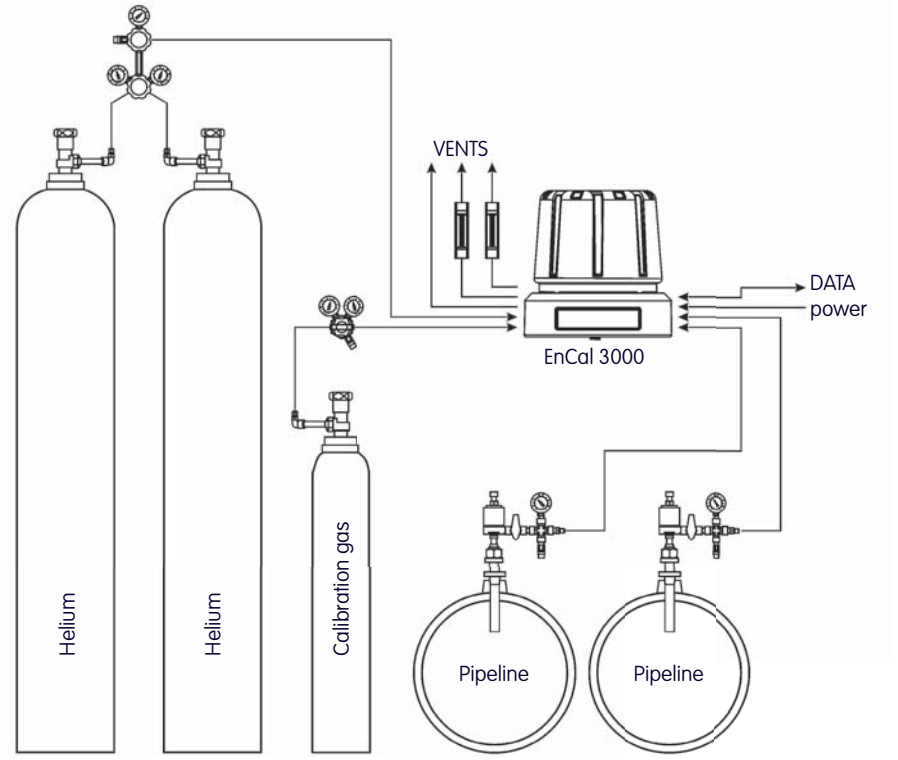
Sampling

An important part of the entire measurement system is the sample retraction and sample transport. The gas that is retracted from the pipe-line must be a representative sample, condensation must be prevented and the pressure must, in most cases, be reduced from very high pressures down to 2 – 4 barg.

Depending on company or country regulations several systems can be used. The most economic system is a (retractable) sample probe with integrated pressure reduction. The main advantage of these sample probes is that the pressure reduction is done inside the pipeline and the heat capacity of the gas in the pipe-line prevents the gas from condensation. The sample probe contains an integrated membrane, which separates any free liquids that might be present in the pipeline from the gas before it can enter the tubing leading to the EnCal 3000 analyser. To prevent the gas from condensation during the transport to the EnCal 3000 it is recommended to provide heat tracing of the transport lines. Whether heat tracing is required and what capacities are needed depends largely on the dewpoint of the gas and the ambient temperatures.

Calibration and carrier gas

The EnCal 3000 uses Helium as a carrier gas. To make sure that an uninterrupted supply of Helium is guaranteed, the use of a Helium switch-over system is recommended. This is a pressure regulator to which two gas cylinders can be connected. The pressure of both bottles is reduced to the required value with a small pressure difference between the two reduced pressures. The bottle with the higher pressure is depleted first and once the pressure of this bottle is lower than the pressure of the second bottle, the supply is taken over by the second bottle enabling the user to replace the first bottle. To protect the analyser against failure of the pressure regulator, the use of a safety relief valve at the outlet of the pressure regulator is recommended.



The calibration gas is a very important factor and determines the overall accuracy of the complete measurement system! After all, the EnCal 3000 can never be more accurate than the calibration gas it is calibrated with. The accuracy of the certificate is, of course, important but on top of this, there are several other issues to be considered, e.g. the optimum composition, the ambient temperatures of the gas cylinder and the possible condensation of the higher hydrocarbons in the calibration gas. Elster-Instromet can advise you on each of these subjects and we supply all required accessories, such as pressure regulators, bottle heaters and even complete cabinets or bottle stands for outdoor installations.

Multi stream sampling

In an ideal situation, the EnCal 3000 is placed as close to the sample point as possible. However, in most situations, especially where two or more gases of different meter runs are to be sampled, there will be a certain distance to the sampling points. To make sure that the lag time between the various sample points and the analyser is acceptable a fast loop system is required. The EnCal 3000 has a built in fast loop system. This means that if the analyser is running several streams in a sequence the next stream to be analysed will be flushed automatically with a flush rate of approx. 20-30 NL/hr. This is sufficient to flush at least 100 meters of 1/8" sample line. By installing two flow meters behind the EnCal 3000, the user can see both the normal gas sample flow and the sample bypass flow. Since the fast loop bypasses the moisture filter in the EnCal 3000, it does not negatively influence life time of the filter. The internal fast loop system of the EnCal 3000 saves substantial costs compared with individual fast loops per sample stream.

Technical data	
Analytical hardware	2 parallel isothermal GC modules with narrow-bore capillary column technology in combination with MEMS based analytical components
Analysis output	Full composition of natural gas up to C_{6+} or C_{9+} (option)* Heating value, density, Wobbe index
Gas composition range	N_2 : 0 – 22 % CH_4: 55 – 100 % CO_2: 0 – 20 % C_2H: 0 – 14 % C_3 : 0 – 10 % C_4 : 0 – 10 % neo-C_5 : 0 – 0.25 % C_5 : 0 – 0.25 % C_6 : 0 – 0.20 % C_7 : 0 – 0.10 % C_8 : 0 – 0.05 % C_{9+} : 0 – 0.05 % Concentrations outside these ranges and other components on request
Performance	Repeatability (according to ISO 6976 par. 9.1.1): < 0.01 % for all calculated properties Detection limit for C_5: 5 ppm Analysis time: 3 min. for C_{6+} analysis, 5 min. for C_{9+} analysis
Ambient conditions	Temperature: -20 °C to +55 °C
Dimensions	Base Ø 37 cm x height 37 cm (Ø 14" x height 14")
Weight	< 30 kg
Approvals	ATEX II2G E Ex d IIB T4, KEMA 05ATEX2191 IP 66, Vibration and shock test in acc. with IEC 60068-2-31 and 64 EMC according to EN 61000-6-2 and EN 61000-6-4 PTB Metrological Certificate Reference No. PTB-3.31-4016861
Power supply	24 VDC, 18 W nominal (50 W start-up peak) for non-heated version 24 VDC, 120 W nominal (170 W start-up peak) for heated version (ambient < 0 °C)
Interfaces	Ethernet UTP 10 Base-T for ModBus TCP/IP and PC link (max. distance 100 meter) Two RS 232/485 ports for ModBus RTU or ASCII (3 wire connection for both RS232 and 485)
Analyser	Complete stand-alone operation, including all calculations and generation of report formats, without need for operator intervention. Calculations in acc. with ISO 6976, GPA 2172, GOST 22667 or ASTM D3588
PC requirements	Windows 2000 or Windows XP professional edition (Service Pack 1 or higher) 1000 MHz processor, 512 MB RAM, CD-rom player, free Ethernet port.
Data logging	History Log: local storage of last 35 days of all analytical data (analysis, events, alarms, averages, last chromatogram, calibration data) in accordance with API Report 21.1 All data can be made available in XML format
Sample gas inlets	Input pressure range 2 – 4 barg, sample gas must be free from particles and liquid, temperature < 55 °C Double block and bleed stream selection for up to 5 streams and 1 calibration gas. Integrated fast loop system with bypass flow of 20 – 30 Nl/hr. (software selectable)
Helium	Quality N5.0, supply pressure 5.5 ± 0.5 barg, consumption ± 8 ml/min Pressure regulator should contain a safety relief set at 6.5 barg
Calibration gas	Supply pressure 2 – 4 barg. Consumption ± 600 ml/day (at atm. pressure) Composition depending on application

* Detailed analysis up to n-C_8 (C_{6+}) respectively n-C_9 (C_{9+}) including all isomers and other hydrocarbons, no backflush

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EnCal 3000 EN03
A30.04.2012

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