

EnCal 3000 THT

Accurate odorant measurement



Introduction

Odorisation of natural gas is an important operational aspect in the natural gas industry. Since natural gas is odourless, a gas leak cannot be detected unless sufficient odorant is added to it. On the other hand, if too much odorant is used, harmless small leaks will be noticed leading to unnecessary reports from worried customers or end users in households and industry.

A widely used odorant for natural gas is THT (tetrahydrothiophene). THT is a sulphur-containing liquid with a strong, unpleasant smell. If added in small quantities to natural gas, THT gives the gas the required odour for safe use in both households and industry.

Since the minimum and maximum concentrations of THT in natural gas are subject to given limit values, the THT concentration must be measured. This requirement is often met by simply carrying out laboratory checks at certain intervals. However, it is also possible to measure THT online, which offers various advantages.

Cost saving

Online measurement of the THT concentration obviously requires an initial investment. The EnCal 3000 however is able of measuring the THT concentration in addition to the heatingvalue measurement. In many cases the heatingvalue measurement is required for billing purposes anyway. Assuming this is the case costly manual sampling, laboratory analysis or spot checks can be saved with very limited additional costs.

Liability

Since spot checks and lab analyses are carried out at given intervals, there is always a period in which the network operator cannot be sure of the exact THT concentration in the gas. Should failures have arisen in the odorant injection system, the operator would only find out at the next check, which could be a week or so later. All this time, too much odorant may have been injected leading to additional costs. On the other hand, if too little odorant has been injected, this could lead to unsafe situations, which could have extremely costly legal consequences in case of an incident.

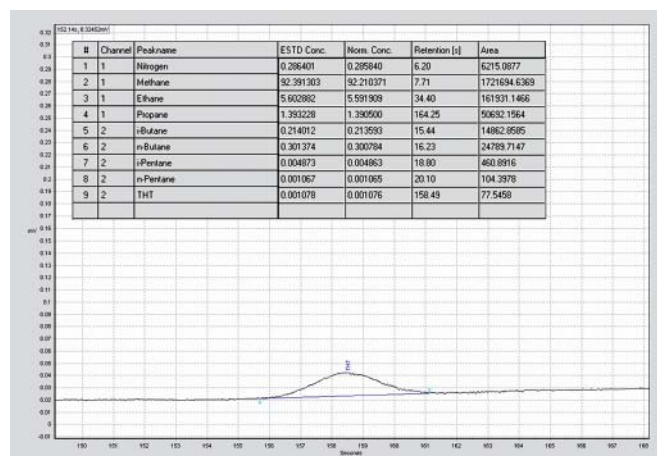
Technical application

The EnCal 3000 is an online gas chromatograph using the latest MEMS (Micro Electro Mechanical Systems) technology. Thanks to the EnCal 3000's modular concept, it is possible to offer various applications within the same system just by swapping analytical channels. For the measurement of THT, there are two possible applications.

THT as a single component: If heating value measurement is not required, it is possible to use an EnCal 3000 with a single analytical module. Then only the THT concentration will be measured.

THT measurement in combination with heating value measurement: It is possible to measure THT in combination with the components, required for the calculation of the heating value. However, to be able to combine these measurements, there is a minor trade-off in the sense that neopentane will not be measured as a separate parameter, but will be added to the n-butane component. This will result in the analysis being slightly less precise (which is, however, acceptable in many cases).

The required THT concentration can vary slightly from country to country, but typically should be 18 mg/m³ (in an allowed range of 10 – 40 mg/m³). This is about 5 ppm, which is hard to measure with traditional TCD detectors. Since the EnCal 3000 uses MEMS technology, which makes for a highly sensitive detector, this has now become possible.



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Analyser specifications

	THT + heating value	THT
Analytical hardware	2 parallel isothermal GC modules with narrow-bore capillary column technology in combination with MEMS-based analytical components	1 isothermal GC module with narrow-bore capillary column technology in combination with MEMS-based analytical components
Analysis output	Full composition of any natural gas up to C ₆₊ or C ₉₊ (option) + THT concentration, heating value, density, Wobbe index	THT (tetrahydrothiophene) concentration
Component range	N ₂ : 0 – 20 % CH ₄ : 0 – 100 % CO ₂ : 0 – 20 % C ₂ : 0 – 10 % C ₃ : 0 – 10 % C ₄ : 0 – 10 % THT : 3 ppm – 100 ppm Concentrations outside these ranges on request	néo-C5: incl. in nC4 C ₅ : 0 – 0.25 % C ₆ : 0 – 0.10 % C ₇ : 0 – 0.05 % C ₈ : 0 – 0.05 % C ₉₊ : 0 – 0.05 %
		THT : 2 ppm – 100 ppm
Performance of THT analysis		
Detection limit for THT	3 ppm	2 ppm
Repeatability for THT	1 ppm (stdev)	0.5 ppm (stdev)
Uncertainty	1 ppm (excluding calibration gas uncertainty)	0.5 ppm (excluding calibration gas uncertainty)
Analysis time	3 min. for C ₆₊ analysis, 5 min. for C ₉₊ analysis	60 s
Performance of heating value measurement		
Uncertainty	< 0.15 % for all calculated properties	N/A
Repeatability	< 0.03 % for all calculated properties	N/A
Min. detection limit	1 ppm for C5	N/A
Ambient conditions	Temperature: -20 °C to +55 °C (provided heated version is used)	
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 IP 66, vibration and shock test in acc. with IEC 60068-2-31 and IEC 60068-2-64 EMC according to EN 61000-6-2 and EN 61000-6-4	
Power supply	24 V DC, 18 W nominal (50 W start-up peak) for non-heated version 24 V DC, 120 W nominal (170 W start-up peak) for heated version (ambient temp. < 0°C)	
Interfaces	Ethernet UTP 10 Base-T for ModBus TCP/IP and PC link 2 RS 232/485 ports for ModBus RTU or ASCII 3 analogue inputs for local sensors (4 – 20 mA or 0 – 10 V DC)	
Analyser	Fully stand-alone operation, including all calculations and generation of report formats, without the need for operator intervention. Calculations in acc. with ISO 6976, GPA 2172 or GOST 22667.	
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 the last 35 days of all analytical data (analysis, events, alarms, averages, last chromatogram, calibration data) in accordance with API Report 21.1. All data available on remote workstation in XML format.	
Sample conditioning (integrated)	Integral part of analyser. Consists of pressure regulators for each stream, particle filters and double block-and-bleed stream selection for up to 5 streams and 1 calibration gas. The internal sample conditioning system also comprises a programmable sample bypass 0 – 20 NL/h.	
Sample conditioning (external)	Membrane filter required for sample gas. To prevent THT absorbance, the use of plastic sample lines and moisture filters should be avoided (SS 316 is advised).	
Helium	Quality N5.0, supply pressure 5.5 barg, consumption ± 8 ml/min. Pressure regulator should comprise a safety relief valve set to 6.5 barg.	
Calibration gas	Nominal supply pressure 2 barg. Consumption ± 600 ml/day (@ atm. pressure). Composition depending on application. Calibration gases containing THT should be heated at ambient temp. below 5 °C.	