

ENCAL 3000 H₂

Accurate Hydrogen Measurement

INTRODUCTION

A new development in the natural gas industry is the injection of hydrogen in the natural gas pipeline system. The maximum hydrogen concentration for custody operation is currently 5 mol%, higher limits are under discussion.

The basic idea is to utilize the excess energy of renewable sources, like wind turbines, hydroelectricity etc. by converting it into hydrogen. The first step in this process is the use of this energy to produce hydrogen by splitting water into its constituents. The second step is to feed the generated hydrogen in the gas grid. A possible intermediate step is the production of methane from hydrogen and carbon dioxide. There are plans to increase the maximum concentration of hydrogen in natural gas to 10% so more hydrogen can be fed in to the grid. This adds a new application to the range of our EnCal 3000 gas chromatograph.

COST SAVING

Online measurement of the hydrogen concentration obviously requires an initial investment. The EnCal 3000 however is able of measuring the hydrogen 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 checkes can be saved with very limited additional costs.

TECHNICAL APPLICATION

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

HYDROGEN AS A SINGLE COMPONENT

In case heating value measurement is not required or already present it is possible to use an EnCal 3000 with a single analytical module. The measurement will be dedicated to the measurement of hydrogen only.

HYDROGEN ADDED TO HEATING VALUE DETERMINATION

It is possible to measure hydrogen in addition to the components which are normally required for the calculation of the heatingvalue. In order to achieve this the first channel will need to be of another type and an additional carrier gas (Argon) must be added to the analyser. This has now become possible.



ENCAL 3000 H₂ TECHNICAL DATA

	Natural gas + Hydrogen + Heating value	Hydrogen only
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) + Hydrogen concentration Heating value, density, Wobbe index	Hydrogen concentration
Component range	N ₂ : 0 – 20 % néo-C5: incl. in nC4 CH ₄ : 0 – 100 % C ₅ : 0 – 0.25 % CO ₂ : 0 – 20 % C ₆ : 0 – 0.10 % C ₂ : 0 – 10 % C ₇ : 0 – 0.05 % C ₃ : 0 – 10 % C ₈ : 0 – 0.05 % C ₄ : 0 – 10 % C ₉₊ : 0 – 0.05 % H ₂ : 0 – 20 % Concentrations outside these ranges on request	Hydrogen : 0 – 100%
Performance Hydrogen analysis		
Detection limit for H ₂	5 ppm	5 ppm
Repeatability for H ₂	0.3%RSD	N/A
Uncertainty	0.6% of reading	0.6% of reading
Analysis time	5 minutes	application dependant
Performance heating value measurement		
Uncertainty	< 0.15 % for all calculated properties	N/A
With multi level calibration	< 0.10 % for all calculated properties	N/A
Repeatability	< 0.02 % for all calculated properties	N/A
Ambient conditions	Temperature: -20 °C to +55 °C (-4°F to 130 °F) (provided heated version is used)	
Dimensions	Base Ø 37 cm x height 37 cm (Ø 14" x height 14")	
Weight	< 30 kg	
Approvals	ATEX / IECEx / INMETRO : Ex db IIC T6 Gb KC MARK : Ex d IIC T6 FM : Class I / Div1 Group BCD T6 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 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	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 or GOST 22667.	
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 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 contains a programmable sample bypass 0-20 NL/hr. (0.7 scf/hr)	
Sample conditioning (external)	Membrane filter required for sample gas.	
Carrier gas(es)	Argon (for Hydrogen measurement) + Helium (in case of hydrogen + heatingvalue) Quality N5.0, supply pressure 5.5 barg, (80 psi) consumption ± 8 ml/min (0.4 scf/day) Pressure regulator should contain a safety relief set at 6.5 barg. (95 psi)	
Calibration gas	Supply pressure 2 barg (28 psi) nominal. Consumption ± 600 ml/calibration (37 in ³ /calibration) (@ atm. Pressure) Composition depending on application.	

Application Note: EnCal 3000 H₂

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