Honeywell | Connected Plant

EnCal 3000 Biogas

Metrological approved heating value measurement of biogas

Introduction

The generation of biogas as a renewable source of energy has soared in the past couple of years. Biogas generation plants are being built all over the world driven by the search for alternatives for fosile fuels and by CO_2 emission reduction programs.

Biogas as such is far from new. It is used for decades already but the scale of the generationplants is increasing in order to make the installations economically more attractive. With the growing scale of the installations it becomes more common to inject the generated biogas into the gas grid thus separating the location where the biogas is generated from the location of where it is consumed. Where biogas used to be locally consumed or converted into electrical energy it now contributes to the overall consumption of natural gas thus reducing the consumption of fosile fuels.

The feed of biogas into the pipeline network requires cleaning as well as changes to the gascomposition to fit the properties of the pipeline gas. Upgrading of the biogas can be done by blending the gas with LPG. This introduces components which are normally not present in biogas, like ethane, propane and butanes. Since the biogas is feeded into the pipeline network it also needs to be measured with metrologically approved analysers to determine the gas properties like heatingvalue and density.

Technical Application

The EnCal 3000 gas chromatograph has been adapted to be able to measure all important components present in biogas. Components like H_2, O_2, and H_2S are normally not measured in natural gas heatingvalue determination. These components are measured in the "EnCal 3000 biogas" version. The application has been approved by the PTB for use in metrologically approved metering systems.

The EnCal 3000 biogas application uses different analytical columns then the standard heatingvalue application. The oxygen present in the sample must be separated from the nitrogen which is done best with a molesieve column. Molesieve columns are particularry sensitive to water and CO_2 which are filtered out for that reason with special filter cartridges inside the gas chromatograph's housing. If the measurement of Hydrogen is required and to obtain the best possible results the EnCal 3000 uses a second carrier gas, Argon.

The H_2S and COS concentration in the biogas are important to monitor since these components may have negative effects on the pipeline integrity and could damage instrumentation downstream especially in the presence of water. These sulfur containing compo- nents in biogas can be measured with a detection limit of 2 ppm. As an important precaution to prevent damage in the gaschromatograph itself it is recommended to install a moisture and liquid filter at the inlet of the EnCal 3000 system.

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ANALYSER SPECIFICATIONS

	BIOGAS
Analytical Hardware	2 parallel isothermal GC modules with narrow-bore capillary column technology in combination with MEMS based analytical components One of the channels uses a molsieve column which is protected against CO_2 and water by two filtercartridges that filter both the carriergas and the samplegas
Analysis Output	Full composition of biogas as specified below, heating value, density, Wobbe index
Gas Compositions	

Allowed sample gas ranges:	Minimum detection limit:	Advised calibration gas comp.
N2 : 0 - 15%	N_2 : 50 ppm	N_2 : 8.0%
CH4 : 60 – 100%	CH_4 : 50 ppm	CH_4 : Balance
O_2 : 0 – 4%*	O_2 : 50 ppm	O_2 : 2.0%
H_2 : 0 – 5%	H_2 : 10 ppm	H_2 : .0%
CO_2 : 0 – 8%	CO_2 : 5 ppm	CO_2 : 2.0%
C_2 : 0 – 12%	C_2 : 5 ppm	C_2 : 4.0%
C_3 : 0 – 6%	C_3 : 10 ppm	C_3 : 3.0%
i-C_4 : 0 – 3%	i-C_4 : 10 ppm	i-C_4 : 0.5%
n-C_4 : 0 – 3%	n-C_4 : 10 ppm	n-C_4 : 0.5%
H_2S : 2ppm – 1%	H_2S : 2 ppm	H_2S : *
COS : 2ppm – 1%	COS : 2 ppm	COS : *
* PTB approved O2 concentration is 0 – 3%		* depending on expected concentrations in the sample

Analysis Cycle Time	5 minutes

PERFORMANCE HEATING VALUE MEASUREMENT

Uncertainty Repeatability	<0.20 % for all calculated properties (based on a single point calibration) <0.03 % for all calculated properties

GENERAL SPECIFICATION

Ambient Conditions	Temperature: -4°F to 130 °F (provided heated version is used)
Dimensions	Base Ø 14" x Height 14"
Weight	< 66lb
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 accordance 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 LNE metrological certificate reference CET LNE-23119
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 Two RS 232/485 ports for ModBus RTU or ASCII 3 analogue Inputs for local sensors (4-20 mA or 0-10 VDC)
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
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 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 4 streams and 1 calibration gas. The internal sample conditioning system also contains a programmable sample bypass 0.7 - 1.1 scf/hr.
Sample Conditioning (External)	Membrane filter required for sample gas. Since H_2S forms an aggressive acid in the presence of free water it is essential that the forming of free liquids is prevented. Therefore the sample gas should be dry at all times and kept above the water dew point.
Carrier Gas(es)	Helium (optionally Argon) — Both Quality N5.0, supply pressure 80 ± 7 psig, consumption ± 1.0 scf/hr Pressure regulator should contain a safety relief set at 90 psig. Argon needed incase of H_2 measurement. Caution! The Argon carrier gas must be led through a moisture filter in order to protect the molsieve column against water.
Calibration Gas	Supply pressure 30-60 psig. Consumption ± 1.2 scf/day (at atm. pressure) Composition depending on application

For more information

To learn more about Honeywell Elster's Gas Solutions, visit www.honeywellprocess.com or contact your Honeywell account manager.

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