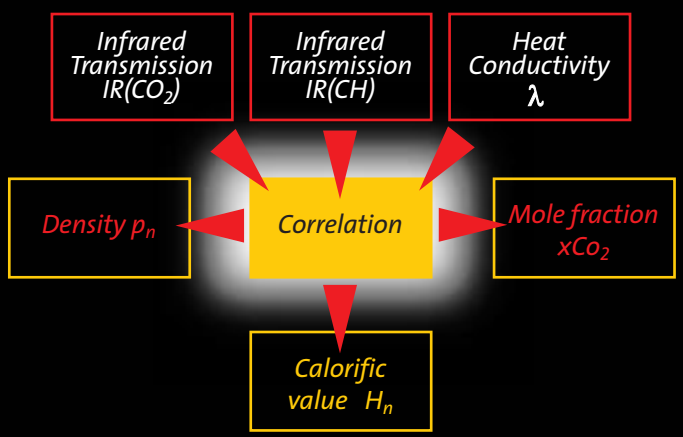
GAS-LAB Q1:

Gas quality measuring device based on infrared technology

In times of liberalised energy markets, this robust new technology opens the door to considerable cost savings. In ELSTER PROFILES, issue 1, 2002, we introduced the principles of a new technology for measuring gas quality based on light absorption in the area of infrared wavelengths. In this article, we would like to present the gas-lab Q1, the first product to work along the lines of this new technology.

Fig.1: Measuring the gas quality using a correlation procedure with spectroscopic and thermal values



How does the gas-lab Q1 work?

The gas-lab Q1 operates with two infrared sensors, which measure the absorption of the hydrocarbons and carbon dioxide contained in the natural gas. In addition to this, another sensor also determines the thermal conductivity of the gas and, in so doing, also registers components such as nitrogen, which do not absorb infrared light. All three values then undergo a correlative calculation, the result of which gives the calorific value, the standard density and the CO_2 content of the natural gas (Fig. 1). With the aid of these values and a flow computer, it is possible to calculate the K-factor (real gas factor) and the energy content of the gas.

On top of this, it is also possible to determine other values such as the Wobbe and methane number, or even a gas composition analysis comprising ten components. Unlike the gas chromatograph, the gas-lab Q1 does not require any carrier gas and pure methane is used as the internal calibration gas. The device measures continuously and determines new values every second, which means it can also be used for quick control tasks.

The structure of the gas-lab Q1

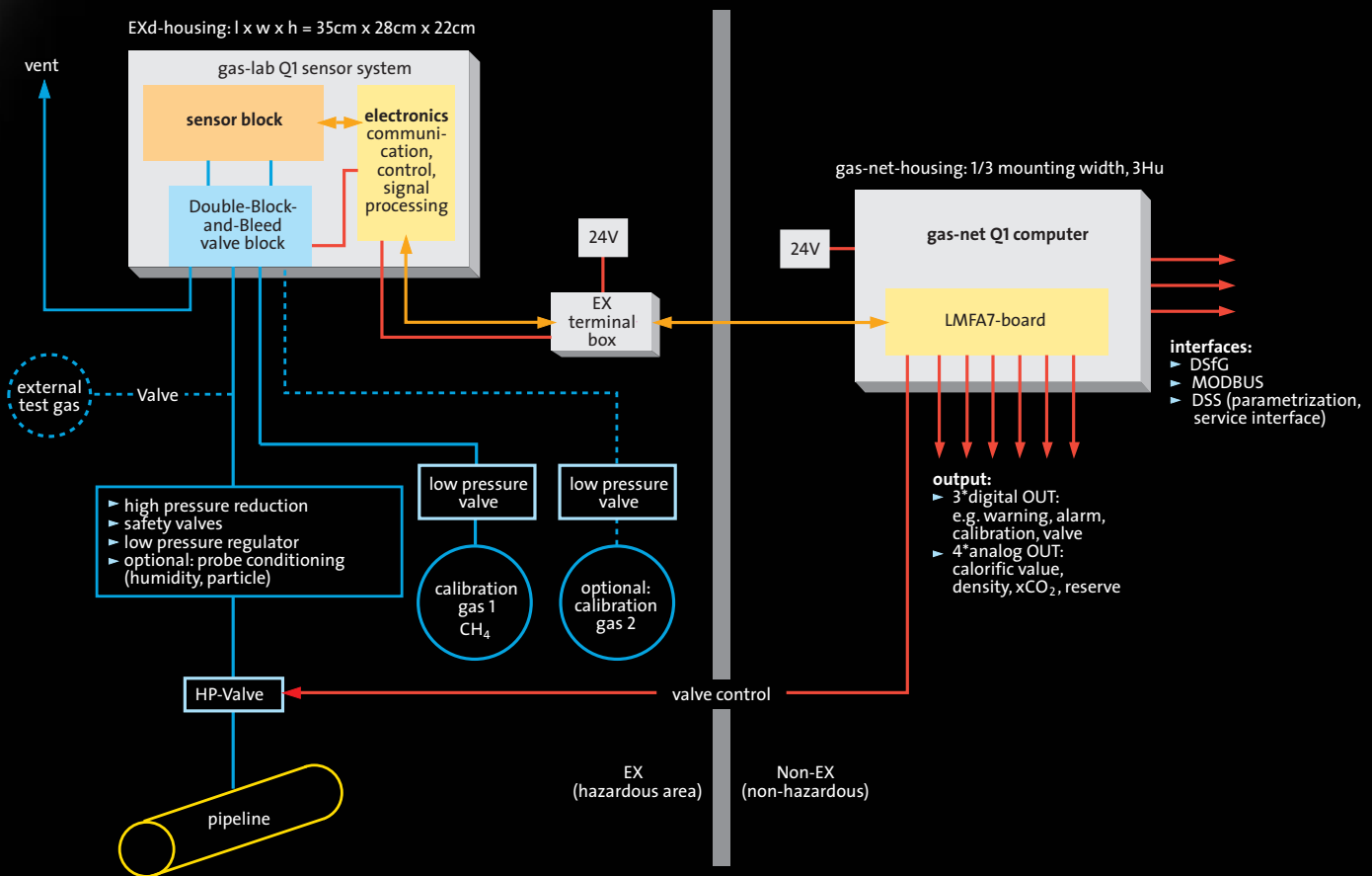
The gas-lab Q1 (Fig. 2 and 3) consists of two parts: the actual sensor unit with the sensor block and primary electronics (Fig. 4) is in a robust aluminium housing, which, on request, can also be supplied in an explosion proof version and which can be installed directly in the gas room.

The gas is fed in at a pressure of approx. 80 mbar and flows over solenoid valves which are designed in a "Block & Bleed" arrangement and are also to be found in the aluminium housing. The calibration gas is also fed through this valve block. The gas flows out of the device via a venting pipe.

The evaluation computer is connected to the sensor unit via a serial data communication interface and can be set up at a distance of several hundred meters. The computer controls the measuring process, calculates the required values and automatically calibrates the device. Since the computer is based on the same platform as the gas-net series (e. g. Z0/Z1 flow computer) it includes all of the features typical for this series of devices, e. g. DSfG, integrated registration device and a wide range of analogue and digital outputs. On account of the modular structure of the gas-net it will be possible in the future to integrate the function of a flow computer so that it will be a real energy measuring system all-in-one. The integrated remote data transfer unit not only enables the call-up of data but also the remote control of the gas-lab Q1 using the GW-REMOTE+ (GAS-WORKS Software Module).

Fig. 2: gas-lab Q1 measuring system comprising the sensor unit in an Exd housing and the evaluation computer (based on gas-net)

Fig. 3: Structure and periphery of the gas-lab Q1



Measuring features of the gas-lab Q1

When discussing measurement uncertainty, you must distinguish between repeatability and accuracy. Repeatability is basically limited by measurement noise and with the gas-lab Q1 the level is 0.1% of the measurement for the values measured.

Fig. 4: Sensor block and primary electronics of the gas-lab Q1

The metering accuracy tells us to what extent the measured value of a device differs from the 'real value'. The 'real value' is determined by the metering results recorded in the Ruhrgas laboratory in Dorsten. The accuracy is limited by the systematic process error, which was determined after a series of tests with 25 different gases from home and abroad (H and L gases).

For typical natural gases an accuracy of 0.3% has been achieved for the calorific value. The accuracy for the standard density is slightly lower at 0.4% but the standard density in a flow computer is only used to determine the K-factor in accordance with SGERG-88 and, therefore, has only a very slight influence on the total energy calculation. The concentration of CO_2 can be determined to a certainty of 0.2% (absolute).

The gas-lab Q1 works 'online' and is therefore suitable for regulation tasks such as mixing gases or controlling a gas powered turbine. What is important here is the quick reaction of the measuring values to any sudden change in the quality of the gas. The time required to achieve 90% of the final value after a sudden change of gas is known as the T90 time. The gas-lab Q1 has a T-90 time of approximately 15 seconds and is, therefore, much quicker than a chromatograph and also compares very favourably to other methods of measurement (calorimeter, Wobbe number measuring device etc.).

The launch of the gas-lab Q1

The measurement procedure of the gas-lab Q1 was developed jointly with Ruhrgas. Initial field tests were held between November, 2000 and March, 2001. Three prototypes have been continuously in operation since December, 2001. The marketing activities for the gas-lab Q1 have already begun. By the end of 2002, 30 devices will have been built in the course of a pilot run and these devices will be installed in a variety of places in order to extend the experience with the device. The PTB (German National Institute of Metrology) will keep one of these devices for the purpose of approval.

If you have any questions concerning the gas-lab Q1, please contact Wolfgang Mursch, FLOW COMP Systemtechnik, Tel.: +049 (0)2 31 / 93 71-100.

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