

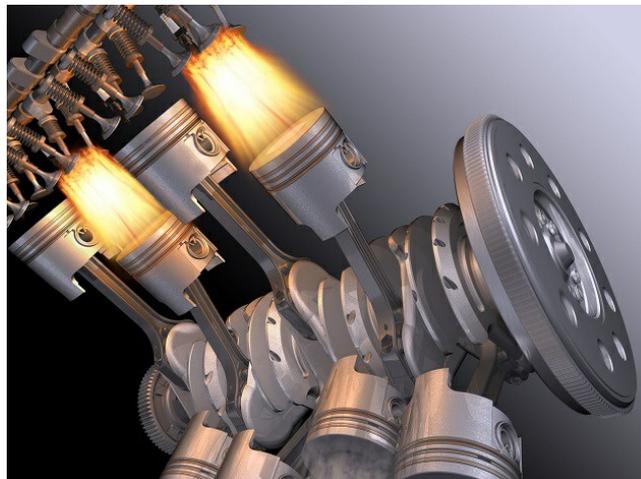
A081 - STEUERUNG DER GASVERSORGUNG IN STATIONÄREN ERDGASMOTOREN

APPLICATION NOTE A081-GP03

GAS SUPPLY CONTROL IN STATIONARY NATURAL GAS ENGINES

In stationary natural gas engines, natural gas is being combusted with air with the aim to exploit the combustion energy, for example for combined heat and power generation (CHP). These engines are flexible in the sense that they can be switched on rather quickly when their energy is required, at a power failure or to 'step in' at peak periods. Although the emission of nitrogen oxides (NO_x) as by-product of the combustion in these engines is relatively low, it can be decreased even further by using exhaust gas recirculation, which reduces the combustion temperature and, hence, the NO_x emission. Furthermore, hydrogen can be added to the combustion process to improve its ignition and flame speed.

To investigate the influence of hydrogen and exhaust gas recirculation components on this type of engine, Bronkhorst was asked to deliver a mass flow meter and several mass flow controllers for this specific gas types.



Combustion inside a V8 engine

Application requirements

A pre-set ratio of a simulated gas mixture of methane, hydrogen, nitrogen and carbon dioxide should be established fast and accurately in the combustion chamber of the engine. Methane is the main constituent of natural gas; nitrogen and carbon dioxide act as artificial exhaust gas recirculation components. Furthermore, the mass flow of each of these components has to be logged.

Important topics

- Fast and accurate flow control of CH₄, H₂, N₂ and CO₂
 - Logging of mass flow of each of these components
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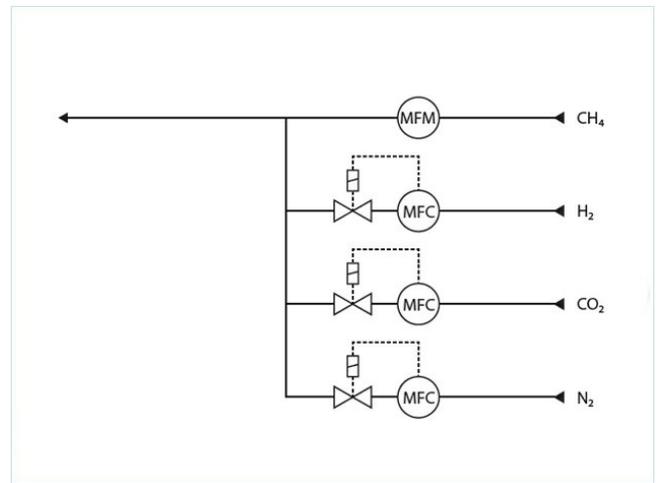
Process solution

Bronkhorst delivered one EL-FLOW Select mass flow meter and three EL-FLOW Select mass flow controllers, together with their power supply, read-out and control equipment, to a stationary natural gas engine test bench.

In this test bench, to simulate the natural gas combustion process with hydrogen and exhaust gas recirculation components added, main component methane (CH_4) is mixed together with additional components hydrogen (H_2), nitrogen (N_2) and carbon dioxide (CO_2). A master/slave configuration is used here. The additional components H_2 , N_2 and CO_2 are supplied by three Bronkhorst mass flow controllers ('slaves'), of which the flows depend on the CH_4 flow ('master'). The operator can set the relative mass flows of H_2 , N_2 and CO_2 via the RS232 communication protocol. The CH_4 flow is measured by the Bronkhorst mass flow meter, and the total fuel mass flow is controlled via the lambda air-fuel ratio controller of the engine.

The data with respect to the mass flows of each of the component are logged using a MATLAB/Simulink interface. In this test bench, many signals are being logged, ranging from operational temperatures to emission concentrations in the exhaust gas. Most signals are available as CAN (Controller Area Network) messages.

The people investigating the combustion process are very satisfied with the way the Bronkhorst devices perform, especially with respect to the master/slave functionality. The H_2 , CO_2 and N_2 mass flows are adjusted exactly as desired using this setup.



Flow scheme

Recommended Products



EL-FLOW SELECT F-201CV

Min. Bereich 0,16...8 mln/min
Max. Bereich 0,5...25 l/min
Druckstufe 64 bar
Kompakte Bauweise
Hohe Genauigkeit
& Wiederholgenauigkeit



EL-FLOW SELECT F-111B

Min. Bereich 0,016...8 mln/min
Max. Bereich 0,16...25 mln/min
Druckstufe 100 bar
Kompakte Bauweise
Hohe Genauigkeit



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Helles, 1,8"-Display (TFT-Technologie)
Benutzerfreundliche Bedienung,
menügesteuert mit 4 Drucktasten



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