APPLICATION NOTE A069-GP03 SIMULATION OF EXHAUST GAS TO TEST LAMBDA PROBE

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Each modern car with a combustion engine has a self-controlling way to optimise the engine performance. A lambda probe, a sensor which is positioned in the exhaust section of the car, measures the oxygen content of the car exhaust gases.

This oxygen content, the 'lambda value', is a measure for the effectiveness of the combustion process in a car's engine. The lambda value is transferred to the car engine management system, and - if necessary - the fuel/oxygen ratio to the combustion engine is optimised by adjusting the fuel injection. A research department of a car producer needs to test the performance of these lambda probes with several exhaust gas compositions. To this end, they have built an artificial exhaust line in which they do not use real exhaust gas, but simulate the composition of car exhaust gases. They asked Bronkhorst to deliver mass flow controllers for this purpose

Application requirements

The car producer wants to have the possibility to change the composition from very low contents of gases like carbon monoxide (CO) and nitrogen oxide (NO), to very high contents. Furthermore, they want to changeover very quickly to another gas mixture.

Important topics

- Accurate dosing of exhaust gas constituents
- Stability
- Flexibility

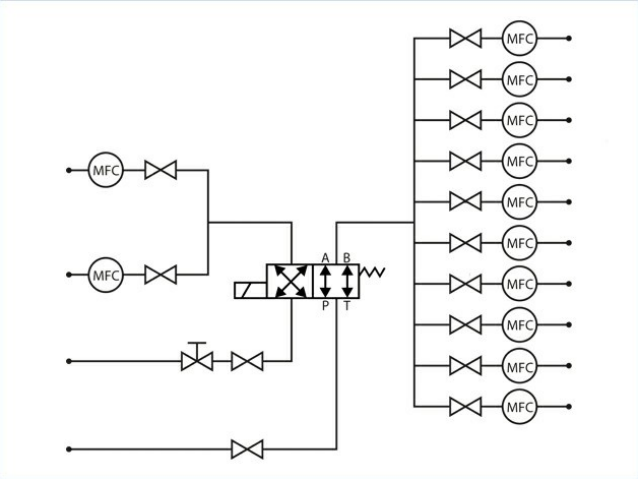
Process solution

Initially, Bronkhorst delivered ten mass flow controllers, type EL-FLOW Prestige, for accurately supplying the components of the artificial exhaust gas composition, to simulate a certain working point. Each specific mass flow controller is meant for a component that may be present in the car exhaust gas (N_2, O_2, CO, CO_2, NO, hydrocarbons, sulphur compounds etc.) These individually generated gas flows enter a mixing chamber, and when the flow is stable, it is fed to the lambda probe.

With the EL-FLOW Prestige mass flow controllers it is possible to incorporate small amounts of gas into the artificial exhaust gas mixture. Several ranges were used, and the mass flow controllers were calibrated from 9 millilitres per minute to 20 litres (N_2 gas) per minute.

To perform more lambda probe tests in the same amount of time, in a later stage the research department requested Bronkhorst to deliver a second set of ten EL-FLOW Prestige mass flow controllers, to simulate another working point in parallel. At the same time that the lambda probe was tested using an artificial exhaust gas composition from the first train, the composition of the second train was premixed in the second mixing chamber. In this way, they could changeover from one working point to another, by physically (dis)connecting each of the mixing chambers to (from) the lambda probe, saving time.

This solution was chosen because of high flexibility, and because of high accuracy. The setup has to be flexible, as the real working points (compositions) do indeed vary. But also to be prepared for different compositions in the future, if compositions or engine effectiveness may change.



Flow scheme

Recommended Products

EL-FLOW PRESTIGE FG-201CV

Min. flow 0,14…7 mln/min
Max. flow 0,4…20 ln/min
Pressure rating 64 bar
100 selectable gases
Customized I/O configurations

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