Novel CEM gas detection system for SO_2, NO_x and CO/CO_2 monitoring based on small size NDIR- and NDUV –Technology

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Continuous emission monitoring (CEM) is a rapidly growing market worldwide. Especially in developing countries the demand of low cost equipment, with sufficient measurement performance, is significant. Another important application is the mobile/portable flue gas analysis. In this case small size and low power operation are required. For both applications we developed a novel CEM gas detection system based on photometric absorption technique.

The detection of Sulfur dioxide SO_2 and Nitrogen dioxide NO_2 in the UV range is a well-known method to measure these components at a low level (<ppm) and without water vapor interference. Selective radiation sources are used for this purpose at $\lambda \approx 285nm$ (SO_2) and $\lambda \approx 400nm$ (NO_2). Typical ranges are 50ppm SO_2 and 100ppm NO_2 with a detection limit $4 \cdot \sigma < 250ppb$. The detection of both gases takes place simultaneously in the same photometric device (ULTRA.sens®). This design saves cost and space for the different applications. By using the NO_2 gas concentration (direct measurement) it is possible to substitute the costly catalytic $NO_2 \rightarrow NO$ converter (indirect measurement) in regular CEM systems.

In the infra-red range a broad band micro machined IR-Source is used for the gas detection. It is possible to modulate the IR-Source up to 10 Hz in order to get low noise signals and fast response concentration readings. By using multiple wavelengths IR detectors up to 3 gases could be measured simultaneously in one arrangement (INFRA.sens®). Based on this technique a combination of Nitrogen monoxide NO, Carbon monoxide CO and Carbon dioxide CO_2 at different concentration levels is feasible (e.g. 1000ppm NO, 1000ppm CO and 20 Vol.-% CO_2).

The individual modules are sealed by O-ring connections. With this modular design, sample cell lengths from 1 mm to 250 mm can be achieved for optimal adaptation to the required measuring range. Optionally, the system can be equipped with coated aluminum or stainless steel sample cells. With corresponding pressure-resistant window materials, working pressures of up to 16 bar can be achieved (Option).

The signal conditioning main board could run both technologies (INFRA.sens® and ULTRA.sens®) simultaneously with a 16bit resolution. The data interface is based on RS232 and CANopen. The operation voltage is 24VDC with a power consumption of less than 1Watt. Furthermore a pressure sensor and humidity sensor (HUMI.sens) could be connected to the main board. Using the HUMI.sens signal it is possible to compensate the residual water vapor interference in the INFRA.sens®.