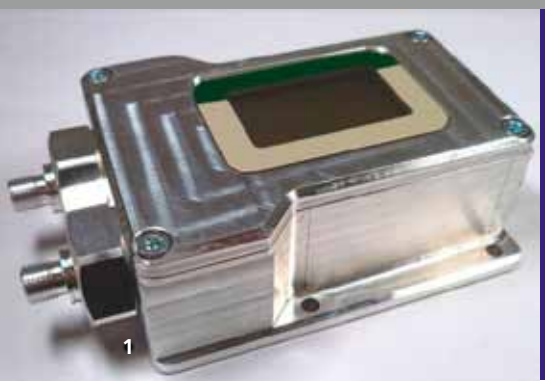
Fraunhofer
IPMS

FRAUNHOFER INSTITUTE FOR PHOTONIC MICROSYSTEMS IPMS



1 *Demonstrator*
2 *Sensor cell*
3 *Electronics*

MeDiDuSe

Fraunhofer Institute for Photonic Microsystems IPMS
Maria-Reiche-Str. 2
01109 Dresden

Contact

Dr. Michael Scholles
Phone +49 351 8823-201
michael.scholles@ipms.fraunhofer.de

Dr. Andreas Heinig
Phone +49 351 8823-288
andreas.heinig@ipms.fraunhofer.de

www.ipms.fraunhofer.de

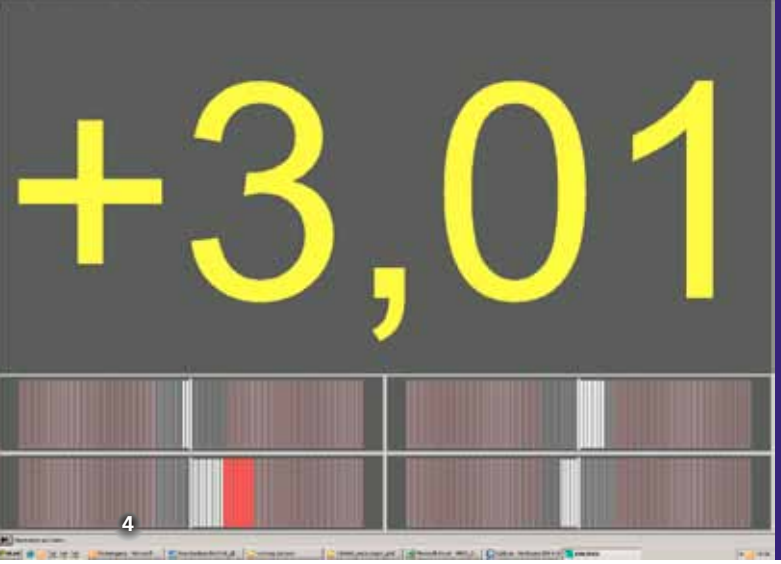
SMT & HYBRID GmbH
i2s

Overview

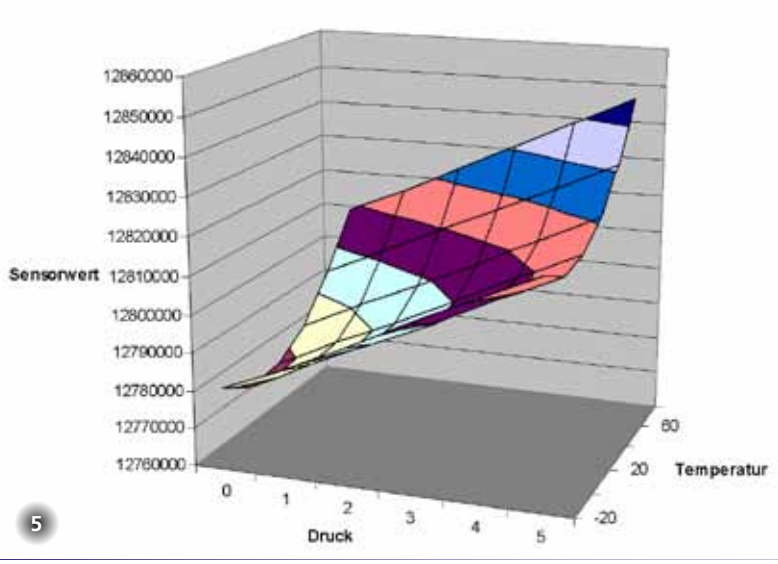
Fuel cells as well as particle filters of modern diesel vehicles require highly precise differential pressure sensors. Those sensors are exposed to adverse environmental conditions, aggressive liquids or gases and high line pressures. Up to now fault or drift of sensor elements led to disturbance of the output signal. This could potentially cause critical or suboptimal states of the overall system. That is why the Fraunhofer Institute for Photonic Microsystems IPMS in cooperation with Intelligente Sensorsysteme Dresden GmbH and SMT & HYBRID GmbH developed a new differential pressure sensor. With this sensor it is possible to detect and even to compensate failure of sensor elements.

Functional principle

Common differential pressure sensors make use of a full bridge configuration of temperature dependent resistors. Those resistors are mounted to a membrane which is on both sides in contact to the media of which the differential pressure is of interest. If the media are aggressive and direct contact would lead to critical reactions indirect differential pressure sensors are first choice. There the differential pressure is calculated from the line pressure signals of two independent sensors. Therefore the layout of both sensors needs to fit for the absolute pressure which is restricting the accuracy. The presented classical principles of measuring are sensitive to changes of the four temperature dependent resistors in the bridge circuit. So aging or damage of resistor elements are directly influencing the precision of measurements. Instead of just interpreting the differential signal the



4



5

system is also measuring all elements of the bridge circuits independently. Utilizing mathematical methods the presented system is able to detect fault of any resistor element. In result the output signal can be compensated. Now it is possible to continue using the whole sensor while simultaneously generating a warning containing the cause of fault. The measuring of the resistors is done utilizing a capacitive method.

Sensor cells

To generate information about fault and cause of fault the system needs to measure every resistor on its own. Therefore special sensor cells are needed. A full bridge sensor needs to be split into half bridges.

Demonstrator

A demonstrator of the system realizes a media resistant measurement of differential pressure over a range of 0 to 5 bar line pressure. The precision is better than 3% FS (full scale). A PC application is displaying the absolute and differential pressures while visualizing the system condition. Failing resistor elements in the sensor and their grade of distortion are graphically shown. The implemented system also allows the manipulation of a single resistor to demonstrate the ability of failure detection and compensation.

4 *Visualization software*

5 *Calibration data*