Real-time Pressure Distribution Sensor for Automotive Aerodynamics Testing

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CSEM has further improved its pressure strip technology platform with the implementation of a miniaturized pressure scanner with CAN bus interface. CAN bus is a message-based protocol, designed specifically for automotive applications but now also used in other areas such as aerospace, maritime and industrial automation. CSEM's highly flexible Pressure Strips together with the small size of the pressure scanners with CAN bus capability will be of great advantage for real-time pressure distribution sensing in the automotive market segment. Aerodynamic experts and car designers get an easy-to-use and cost-efficient tool for a variety of aerodynamic testing applications.

CSEM's pressure strip, a novel technology for non-invasive pressure distribution measurements on surfaces, has been introduced previously [1] and evaluated in different applications [2]. The pressure strip system is ideally suited for aerodynamics outdoor testing on objects in their natural environment, such as cars, airplanes, trains, wind turbines or sailboats. Its main advantages are the light weight and small size of the whole system and its thin, flexible foil appearance. The system consists of the key elements: Pressure strip, pressure scanner (Figure 1), a base station and a PC software tool for configuration and data acquisition management.

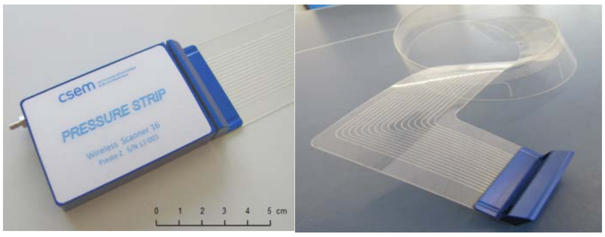

Figure 1: Pressure scanner (left), pressure strip (right).

The pressure strips are made of thin polymer films which can be attached to the test surface with double sided adhesive tape. Tiny micro-channels in the pressure strip propagate the pressure from the tap to the pressure scanner. The strip geometry can be designed for nearly seamless fitting to 3D objects like wings, rotor blades, or car bodies.

CSEM has now developed a miniaturized pressure scanner with CAN interface. High attention was given to dimensions and shape of the scanner box. The scanner height of only 5 mm has minimal impact on the airflow, which makes it possible to place the scanner directly on the test surface close to the actual measurement section.

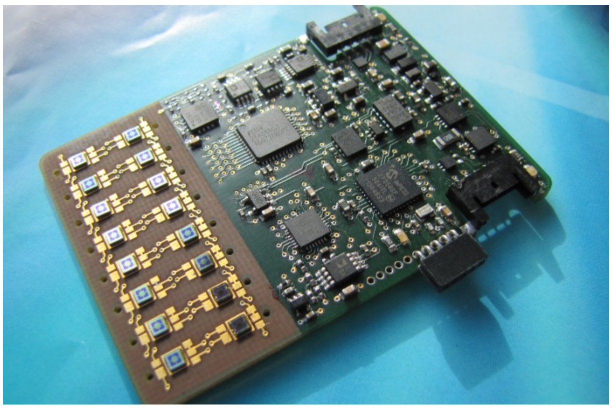

Figure 2: CAN pressure scanner PCB with integrated pressure sensors.

Each scanner incorporates 16 piezo-resistive, temperature compensated differential pressure sensors. The pressure sensors are bonded to a sensor array with minimal air cavity to ensure optimal performance and maximal pressure bandwidth in combination with the pressure strips (Figure 2). Several CAN scanners can be connected in daisy-chain mode to a CAN network together with other standard CAN devices. The CAN interface paired with the small size makes the scanner attractive for the automotive industry to measure real-time pressure profiles, for example on front- or rear-spoiler, windscreen, car body or on the front floor as shown in Figure3.

Key features of the CAN pressure scanner

- Non-intrusive pressure measurement
- Fast and ease of application
- 2, 10, 15 or 150 kPa pressure range
- Temperature compensated sensors
- 0.5% full scale accuracy
- Scan rate up to 100 Hz
- CAN interface
- Small dimension: 5 mm x 60 mm x 45 mm

Figure 3: Pressure Strip applied to a sports car to measure front floor pressure suction.

[1] T. Burch, *et al*., "A customizable pressure strip for rapid and insitu aerodynamics testing", CSEM Scientific and Technical Report (2012), 72

[2] J. Kaufmann, *et al*., "In-flight pressure distribution measurement on a paraglider wing", CSEM Scientific and Technical Report (2013), 38