Application Note

EV Automotive Aerodynamic Pressure Scanning – On-car

THE CHALLENGE

APPLICATION: AUTOMOTIVE AERODYNAMIC OPTIMISATION

The Application:

A key factor in determining the performance and distance capability of a new EV road car is in understanding its aerodynamic performance. This has a huge effect on its vehicle dynamics and ultimately on its "All Electric Range" that can be achieved with a single charge.

The main applications can be split in vehicle aerodynamics, where you assess the drag or wind resistance of the car, and vehicle aerothermal, where you work to ensure that batteries and motors are always within their optimal operating window.

Vehicle drag is a significant factor in determining the performance and distance that a car can travel. Any resistance to the car moving through the air in the most efficient way directly impacts the mileage that can be achieved by the car in addition to creating turbulence, buffeting, noise and harshness in the driving experience.

Constrained by the increasingly restrictive rules of country-specific approvals, the skill of the Aerodynamicist in seeking performance advantage leads to the need for more accurate measurement and analysis - and in doing this better than the next company. Innovation and experimentation are at their peak in a fast-changing and highly competitive market-place where the consumer expects rapid development and product evolution. The best aerodynamicists are much prized and respected.

Exterior design concerns making the car look good and representing the company branding, but increasingly the importance of the surfaces have the aerodynamicist considering every tiny part in order to reduce drag and extend battery range. The role of the aerodynamicist in the EV car industry becomes ever more important with the advent of major changes in car powertrain.

The Aerodynamicist broadly has three tools in their "toolkit" for translating ideas into reality and measuring performance – CFD, the wind tunnel and real-world on-car measurements.

CFD (Computational Fluid Dynamics) is often the first step in narrowing-down the options for consideration at the lowest cost - but it doesn't give the whole story! From CFD, the engineer will determine the "best few" design concepts and scale models will be built for wind tunnel testing of these designs. In a highly controlled and known environment, the engineer works methodically towards solutions that will be ultimately used on the production vehicle. Scanivalve products, such as the MPS pressure scanner, excel in these wind tunnel measurements, providing sensitive, accurate and fast, synchronous data for further analysis.

When the CFD and Wind Tunnel have provided confidence and proof of the concept, the new part is manufactured in full-scale and fitted to the car where the final road or track testing is done to ensure it does indeed offer advantageous performance when analysed in the context of the whole vehicle in real-world conditions.

The Measurement Challenge:

In the wind tunnel, the instrumentation is highly sensitive, accurate and responsive, but under relatively straightforward, benign, conditions. However, wind tunnel-type measurement instruments are usually too costly, large, heavy and not rugged enough for on-car use where vibration, noise, and variations in temperature and ambient pressure are seen. A miniaturised and ruggedized measurement is needed. The ideal solution is also a distributed measurement system, taking the measurements into the areas where they are directly needed and enhancing the capability for local data around the vehicle, often in tight spaces where no other solution can be used.

Traditionally, the measurements from aerodynamic surfaces on the car would mean long lengths of pressure tubing connected to the centrally mounted scanners. These long tubes could be subject to trapping, kinking, frequency response inaccuracy and would become a space and an aerodynamic disturbance in themselves. Keeping the tube length as short as possible would give a significant advantage in frequency response and overall measurement performance and accuracy, especially when coupled with real-time correction of atmospheric change. A new concept was needed that took the scanner to the point of measurement, minimizing weight and distance to best advantage.

Unlike in a race car, the pressure levels observed in the EV sector can be very small and can easily be overwhelmed by changes in atmospheric pressure, giving false data about performance improvements in real-time. A solution was therefore needed that would not only measure live barometric pressure changes but also have the sensitivity to see very small changes in pressures caused by a relatively slow-moving vehicle.

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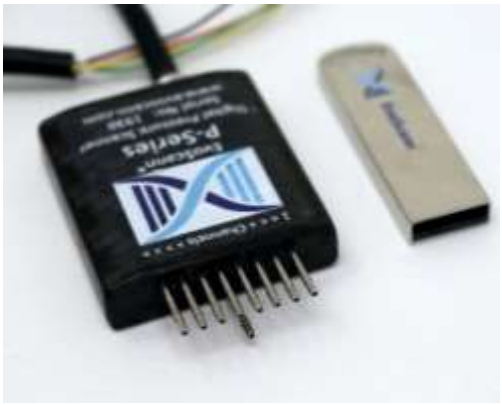
THE SOLUTION

EVOLUTION MEASUREMENT'S EVOSCANN® P8D PRESSURE SCANNER EXCELS IN THIS APPLICATION

Compact, high performance True Differential Pressure Scanner



- Smallest, lightest pressure scanner available
- High accuracy multi-channel pressure measurement
- True Differential measurement
- Lightweight carbon fibre external construction
- Integral microprocessor
- High accuracy output directly in engineering units
- CANbus output
- Comprehensive range of industry-standard installation accessories
- Wide range of aerodynamic applications

The EvoScann® P8D was developed to allow direct measurement of the dynamic pressures, whilst simultaneously, in real time, eliminating offsets caused by changes in barometric pressure; a True Differential pressure measurement device.

Small physical size and weight means that it can mounted in a wide range of positions on the car to provide high accuracy, fully digital data into the nearest CANbus node. Every pressure channel is temperature corrected for optimal accuracy under changing conditions.

Multiple EvoScanns can be mounted across, or even within, the main aerodynamic surfaces of interest to gather essential real-world data that is directly gathered via the car, or an external, CANbus logging system. The EvoScann® is becoming part of the car's infrastructure, effectively.

Based upon the lower aerodynamic pressures encountered in road vehicle, as opposed to race car developments, Evolution Measurement developed the product with lower ranges and higher sensitivity, so a 20mbar or a 100mbar True Differential measurement became possible, achieving 0.1% full scale accuracy, the only scanner of this size to do so.

In addition to a versatile range of high-performance pressure scanners, Evolution Measurement offer the widest range of accessories including pressure tubulations, tubing and connectors that enable the test model to be commissioned very quickly and efficiently. Additional products offered for this sector include custom multihole probes, rake arrays and pressure patches for use in determining aerodynamic pressures around many locations on the vehicle.

We'd love to tell you more -

Download the datasheets:

https://www.evoscann.com/product/true-differential-pressure-scanner/

https://www.evoscann.com/product-category/accessories/

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