

Making NO_x measurements easier

ECM has developed the EZ-PEMS mobile demonstrator of its miniPEMS compliance tool that integrates two Kvaser products, the Air Bridge gateway and the Memorator data logger. This solution can be used by governmental and national law enforcement agencies to measure NO_x on a driving car.

The EZ-PEMS system measures NO_x emissions on a driving vehicle. The compact housing can be mounted to a flat surface, such as a car's rear window, using a suction mount. Within the housing is the ECM NO_x module, a Memorator data logger to receive CAN frames, connected to one of the pair of Air Bridge gateways connecting CAN in-vehicle networks wirelessly to the measurement unit. A T-script running on the data logger performs signal filtering and conversions before sending the data to the Air Bridge. This transmits data to a cockpit display for immediate viewing and to a cloud server.

Oskar Hellsten from ECM Europe explained: "The EZ-PEMS is particularly quick and simple to set up, differentiating it from the non-mobile systems on the market today. This system adapts particularly well to different vehicles. For example, truck exhausts can be hard to access, so the Air Bridge is a much more reliable and ergonomic way of routing live data to the display in the cabin than a wired solution."

At present, legislation is lacking regarding harmful NO_x emissions in vehicles that are already in service and when there is legislation, a simple, routine test tool is needed. In certain parts of the world, it is common practice to remove emission reduction equipment from cars and trucks to cut costs, notably the purchase of expensive urea used to reduce NO_x emissions to nitrogen and water. EZ-PEMS proves that a reliable, mobile test solution is ready to catch the perpetrators.



Figure 1: The mobile demonstrator of the miniPEMS compliance tool uses an exhaust adapter to which the sensor fits, without requiring modification of the exhaust (Source: Kvaser)



(Source: Kvaser)

Measurement module kits

ECM (Engine Control and Monitoring) provides test instrumentation and control systems for vehicle powertrains, engines, and combustion systems. Founded in 1988, the U.S.-headquartered company produces ceramic sensor-based engine- and combustion-system test instrumentation. This includes the sensor-based NO_xCANf, NO_xCANg, and NO_xCANt kits. They are recommended for spark ignition and diesel engine applications. The NO_xCANg kit has a more stable zero point and is therefore recommended for diesel and lean-burn combustion processes where the NO_x level is less than 10 ppm (parts per million). The provided CAN interface complies with CANopen.



The shown measurement kit comes in an IP67-rated housing featuring CANopen connectivity (Source: ECM)

The products have a cross-sensitivity to NH₃. For the NO_xCANt kit, the cross-sensitivity is 1:1 (1 ppm NH₃ looks like 1 ppm NO_x to the sensor). For the NO_xCANg, the cross-sensitivity is approximately 1:0,67 (1 ppm NH₃ looks like 0,67 ppm NO_x). The NO_xCANf has a built-in and replaceable NH₃ absorption filter. It has zero cross-sensitivity to NH₃, however the exhaust gas temperature cannot exceed 210 °C and the filter requires replacement at intervals as short as 20 min.

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Suitable for PTI

Martin Sventen, CEO of Kvaser, explained: "Something that is fantastic with the system is that it is not only a measurement system. It also provides a method that would enable NO_x measurement for periodical technical inspection (PTI) services of road vehicles in a very easy and efficient way. A 2-km drive with this system mounted is all that is needed in order to check if the vehicle is within regulations or not. Total testing time with setup, driving, generating a report and so on is around 15 min. The same system could also be used for more extended PEMS measurements or other applications such as marine engines or heavy-duty diesel used in construction machines and so on. To simplify, we use NO_x measurement and then CO₂ that tells how the engine is working. The result is an emission index that will give the threshold for the emission level. These

techniques have been known within the industry since at least the mid 90s, but it is only now that components have become available to make small, light measurement systems that can be mass produced. The EZ-PEMS system is co-developed by ECM and EXIS. EXIS is a Swedish company that has done many measurement projects for TÜV as well as for Swedish and Danish environmental organizations. There are some reports from the work conducted that prove the method, concept, and product."



Martin Sventen,
CEO of Kvaser

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Combined with the Air Bridge and Memorator devices, EZ-PEMS has the potential to answer the needs of the U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and Environment and Climate Change Canada (ECCC), who have worked together for some time to find solutions for real-world emissions data gathering on smaller vehicles, such as quads, snowmobiles, and motorcycles. Testing how driving and usage patterns impact emissions on all vehicles is a key step in finding ways to reduce them.

ECM bills the measurement product as suitable for Periodic Technical Inspections (PTI), investigation of malfunctioning or manipulated emissions control systems, screening tests according to Commission Regulation (EU) 2018/1832 and engine test cells or real-world NO_x PM (particulate matter) and PN (particle number) measurement. The wireless CAN communication from the sensor to the cabin display enables testing without laptops or complicated PC programs, stated Kvaser.

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