Opel Vectra Heading for its World Premiere

- dSPACE Simulator for testing car interior electronics
- 15 networked ECUs
- Extensive CAN bus and I/O requirements

In January, the new Opel Vectra went into production in one of the world's most modern automobile plants in Rüsselsheim, Germany. Equipped with a variety of new features, the new model will have its world premiere at the Geneva Motor Show in March. The Vectra will feature a completely new, driver-oriented design with pioneering technology for a high level of safety and comfort. Thanks to positive experience made with former dSPACE systems, Opel decided to rely on dSPACE Simulator for running the hardware-in-the-loop tests on the Vectra's new electronics systems.

High Goals with Comfort and Safety Systems

Our new Vectra's ambitions are above all reflected in the variety of equipment aimed for improving the comfort and safety of the driver and passengers. For example, the Vectra features new safety and comfort systems, intelligent Electronic Climate Control with an air quality sensor, a wide range of communication and entertainment systems, eight-way adjustable front seats, a rain sensor and park pilot. The passive safety equipment includes standard front and side airbags and full-size curtain head airbags, Opel's patented Pedal Release System, and further improved active head restraints for protection from whiplash injuries.

Much of the new Opel Vectra's functionality is provided by a new integrated electronics system, which provides features like body control, info modules, instrument panel control, a parking assistance, and interfaces to other electronic car components. In total, there are 15 electronic control units (ECUs) connected via the CAN bus, controlling the interior comfort and safety system. The communication between the ECUs is enormous. Thus, a big challenge for us is to check the functionality of the ECUs when connected, especially considering that the ECUs are from different suppliers. Therefore, we were not looking for a system to test the single ECUs, but for a system to test the networked ECUs and their interfaces to the driver and to the powertrain and chassis electronics.

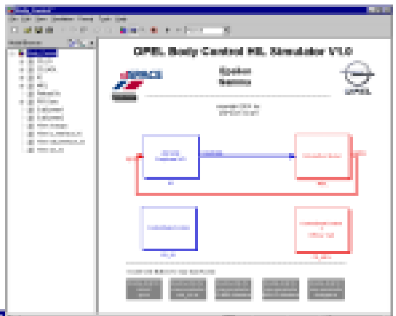
CAN and I/O: Huge Communication Requirements

After evaluating different HIL solutions, our decision to deploy a dSPACE Simulator was based on dSPACE's good reputation at Opel and the clear hardware architecture of dSPACE Simulator. This guarantees high reusability for all hardware and software components when the architecture of future HIL test stands is changed. It also allows us to execute reproducible functional tests with different ECU variants very systematically.

dSPACE Simulator was tailored to our challenging requirements. The complexity is mainly related to I/O and CAN: the I/O of our dSPACE Simulator comprises 192 digital outputs, 16 analog outputs, 4 resistance simulation outputs, 104 digital inputs, 32 analog inputs, 8 PWM channels, equipped with signal conditioning, load and electrical fault simulation, where required, and 199 CAN messages with a total of more than 1200 signals. The CAN messages had to be read, written, and falsified for failure simulation – all in real time. Thus, there were high requirements on the calculating hardware. However, dSPACE Simulator – equipped with the powerful DS1005 PPC Board – mastered the realtime calculation easily.

Simulation of Driver Operation

The tests were executed in two modes: fully automatic and partly automatic. For the partly automatic tests, the aim is to check ECU operation after failure. The operator manually generates hardware errors via ControlDesk, and the ECU has to react correctly. For the fully automatic tests, we have constructed small yet powerful test automation scripts that offer a full range of options, especially for the typical driver.

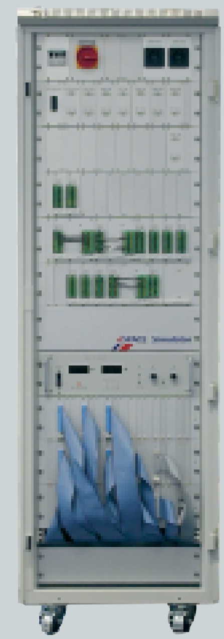


Ready-to-use Simulink models and layouts for automated tests in ControlDesk.

New comfort and safety systems controlled by 15 car interior ECUs.

The Car Interior ECUs

- Auxiliary Heating System (for engine start-up)
- Body Control Module
- Column Integrated Module
- Driver Door Module
- Driver Seat Module
- Instrumental Panel Cluster
- Parking Assistant (ultrasonic sensors)
- Passenger Door Module
- Rear Electrical Center (for example, rear light control)
- Sensing and Diagnostic Module (crash detection and reaction)
- Shift Lever Module (gear selection for automatic transmission)
- Sunroof Module
- Triple Info Display (for example, radio and navigation system)
- Tire Pressure Monitoring System
- Underhood Electrical Center (for example, front light)



Complete list of the car interior ECUs – the test environment is simulated by dSPACE Simulator.

A typical test sequence is as follows: Test start – simulation of driver action – check of system reaction – diagnostics scan – reset – change of variables – restart.

Even though the dSPACE Simulator has been in use since only September, we are seeing a significant saving in time and effort needed for executing our standard tests. The Vectra will initially be available as a four-door sedan with a four-cylinder engine, but the model range will soon be extended with the introduction of additional innovative body styles, engines and gearboxes. We are sure that we will run successful HIL tests for all the new model variants, and later for the Opel Astra's successor, with our dSPACE Simulator.

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