

Automatic test environment  
for body control modules leads  
to better quality and efficiency

# Smart Automation

At Magneti Marelli, teams from the USA and Italy have developed a new test environment for the validation of their body control module (BCM). The BCM is an electronic control unit that controls the operation of a wide range of auxiliary functions, such as power windows and immobilizer systems. To support the extensive tests required early in the development process of the BCM, the teams recently introduced dSPACE AutomationDesk to their testing process.

UTO

Solving the technological challenges of future mobility is at the forefront of Magneti Marelli's efforts. Since 1919, this international manufacturer of high-tech systems and components has been committed to finding solutions that help advance the progress and evolution of the automotive world. The drive to find the best ways and methods to improve quality also extends to Magneti Marelli's testing processes. For their embedded electronics, this innovative company is turning to automated test sequences for better efficiency and easier configuration, debugging, and maintenance.

#### **New Test Environment for BCM Validation**

In the Lighting & Body Electronics group of Magneti Marelli Automotive Lighting, teams from the USA and Italy have developed an efficient testing process that enables engineers to automatically update parameter values in test cases. The teams are currently using this new test environment, which they have named Diagnosis Automatic Test Environment (DANTE), to validate their body control module (BCM). The BCM is an electronic control unit (ECU) that controls the operation of a wide range of auxiliary functions related to the body of the vehicle. This vehicle body equipment includes power windows, internal lights, immobilizer systems, central locking, etc. The BCM com- >>



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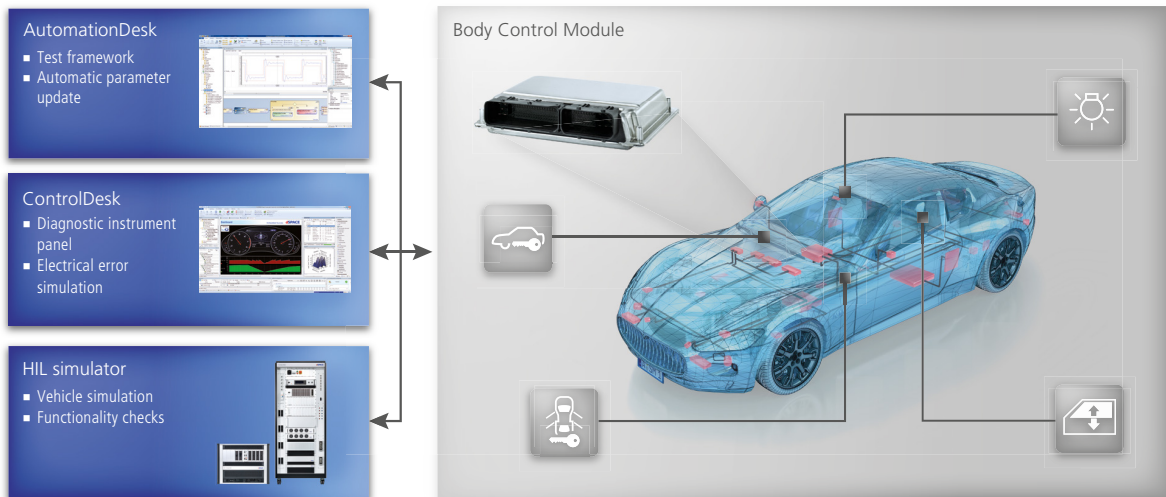


Figure 1: At Magneti Marelli, dSPACE tools are used for testing body control modules (BCMs). The BCM controls the operation of auxiliary functions related to the body of the vehicle, such as power windows, internal lights, immobilizer systems, and central locking.

municates with other ECUs via a vehicle bus (e.g., CAN/LIN) to control the behavior of the electronic systems. It can also detect malfunctions in wiring and in components.

### Functional and Diagnostic Testing

Because the BCM controls many capabilities in the vehicle, it has to be extensively tested early in the development process to verify that the functions of the vehicle body equipment are performed properly and that requirements and technical specifications are consistently met. Two types of tests are performed on the BCM: functional testing and diagnostic testing. Functional testing entails translating requirements into a test that is then validated. This can be done by assigning certain values to the variables involved and checking if the BCM reacts correctly. Diag-

nostic testing includes various tasks, such as checking network traffic between internal functions and connected ECUs, as well as checking the validity of diagnostic trouble codes (DTCs). This is where the teams are focused on improving their testing process.

### Solution to Diagnostic Testing Challenges

Prior to developing DANTE, the teams were experiencing limitations in their diagnostic testing process. Every time software was modified, a new library block had to be created as well as new parameterization. This process was time-consuming. To solve the problem, the teams introduced AutomationDesk, the test automation software from dSPACE, to implement two strategic changes:

1. They established a customized test framework that enables test engineers to automatically update various test parameters.
2. They automated a process for importing different diagnostic input files with a Microsoft® Excel® sheet, which greatly simplifies test configurations.

The result was a fully automated process for diagnostic testing. "Now everything is handled automatically, as the Excel sheet seamlessly parameterizes library blocks. No script rewrite is required," said Basel Samman, Lighting & Body Electronics System Validation Manager at Magneti Marelli Automotive Lighting LLC. "Equipped with this, our test engineer is able to easily write validation routines, as the test configuration is less complex with



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AutomationDesk. Now we have one single test sequence for all diagnostic trouble codes.” Samman explained that with AutomationDesk, diagnostic input files such as DTC configurations or the Vector description files CDD and DBC can be automatically imported and configured. The test engineers can now automatically update various parameters for diagnostic trouble code test sequences. By attaching CAN trace as log data to test result data, debugging is made much easier. “An important benefit of AutomationDesk is its ability to reuse test scripts with new parameters,” Samman said. “With AutomationDesk, debugging and maintenance also become easier, regardless of the number of diagnostic trouble codes that have to be addressed.”

### Several dSPACE Tools Used

In addition to AutomationDesk, the diagnostic testing process with DANTE also includes dSPACE hardware-in-the-loop (HIL) simulators and ControlDesk, the dSPACE experiment and visualization software. The HIL systems are used to simulate the vehicle connected to the BCM and to test different functionalities. Standardized ASAM ODX (Open Diagnostic Data Exchange) files

are generated from proprietary files, such as CDD. Using the diagnostic instrument panel from ControlDesk, these ODX files are then used as input to send diagnostic commands. This is done both manually and by means of AutomationDesk scripting, using the logical link name of the diagnostic instrument. The teams also use ControlDesk for the definition and execution of electrical error simulation, which is then automated with AutomationDesk. As part of its automated testing environment, the Lighting & Body Electronics group currently has eight PHS-based and two SCALEXIO-based HIL systems in the USA, Italy, and India. Additional systems are used by other groups at Magneti Marelli. The company plans to extend its automated testing environment to lighting ECU applications in the future.

### Conclusion

To test their BCMs, the teams from Magneti Marelli developed customized solutions in AutomationDesk. It is the tool’s wide range of features as well as its flexibility to extend functionalities as required that considerably helped the teams when optimizing their testing process. The number of errors was reduced significantly, and

Magneti Marelli supplies a wide range of automotive systems and components to automobile manufacturers around the world. These products include:

- Electronic systems, such as instrument clusters, infotainment and telematics as well as lighting and body electronics
- Automotive lighting, i.e., front and rear lighting systems
- Powertrain components, such as engine control systems for gasoline, diesel, and multi-fuel engines as well as automated manual transmission gearboxes
- Suspension systems, such as shock absorbers and dynamic systems
- Exhaust systems, such as catalytic converters and silencing systems
- Electronic and electromechanical systems for motorsport applications

test configuration as well as maintenance and debugging tasks have become much easier and less time-consuming, providing Magneti Marelli with an efficient process for BCM testing. ■

*With the kind support of Magneti Marelli*

