Testing Electrical Control Units with NI PXI and TestStand

by Andreas Heim, Alfautomazione, Inc.

The Challenge: Providing an innovative and cost-effective functional engine control unit (ECU) and electronic control module (ECM) test solution for service and high-volume manufacturing.

The Solution: Developing an ECU and ECM test system based on open standards NI PXI and TestStand with comprehensive test functionality and short cycle times.

Industry Standards
Alfautomazione designs and develops functional test equipment for the automotive industry. Our experience in testing automotive electronic components led us to develop a new ECU and ECM test system based on industry standards such as PXI and TestStand.

With TestStand and the HFT3000-ECU, test engineers can get a test system up and running quickly, or modify an existing test sequence with minimal effort.

A Flexible, Modular Test Solution
The increasing complexity of ECUs and ECMs make it necessary for test engineers to have a flexible and modular test solution available to prepare them for future test requirements. The ECU tester had to address a variety of requirements, such as:
• Multiple analog and digital I/O – measuring and stimuli various inputs
• High-voltage clamping – testing ECU input clamping with 500 V test voltage
• High-density switching – making large numbers of test points and instrument resources readily available
• Active and passive loads – simulating various components and sensors in the vehicle according to the ECU/ECM under test
• Support all major automotive protocols – communicating to various products from different manufacturers

• Run mode – testing ECU or ECM by simulating the entire vehicle environment
• Simple test sequence development – rapid test development for new products
• Short cycle times – for high test throughput

Easily Configuring and Outputting Waveforms over Analog Output Devices
Our Alfautomazione HFT3000-ECU Tester uses National Instruments PXI instrumentation, switching modules, various power supplies, and other GPIB controlled instrumentation.

The HFT3000-ECU tester uses NI E-Series DAQ to measure all analog output signals of the ECU. We condition high-voltage signals before applying them to the E-Series boards.

Waveforms are important stimuli when testing ECUs and ECMs. When testing an ECU in run-mode, you must maintain amplitude and phase relations between simulated sensor signals, such as crank, cam, and mass airflow. Using the HFT-3000, test engineers can easily define arbitrary waveforms and configure the phase relationship through editors provided with the test system. An interactive step type for TestStand makes configuring and outputting simultaneous and synchronized waveforms over multiple NI analog output devices simple.

ECUs have multiple inputs controlled by relays. The HFT3000 also enables test engineers to test the effect of defective relays on the ECU.
Convenient and Efficient Methods for Test Sequence Development

NI TestStand is the core software component of the HFT3000-ECU Tester. We developed a wide variety of high-level, interactive custom step types for TestStand. We developed interactive custom step types in LabVIEW to enable the use of NI TestStand as a rapid development environment. With TestStand and the HFT3000-ECU, test engineers can get a test system up and running quickly, or modify an existing test sequence with minimal effort.

The interactive step types fully integrated in TestStand provide a convenient and efficient method to create test sequences. We offer a wide variety of high-level, interactive step types to control instruments or perform signal acquisition and measurement analysis. You can request additional software packages for preventive maintenance and statistics.

Cost-Effective Results

The modular nature of PXI and the flexible software architecture provide test engineers with an easy-to-use test system that reduces development time by half. The HFT-3000 ECU tester includes all the functionality required for a sophisticated and cost-effective solution and provides the ideal solution for current and future ECU and ECM testing needs.