ECM Test System Selection

The Engine Control Module (ECM) is directly responsible for the monitoring and control of essential automotive functions including ignition, canister purge control, air compressor control, automatic idle speed control, transmission control interface, and the monitoring of various voltage and battery conditions. Typically, the ECM device has a microcontroller unit and memory, as well as built-in input/output controllers, to process signals from various sensors and switches. The ECM then responds with outputs to drive various devices through relays and digital commands.

A typical ECM test interface will include digital and pulse inputs, analog inputs, digital and relay outputs, along with analog outputs driving inductive loads. Various inputs to the ECM, such as engine temperature, speed, and battery voltage supplies need to be simulated while the timing and angles are measured by the test system. For example, a major activity of the ECM is the ignition control; ignition control inputs to the ECM are engine load (proportional to air quantity), speed, engine temperature and throttle position.

One way to pre-qualify new software developed for the ECM is to simulate the test prior to road testing the update. A sample test requires the simulation of different input conditions for the ECM, and measures the variation in the ignition timing with reference to the crankshaft position. The test involves varying the output coil conditions using a programmable load; the test could be carried out programmatically for different engine and vehicle conditions. Variations in timing intervals are then precisely measured utilizing a digitizer and time stamp card.

The ideal platform for ECM test and verification must be capable of generating test stimuli, measuring a variety of static and dynamic signals, switching test signals to the instrumentation, as well as switching simulated fault conditions. The platform must be computer independent and based upon an open architecture design to ensure test station longevity. Additionally, the open platform approach will ensure multi-vendor support and hardware availability.

The high-density, modular nature of VXI-based test systems is ideal for this type of application, making it a favorite selection for many ECM manufacturers. The ability to place high density switch modules in the same functional subsystem with signal sources and measurement instruments, such as digital multimeters arbitrary waveform generators, simplifies system configuration as well as reduces the overall footprint of the test system.
VXI Technology’s VMIP™ and SMIP™ family of high-density modular instrumentation and switching solutions are ideal for this application. Three multi-channel instruments can be configured in a single slot, with flexible switching ranging from low-level signal distribution to high-current power routing. One ECM test platform contained the following hardware in a portable 6-slot chassis, with space to spare (See Figure 1 and technical notes http://www.vxitech.com/Technote.aspx#):

- VM3618  8-channel D/A
- VM1548  48-channel digital I/O
- VM3616A 16-channel 100kHz ARB
- VM7004  4-channel programmable load
- VM2616  16-channel digitizer
- VM2710A 6.5 digit DMM
- SMP2001 20-SPST 16A relay
- SMP4004 8x16, 2A matrix
- SMP5001 80-SPST 2A relay

Figure 1.

The emergence of the LAN Extension for Instrumentation (LXI) Standard, leveraging all of the advantages of Ethernet while adding several critical components necessary for true test and measurement compatibility, further expands the utility of the VXIbus open platform. An LXI-VXI slot-zero control bridge, such as VXI Technology’s EX2500, performs all of the functions expected of any VXI controller, in addition to providing the LXI interface functionality for the external network. This includes providing a communications path for the host computer, facilitating instrument and switch card
discovery (within the chassis), memory allocation, trigger distribution and generation, and error reporting.

Each of the instruments or switch cards within the chassis will function independently of the LXI interface, and retain all of the exceptional timing and synchronization characteristics that have driven wide industry acceptance of platforms such as VXI. Internal backplane functionality is unaffected by the LXI bridge, and performance characteristics such as data transfer rates, device triggering, high-speed local bus, and power supply capabilities are retained.

Many applications, such as ECM testing, demand the performance of open-platform, chassis-based modular systems such as VXI, and providing bridge interfaces completes a logical link into these systems. Engineers seldom appreciate having their design path dictated, and welcome the freedom to choose the solution that best fits the need. Bridge interfaces and transition devices will ensure this freedom of choice and foster the adoption of the LXI Standard in a well thought out, logical manner (See industry solutions at http://www.vxitech.com/Industry.aspx).

VXI Technology, Inc. headquartered in Irvine, California, is a global supplier of high-density modular test instruments and switching systems for both electrical and mechanical test applications. All solutions are based on open-platform, “computer independent” standards. For more information about these and other products, simply visit www.vxitech.com, or call 949-955-1894.