Military Vehicle Body Mount Testing
using the WaveBook

Automotive

Application Note #56

Application Summary

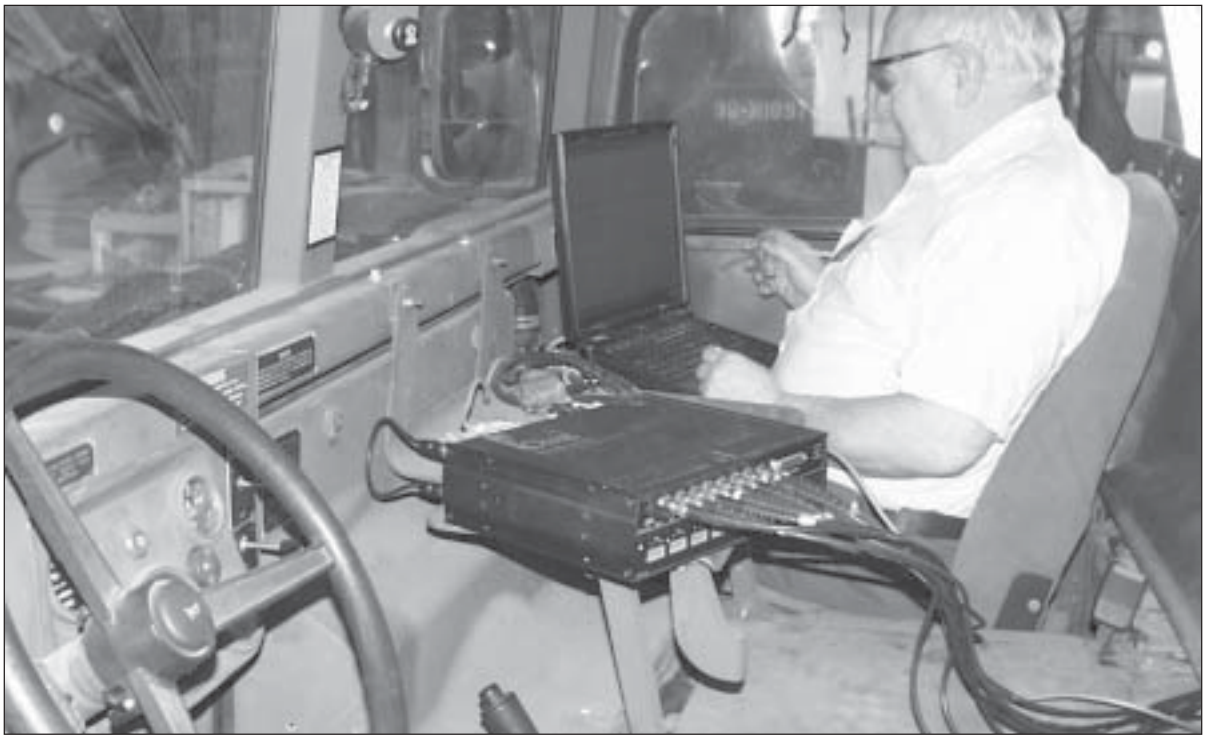
A small test laboratory in Livonia, Mich. — a facility within the larger AM General operation that manufactures the HUMVEE® military vehicle — has the primary mission to support its design and engineering departments. Among other activities, it supplies and maintains data acquisition systems used in new vehicle manufacturing, testing, and quality assurance. The lab also services continued-engineering projects assigned by various government agencies. Unlike the big three auto makers that have a separate laboratory for acoustics and another for vibration, or for that matter, one lab for each particular suite of measurements, AMG's lab conducts all measurements required for all test functions. The wide range of parameters it measures includes load forces, strain gages, pressures, temperatures, accelerations, rpm, displacements, and a host of others.

Potential Solution

Before purchasing a data acquisition system, AM General engineers investigated two other large data acquisition system manufacturers that have been in business for many years. Units from both companies had a sufficient channel count to suit its needs, but their major drawback was their proprietary software. Says Mark Birecki, Development Test Supervisor, "You are tied to them forever because of it. We found other software suppliers that have a lot of good, flexible packages to offer, and we wanted the ability to try and use different ones when we felt we might have a special need."

IOtech's Solution

Birecki checked out the IOtech data acquisition system, the WaveBook™ with a WBK14™ dynamic signal conditioning module, WBK15™ isolated signal conditioning modules, and a WBK16™ strain gage module, and found the combination to be the best solution. "I like it because it's small, compact, and you can use it to measure just about anything you can think of. The price is pretty reasonable, and best of all, IOtech is not software limited. We can use IOtech software or any one of the others currently on the market. These are the major reasons we purchased the IOtech WaveBook over the other two brands," says Birecki. He uses a separate computer, a desktop or a laptop, and that gives him the ultimate flexibility he needs; it allows him to go with just about any kind of computer he



A definite advantage for vehicle test engineers is IOtech WaveBook's ability to operate from the 12-VDC vehicle power supply. The feature lets the equipment run live road tests while operators observe and record data in real time and make necessary vehicle adjustments on the fly.

prefers. Furthermore, Birecki was emphatic about his satisfaction with all the data he records, both the accuracy and the repeatability. He likes how easy the WaveBook is to use, and it's portability, especially the fact that it runs on either ac in the lab or 12 VDC in the vehicle during road tests.

The real beauty of the instrument, claims Birecki, is that everything about it is fairly straightforward and simple to hook up, such as common types of connectors. And after learning the software, he was in business and ready to test in a couple of hours. The learning curve turned out to be quite minimal. The software Birecki uses is easy to load and he often monitors the data in real time, watching the waveforms change and stay within the intended range during the test. This lets him determine if the data right out of the box makes sense and it gives him a degree of confidence in the data before relegating it to automatic memory to study later.

For instance, the lab is now conducting a body mount study that includes measuring displacements. The LDVTs measure several displacement/strain levels on the frame, loads with a load cell, and accelerations with various types of accelerometers. It gathers and analyzes the data with an IOtech WaveBook, WBK14, WBK15 for rpm, WBK16, and signal conditioning modules over 24 analog channels.

Birecki runs tests in the desert and in frigid climates, so the test gear he uses must withstand these extreme temperature ranges. And he is satisfied with the ability of the WaveBook to withstand those extremes. Moreover, the WaveBook and modules are very durable; they withstand the shock, vibration, and the general all around bouncing experienced on road trips.

Conclusion

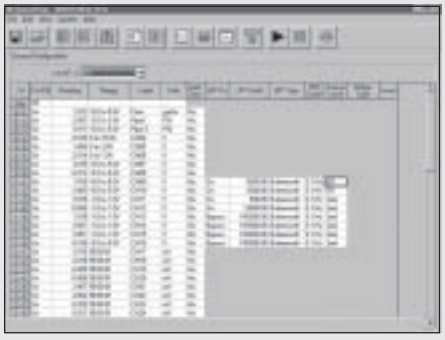
Two WaveBooks are used currently in AM General's labs for testing HUMVEE military vehicles. The flexibility and number of channels they afford the test engineers rival the equipment capability of much larger, dedicated test labs that house separate acoustics and noise/vibration facilities. The WaveBook is less expensive than the dedicated software and hardware and provides the same or better accuracy and repeatability. Variables include load forces, strain gages, pressures, temperatures, accelerations, rpm, displacements, and numerous others that conveniently drive the signal conditioning modules interfaced to the WaveBook.

WaveBook Series

The WaveBook™ series of portable and desktop digitizers offer multi-channel waveform acquisition and analysis for portable or laboratory applications. All WaveBook models include 8 built-in channels expandable up to 72 channels of voltage, accelerometer, microphone, strain gage, thermocouple, position encoder, frequency, high voltage, and other signal types. For applications beyond 72 channels, up to four WaveBooks can be combined within one measurement system, for a total capacity of 288 channels. WaveBooks are available with either an Ethernet or parallel connection to a PC.

Features

- PC connection via Ethernet, parallel, PC-Card, or PCI card
- 1 µs/channel scanning of any combination of channels
- Expandable up to 288 high-speed channels
- SYNC connection allows multiple units to measure synchronously
- Add up to 224 lower-speed thermocouple channels
- DSP-based design provides real-time digital calibration on all channels
- Single and multichannel analog triggering with programmable level and slope
- Digital TTL-level and pattern triggering
- Pulse trigger and external clock
- Programmable pre- and post-trigger sampling rates
- Sixteen 1-MHz digital inputs
- Operable from AC line, a 10 to 30 VDC source, such as a car battery, or optional compact rechargeable battery module



Using WaveView software's spreadsheet-style interface, you can easily set up your application and begin taking data within minutes.

Included Software

- WaveView™ for *Out-of-the-Box*™ setup, acquisition, and real-time display:
  - Scope mode for real-time waveform display
  - Logger mode for continuous streaming to disk
- eZ-Analyst™ for real-time spectrum analysis
- Export data in third-party formats
- Includes drivers for Visual Basic®, Delphi™, C++ for Windows®; DASYLab®, and LabVIEW®
- ActiveX/COM development tools