Application Summary

Durability, performance, and life-testing equipment intended for automotive components such as automatic transmissions, brakes, and steering systems require a high degree of flexibility in the tests they perform. Parameters change from test-to-test and between component suppliers of similar parts, so data acquisition systems for monitoring wide dynamic ranges and numerous alarm set points need to be easily programmable. Also, the hardware must be modular for custom tailoring each application. For example, Link Engineering, Plymouth, Mich., designs and builds precision test machines and vehicle test systems for major automakers and automotive component manufacturers. Each machine includes a complete data acquisition system embracing these qualities.

Potential Solution

One data acquisition system hardware supplier in competition with IOtech that Link evaluated for its testing machines is based on plug-in boards for desktop-size computers. While it appears on the surface that such a system would be cost effec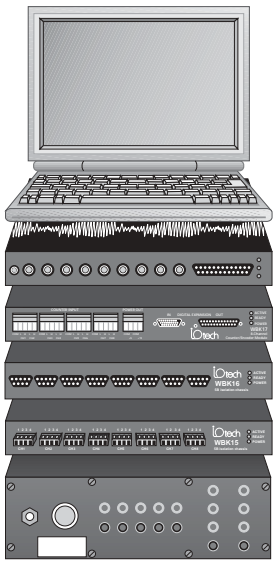tive and flexible, it proved to be somewhat cumbersome. It uses plug-in cards and multiple chassis, so changing a test setup or configuration requires swapping PC boards or going to a new chassis, typically not an easy or fast way to modify a set up.

IOtech's Solution

After evaluating several data acquisition systems, Link decided to integrate an IOtech WaveBook/516™ and signal input modules into its vehicle data acquisition system. The major advantage of IOtech over other systems, claims Jim Thompson, Executive Director of Link, is its modularity. He is able to configure a system for any particular customer's need, and customers are likewise able to change configurations on the fly. The WaveBook runs easily under the same software that Link developed for its dynamometers. For instance, Link software includes a feature that allows customers to pull a module out of one system and put it in another. The software recognizes that event and it helps reconfigure the system to manage the extra module. This is a major advantage for both Link and its customers. Says Thompson, "Our competitors are using another brand of system, and in order to reconfigure the setup or make a small change, they need to swap out boards or go to an entirely new chassis."

System Configuration

Notebook PC
running Windows® NT or 2000

WaveBook/516A
16-bit, 1-MHz, data acquisition system

WBK17
8-channel counter/timer module

WBK16
8-channel strain gage module

WBK15
8-channel isolated (5B)
signal-conditioning module

Link Power Module

Link has integrated IOtech data acquisition components into its vehicle component test machines and vehicle test systems because of its modularity, flexibility, and high reliability. Mobile systems are used in vehicles for investigating noise, vibration, and harshness (NVH); correlating brake noise to other parameters; analyzing data; and general troubleshooting.

The architecture of a typical Link Engineering test system includes a notebook PC connected to a WaveBook/516 for high-speed waveform acquisition and analysis with WBK15 and WBK17 input modules.

The WaveBook/516 transfers acquired data to the PC allowing a continuous stream of a large amount of data to be collected and stored in the PC's memory or hard drive for post processing. WaveBook/516Es have 16-bit resolution, sample at a rate of 1 MHz, and come with a built-in 10/100BaseT Ethernet interface. WaveBook/516As replace the Ethernet interface with a parallel port. All WaveBook models include 8 built-in channels expandable to 72 channels for voltage, accelerometers, microphones, strain gages, thermocouples, position encoders, frequency, high voltage, and other signal types. For applications beyond 72 channels, up to four WaveBooks can be combined to provide 288 channels.

WBK15 modules are multiple-purpose, isolated signal conditioners that are driven by various IOtech 5B modules, in this case, thermocouple input signal conditioners. WBK17s are eight-channel counter/encoder/high-voltage signal modules, used in Link's system to measure speed, temperature, and strain driven by thermocouple and strain gage modules. In addition, Link provides a power module that supplies the IOtech hardware, and any other components, actuators, or sensors the customer is using. It includes inverters, battery packs, excitation voltages for transducers, and a unique heads-up display.

The heads-up display (HUD) is a Link Engineering product that customers place on the dashboard to view prompts, reminders, status of tests, ramps for braking or acceleration, or other data needed for the test. The HUD is primarily employed in test track vehicle evaluations.

Most channels currently measure numerous temperatures that include brake rotors and pads, brake-line pressure at multiple points, and strain on suspension components and anchor brackets. The system also measures speed using a 5th wheel or an optical sensor, or the speed signals from all four wheels. Another wheel is often added to evaluate ABS operation and other tests. In addition, Link measures interior noise, noise or vibration at the four vehicle corners (using accelerometers), and brake-pedal displacement and force. Link engineers also plug into the OBD-II bus with the DBK70 module. Says Thompson, "We like that very well; for the ABS guys, that's just wonderful. They simply pull the ABS signals off the bus as they are going down the road."

A typical Link integrated system contains from 16 to 64 channels. "Going beyond that will most probably be additional temperature measurement channels," says Thompson, "because temperature is the parameter that may require measurements at a large number of points."

Conclusion

IOtech hardware modularity and software compatibility make it easy for Link Engineering to integrate the data acquisition system into its dynamometer durability test machines. Although the WaveBook/516 comes with WaveView™ software for setup, acquisition, and real-time display, drivers are included for Visual Basic, Delphi™, C++ for Windows®, DASYLab®, and LabVIEW®. In addition, ActiveX/COM development tools are provided for users to design custom applications. Also critical to the success of the test equipment is IOtech durability. In the 16 or more systems that Link engineering has commissioned, none had a single failure. And this is also a reflection on Link's reputation as a quality machine supplier.

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

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

eZ-Analyst™, WaveBook™, WaveView™, and *Out-of-the-Box*™ are the property of IOtech; all other trademarks and tradenames are the property of their respective holders. 021207.