Automotive Research Engine Testing

using the PointScan™ Series

Automotive

Application Note #57

Application Summary

Research Laboratories are notorious for having to monitor and record "tons" of data. And many of the data acquisition systems they employ must be portable, quick to learn, and easy to use and connect. This is especially true at the General Motors Research and Development Science Labs in Warren, Mich., where John Shotts, Staff Technical Specialist at the lab is responsible for many of its PC-based data acquisition systems, PLC software for engine test cells, and other instrumentation. John is a member of the group that maintains the instrumentation at the R&D facilities that include scientific labs, dynamometer test cells, and the metallurgy department. Moreover, they often support scientists on the plant floor when trouble shooting new installations.

Until about 1990, the Data Acquisition Center included systems that hinged on large analog/digital computers such as IBM 370s and General Automation Spec 16s, — high-tech laboratory equipment widely used during the 70's and 80's. But now, the Data Acquisition Center has been replaced with distributed PCs.

Potential Solution

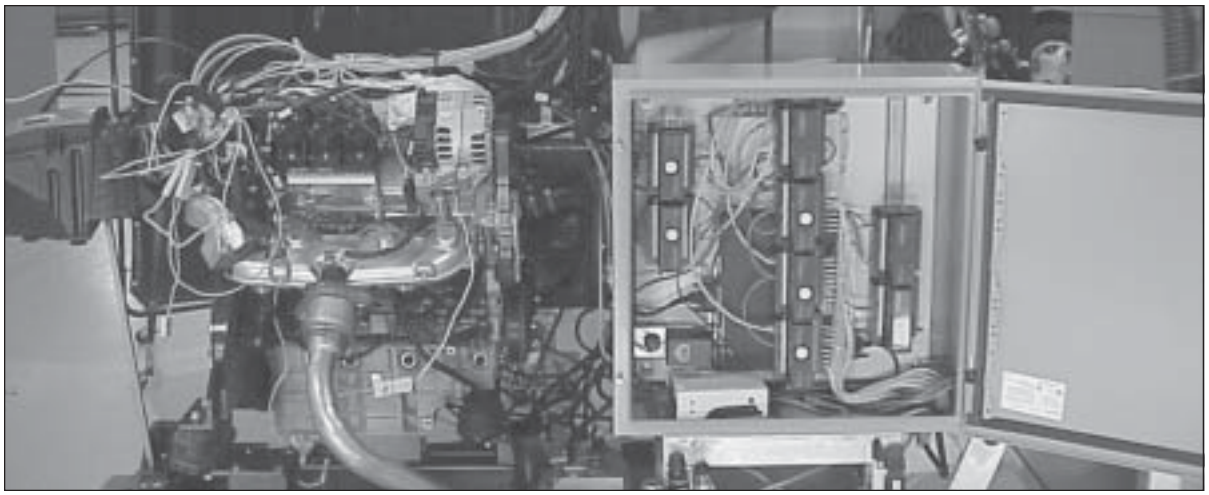
Shotts originally started out in the early 1990's with a general-purpose data acquisition software package for PCs and a well-known brand of hardware for the front end, all used on series 286 personal computers. Although the new PCs were handier to work with, that particular combination of hardware and software for data acquisition was not easy nor quick enough for him to set up an efficient application program for running relatively complex systems such as a test cell with as many as 70 thermocouples. In 1995, Shotts began searching for an upgrade.

IOtech's Solution

Shotts evaluated two other systems and selected an IOtech DaqBook/100® and DASYLab® software. That was considered a significant upward migration. Says Shotts, "We started using the DaqBook/100s about eight years ago. We still have a couple of them in use. But the majority of the equipment we now use is the DaqBook/200, DaqBook/260, and DaqBoard/2000. We have about 30 systems running here at the R&D facilities."

DASYLab is so much easier to use, claims Shotts. For example, a technician working with the early software and hardware package (who was already familiar with it) was struggling with an application and couldn't get it to work. The technician then tried the DASYLab software, which he was not yet familiar with. But within four hours, he had the application up and running without even opening the manual. This dramatically illustrates just how intuitive DASYLab software is.

Recently, Shotts' group purchased a few DaqBoard/2000™ data acquisition boards, PointScan™ thermocouple modules, DBK70™ engine bus interface modules, and DBK signal conditioner modules. They have a couple of applications for the DaqBoard/2000, including a mass spectrometer where they automated the processing of its output data. Previously, the process



The General Motors Research Center is conducting long term testing of engine performance. A PC located in the center displays temperatures in real time using DASYLab software and PointScan modules with Ethernet capability. The system scans as many as 96 type K thermocouples once/second for as long as a week without interruption.

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was slow; engineers could look at only one mass number at a time. But, with the DaqBoard/2000 and DASYLab software, they were able to analyze all 40 mass numbers simultaneously.

The PointScan modules are intended for seven other applications, either proposed or currently running. The majority of those are remote engine test stands, so the Ethernet I/O PointScan modules save on cabling. About 24 thermocouples are configured in three groups of three PointScan modules where they are dedicated to measuring engine temperatures. Other PointScan modules in the test cells measure pressure transducers and throttle positioners.

For certain other engine tests, the IOtech DBK70 interface modules connect to the various vehicle control buses. It's extremely helpful when testing cars on the road and to observe how the ECM is functioning while driving. The car doesn't have to be modified; it is run "just as is" to obtain the data. The DKB70 is now the heart of R&D's new engine test stands. Engineers are controlling the engine using data from the DBK70 as feedback.

Another noteworthy application supports PLCs. The lab has a complete DASYLab system with digital I/O that simulates a test cell for checking out PLC software. Shotts has a full-blown PLC in his office connected to an IOtech DASYLab with DBK21 modules to mimic every digital input and output of the PLC. As many as 192 I/O signals are routed between the PLC and the DASYLab system. Now when Shotts develops software he can write the code and check it out in his office without bringing down a cell to debug it.

In yet another unique application, an intern student from the University of Minnesota thermally mapped the entire exhaust system — from the engine to the tailpipe, through all the connecting pipes, through the catalytic converter, and finally out the tailpipe. The project involved almost 70 thermocouples. And the IOtech DBK84™ signal conditioning modules provided extremely clean and impressive data. Says Shotts, "These modules were really the heart of the project that made it successful."

Engine test cells are not the only place that temperature measurements are carried out. Much thermocouple work is also done in the metallurgy area. Several DaqBook/200 systems using DBK84 thermocouple boxes connect to the inputs and outputs of an extrusion process. They frequently monitor the pressures and speeds of the pistons in an extrusion machine, on small presses in the lab and out on the factory floor. For example, an engineer recently used an IOtech system and for the first time was able to record cooling curves correlated to fast injection timing. In previous attempts, he had 24 thermocouples in an injection die and had to use sampling times ten times faster to filter out the noise. But with the new DBK84 modules, he didn't need the additional filtering and obtained extremely clean results.

Conclusion

The General Motors Research and Development Science Labs employs numerous IOtech data acquisition DaqBooks, DaqBoards, DBK series signal conditioning modules, and especially the DASYLab software package to collect and analyze millions of bytes of data. Before acquiring these units, now comprising about 30 systems, the engineers spent more time setting up and debugging the tests and less time collecting and analyzing the data. In addition, they are now able to run tests and analyze data that were impossible to collect previously.

PointScan Series Distributed I/O

PointScan™ distributed I/O modules feature integrated field wiring terminals and resident network interfaces in a single, small form-factor module. These industrially robust modules can be either DIN-rail or panel mounted and are designed to be located near the sensor, process, or device under test/DUT. With I/O count options from 4 to 16 channels, modules can be economically matched to I/O count requirements, and modules can be easily added to meet future I/O expansion requirements. Over 40 analog, digital, and combination modules are available for a wide range of signal measurements and switching applications. With easy-to-use drivers for Citect monitoring and control software, configuring and maintaining a distributed I/O system has never been easier or more economical.

PointScan

- Over 40 I/O modules for measuring and controlling a wide variety of signals
- Cost-saving integrated terminal base for direct field wiring
- 4-, 8-, & 16-channel analog input module; up to 16-bit resolution
- 4- or 8-channel analog output modules; up to 14-bit resolution
- NIST-traceability for all analog I/O modules
- 8- or 16-channel isolated industrial digital I/O modules
- Economical combination analog/digital I/O modules
- 1200 Vrms isolation (module-to-communication port)
- Direct Ethernet connection (/100 series) 10BaseT @ 10 Mbps
- Direct RS-485 connection (/200 series)
- RS-232 or Ethernet gateway-based connection (/300 series)
- Hot-swap function for module substitution under power
- On-board diagnostics and status LEDs
- -30˚ to +70˚C extended operating range
- Class I, Div 2 (hazardous location) compliance
- Space and cost saving compact form factor

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