

Load Cell & Vehicle Jack Testing

using the DaqBook

Automotive

Application Note #82

Application Summary

Tires and rims manufactured for today's passenger cars are safer, more reliable, and longer-lived than they have ever been. Although tires should be examined frequently for damage, they seldom require any serious attention other than a monthly pressure check. But when a tire does get punctured or damaged and needs quick replacement, many times, vehicle owners rely on a safe and sturdy jack to lift the car. Car jacks are relatively small and require little trunk space. But they must be strong and meet certain safety standards, and ensuring that jacks are safe requires extensive load testing.

In order to perform the testing, Bosal International, Inc., Ann Arbor, Michigan, a manufacturer of scissors jacks for passenger vehicles, measures the vertical displacement of the jack, the total load, and two-axis torsion moments using a full-size car. The load cell is placed between the jack and the floor, and any twisting moments are recorded as well as the load while the car is raised and lowered. Mechanical engineers can then use the data to validate their paper designs or find areas where the jacks need some rework.

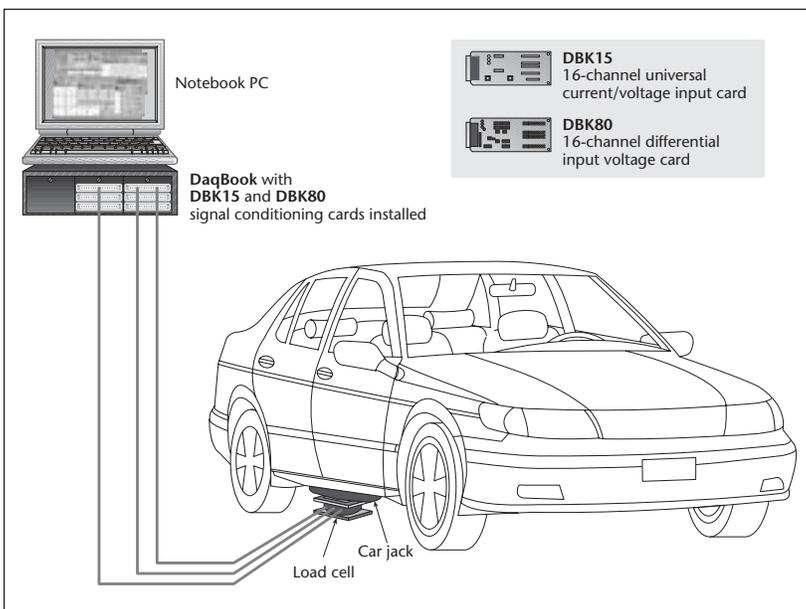
IOtech's Solution

John Herman, the head of the Testing and Development Department at the Bosal R&D center, initially evaluated several possible data acquisition systems using thermocouples for temperature measurements, and other sensors for measuring engine vacuum. The system had to be capable of measuring and recording four channels of input signals. Herman decided upon the IOtech DaqBook® at that time because it was very flexible with modular upgrades and the easiest to understand and use. Now, Michael Reysman, Development Engineer, at the R&D center uses the same DaqBook for the automotive jack test. It connects to the DBK15™ signal-conditioning unit, which measures the two channels of torque moments and one vertical load, while the DBK80™ is used with the string potentiometer to measure displacement. The load cell is calibrated for a $\pm 10V$ output with a vertical load range to 2000 lb. and two twisting moments in two axes in the range of 800 in.-lb. The jack's vertical displacement of 0 to 16 in. is measured with a signal of 0 to 5V.

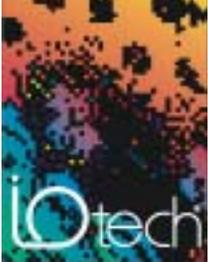
The data collected by the DaqBook is initially viewed in DASyLab®, and the data is presented with the Excel XP spreadsheet software for reports. "The DASyLab software is more user-friendly than most professional software designed to do complicated things, along the lines of data acquisition or data analysis," says Reysman. "It was easy to write my own software routine for the entire jack-testing program." The collected data are sent to the design and manufacturing groups for further analysis and archiving.

In addition, Reysman says that the IOtech equipment performs well within its stated accuracy envelope, and proved to be extremely durable. The advantage of the DBK modules is in their ability to handle both a large range of input signals, and a scaled-down range to increase the precision of the measurement.

Future applications for the same DaqBook include measuring thermocouples placed on exhaust systems as well as differential pressure in a flow test stand. "Among the reasons we selected the IOtech DaqBook was its flexibility and uncomplicated, companion signal conditioning modules. These factors make it a reasonable choice for accurately measuring temperature gradients in exhaust systems and differential pressure in a flow bench as well as displacement, load, and torque for jack testing."



The DaqBook and the DBK15™ signal conditioner measure two torsional axes and one vertical load axis in the car jack. The DBK80™ connects to the string potentiometer to measure vertical displacement under load. The measured data are then compared to the engineers' design data to verify the jack's capacity to handle the task safely.



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Conclusion

Bosal International selected the IOtech **DaqBook** data acquisition system for use in their R&D and prototyping labs for testing automotive jacks. The system was preferred over other systems for its durability, flexibility, accuracy, and ease of use. These factors allow it to be used for other applications that are planned; including temperature measurements in exhaust systems and differential pressure in a custom flow test stand.

DaqBook/2000 Series

The DaqBook/2000® series of portable data acquisition devices can synchronously measure analog inputs, frequency inputs, and digital inputs. The 16-bit/200-kHz DaqBooks come equipped with built-in signal I/O capability, which can be further expanded and enhanced with over 40 DBK series expansion and signal conditioning options.

The DaqBook/2000 series includes a built-in 10/100BaseT Ethernet interface capable of transferring acquired data back to the PC at the full 200 Kreading/s measurement rate of the DaqBook. Multiple DaqBooks can be attached to a single PC via an Ethernet hub or switch, and are capable of being synchronized and of transferring data continuously at full speed into the PC. Up to 10 DaqBooks can be transferring 200 Kreading/s back to a PC concurrently, with no loss in data.



Features

- Analog input, analog output, frequency input, timer output, and digital I/O; all in one compact and portable enclosure
- Built-in Ethernet connection provides continuous streaming to the PC with no data loss
- 16-bit, 200-kHz A/D converter
- Operates from -30° to +70°C
- Powerable from 10 to 30 VDC, or with included AC adapter
- Synchronous analog, digital, and frequency measurements
- Trigger modes include analog, digital, frequency, and software
- Virtually infinite pre-trigger buffer
- 4 channels of 16-bit, 100-kHz analog output (models /2001 and /2020)
- DaqBook/2020 offers convenient front panel connectors for thermocouple, voltage and frequency measurements all in one box
- DaqBooks attach to over 40 DBK signal conditioning options to assemble a low-cost system, customized to your particular application



DaqView™ graphical data acquisition and display software is included with all DaqBook systems

Signal Conditioning Options

- Signal conditioning and expansion options for thermocouples, strain gages, accelerometers, isolation, RTDs, etc. — over 40 DBK I/O expansion options are available

Software

- DaqView™ software included for effortless data logging
- Includes support for Visual Basic®, C/C++, ActiveX/COM, LabVIEW®, MATLAB®, and DASyLab®

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