

Vehicle Crash Testing

using the LogBook/300™

Automotive

Application Note #38

A leading original equipment manufacturer (OEM) of automobile and truck air-bag systems required an in-vehicle data acquisition system to verify crash test results. Crash testing is critical to developing reliable air-bag systems that conform to federal transportation specifications.

Application Summary

When attached to ferromagnetic material, the magnetostrictive sensor emits a signal with an amplitude in the millivolt range. When the ferromagnetic material experiences a stress, as it would during a vehicle crash, the material's magnetization changes and the output of the sensor changes. Because shock waves travel well through the vehicle's metal frame, the sensor can detect impacts from any direction that occur at a distance from the sensor.

To test the reaction time of the sensor, the OEM installs air-bag systems into vehicles and subjects them to simulated crash tests. Engineers perform many crash tests at different speeds and angles to acquire test data.

Because the beginning of the crash contains the most critical events, the engineers look to discover the

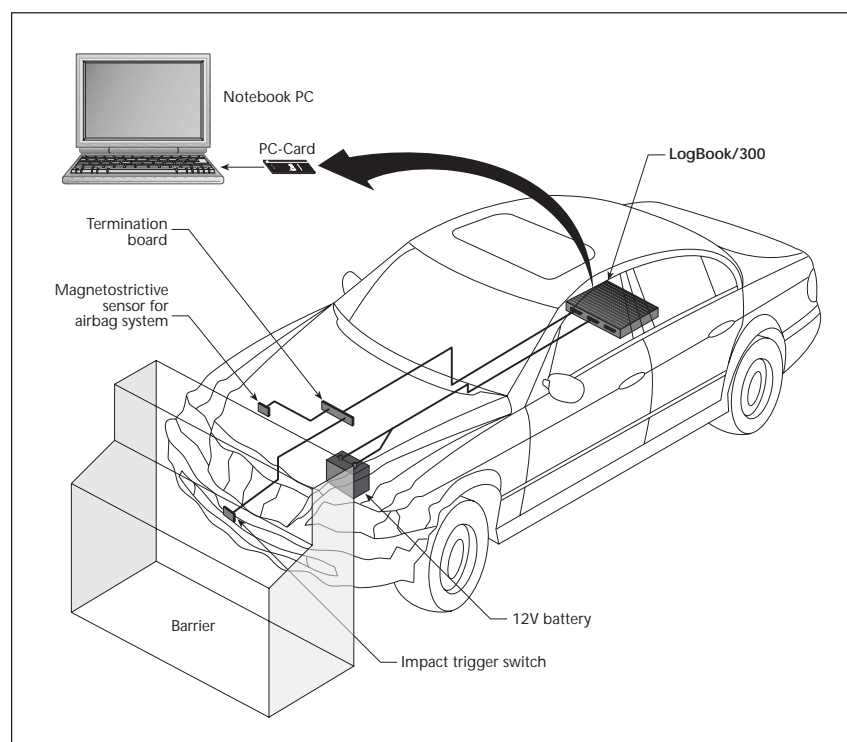
precise time at which the crash occurred (time zero), and how long it took for the sensor to detect the crash. Data is collected in the 0.5s to 1s interval immediately following impact, an acquisition period which produces approximately 50,000 to 100,000 data points.

Potential Solution

The air-bag manufacturer evaluated several data acquisition systems that would quickly and easily collect the data from a high-speed vehicle crash; however, these systems were not able to withstand the g forces involved in a crash and did not meet the OEM's sampling requirement.

IOtech's Solution

Ultimately, the air-bag manufacturer selected IOtech's LogBook/300 stand-alone data acquisition system, which provided the convenience of a PC-based system without exposing the PC to potentially damaging forces. The LogBook/300's removable PC-Card (PCMCIA) permitted the data to be transferred to a benchtop PC. The card's non-volatile storage of up to 250 million samples was adequate for the sizable files of data, acquired at a rate of 100K samples/s with a resolution of 16 bits.



Two essential requirements for the data acquisition system were portability and ability to withstand the g forces encountered in a high-speed crash test. To perform a test, company technicians mounted the compact LogBook/300 chassis in the test vehicle, using twisted pair cable to connect the system to a terminal board located four to six feet away. The terminal board, in turn, was connected to the air-bag system's magnetostrictive sensor and an impact trigger switch.

The air-bag manufacturer was impressed by the LogBook/300 system's trigger programability. Contact switches or tapes placed in the test vehicle's impact area supplied the trigger signal. When the trigger signal

The LogBook/300 stand-alone data acquisition system collected data from an impact switch and air-bag sensor, storing the data on removable PC-Card memory



came from a simple switch, the company's engineers easily programmed the LogBook/300 to trigger on the switch closure signal — often a TTL compatible signal. IOtech's LogBook/300™ was configured to sample the magnetostrictive sensor at 100 kHz for 1 second after it was triggered by the impact trigger switch.

Moreover, the air-bag manufacturer was pleased with the LogBook/300's 20 Mbyte memory storage PC-Card. After each test, technicians remove the card from the data acquisition system, insert it into the lab's laptop computer, and quickly and easily upload the data for analysis with their analysis software of choice. LogView™ *Out-of-the-Box*™ software, a graphical data acquisition package included with the LogBook/300 system, provided an easy means to configure the application on the lab PC, without programming.

Another compelling reason for choosing the LogBook/300 was the ease of use of LogView, the included application software. The OEM needed a data logging software package that was flexible and powerful, yet did not require the help of programmers or software integrators. LogView met all of their requirements by providing a simple interface for setting up channel acquisition parameters while providing sophisticated features such as multiple sample rates, calculated channels, and dynamic outputs.

Conclusion

The Logbook/300 data acquisition system and included LogView software provides flexible triggering, low cost, and ease of use. With removable PC-card memory, the stand-alone Logbook/300 system can operate without an attached PC in the test platform. What's more, the system's extensive signal conditioning options for strain gages, thermocouples, accelerometers, and other signal types — combined with an optional control terminal for triggering and reviewing acquired data — make it an effective solution that outperforms other test and measurement instruments.

LogBook/300



IOtech's LogBook/300™ data acquisition system provides highspeed, low cost, and ease-of-use, without requiring a PC at your test site. The intelligent LogBook/300 executes your data acquisition applications and saves acquired data using low-cost PC-Card memory. And since you don't need a PC at the test site, you save cost, space, and avoid the threat of damage or theft to your PC.

Features

- 16-bit, 100-kHz A/D converter with digital calibration
- 16-channel analog inputs — expandable up to 256 channels
- Digital I/O, frequency I/O, and analog output expandable to over 200 channels
- Non-volatile storage of up to 250 million samples via low-cost and removable PC-Card memory
- Infinite acquisition duration by swapping PC-Cards
- Direct communication with PC via serial, parallel port, or modem if desired
- Optional control terminal for triggering & reviewing acquired data
- Signal conditioning options for strain gages, thermocouples, accelerometers, and nearly every other signal type
- AC or DC powerable
- Vehicle network interface option
- GPS option

Signal Conditioning Options

- Expansion cards and modules for high-voltage/current, strain gages, thermo-couples, isolation, relays, accelerometers, filtering, simultaneous sample & hold, vehicle network measurements, and more



LogView requires no programming or block diagram configuration

Software

- Includes LogView™ *Out-of-the-Box*™ software for easy setup, calibration, and more; no programming required
- Simple spreadsheet-style interface provides powerful setup features for immediate startup
- Acquisition configurations can be transported to the LogBook via PC-Card, serial port, parallel port, or modem connection
- Provides direct support for a wide variety of transducers
- Includes eZ-PostView™ for post-acquisition data viewing

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