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# Bloomy Solutions

For Automated Test, Data Acquisition, and Control Users

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## LabVIEW and TEDS Streamline Automotive R&D

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Automation can help you overcome the roadblocks of manual, time-consuming tests and processes, and outdated equipment and technologies.

*Free download: Running Average.vi maintains a running average of data in your LabVIEW application, page 3.*

Bloomy Controls is a National Instruments Select Alliance Partner and a Registered Member of the Control and Information System Integrators Association. We can help you form an automation strategy to address your current test, data acquisition, and control needs, while keeping your future goals in mind. We partner with you to examine your challenges and identify opportunities where automation can increase your productivity, improve quality, and reduce costs. We help you develop and implement high-performance software and systems that scale from research to design to manufacturing. We provide training, so you can take advantage of and maintain the system's full functionality.

Contact our office nearest you to put our experienced team to work for you. ↪

NSK Steering Systems America Inc. (NSK) manufactures steering systems for vehicle and cockpit manufacturers. Its R&D laboratory in Bennington, VT, performs a wide variety of mechanical testing on steering columns. Most tests involve applying a load or torque to a steering column and measuring the corresponding linear or angular displacement of the unit. A variety of steering column designs, in varying states of assembly, is tested on several different test stations. The wide array of tests requires a vast assortment of load cells, torque meters, and displacement transducers.

To accommodate the different transducers, NSK developed separate data acquisition software applications for each transducer/test combination. An engineer had to manually edit transducer range and calibration data hard-coded within the software. This mass duplication, distribution, and editing of source code created reliability and repeatability issues. Additionally, user interfaces became inconsistent, increasing the time required to train operators.

To streamline the maintenance and control of the data acquisition software, NSK contracted Bloomy Controls. Using LabVIEW and IEEE 1451.4 standard format and virtual transducer electronic data sheets (TEDS), Bloomy Controls created applications that easily supported transducer interchangeability and provided reliable storage of calibration data.

### Hardware

Bloomy Controls began by replacing several legacy data acquisition boards in NSK's existing system with one National Instruments (NI) M Series PCI-6221 data acquisition card, reducing the cost and complexity of the system. The PCI-6221 performs both analog voltage and quadrature encoder measurements. Analog transducer conditioning is accomplished using the existing NI 5B signal conditioning in an NI SC-2311 carrier. By simply treating each module channel as high-level  $\pm 5 V_{DC}$  analog input

Continued on page 2



Figure 1. To test the bending stiffness of a shift cable holding bracket, the S-shaped load transducer (left) measures applied load while the dial indicator (right) measures displacement as the bracket flexes. Both devices are candidates for TEDS. Photo courtesy of NSK Steering Systems America Inc.

*Don't miss the June 7 Automated Test Summit 2005 in Chelmsford, MA, page 3.*



## LabVIEW and TEDS Streamline Automotive R&D (Continued)

signals, the new application can support the previous signal conditioning modules. Encoder measurements are taken by wiring to the programmable function input (PFI) lines of the PCI-6221 via the SC-2311. The PFI lines and analog channels are configured by each application. All test data is acquired by the PC using NI LabVIEW, NI DAQmx, and the PCI-6221.

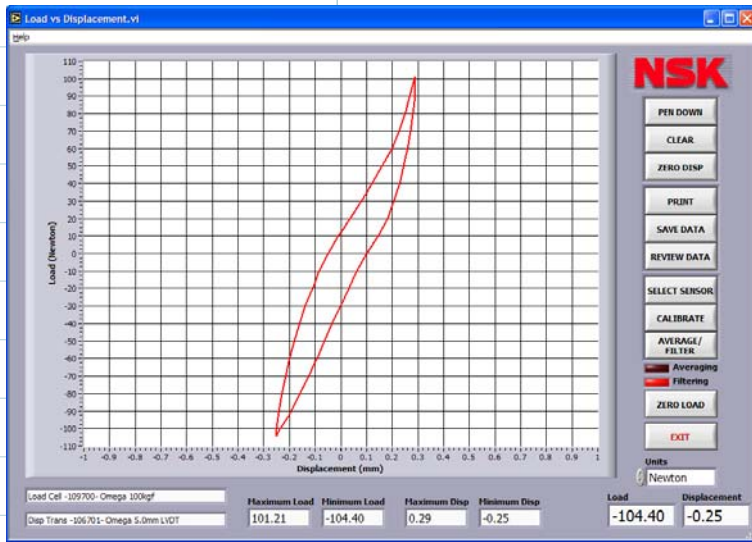


Figure 2: Load vs. Displacement.vi displays test results.

operator only has to create a TEDS AI Voltage task for that channel. DAQmx transparently performs the appropriate engineering unit conversion. Calibration data is conveniently stored in the Virtual TEDS files and is automatically applied to the transducer measurements. Several tests required the use of an encoder. Since encoders are not currently supported by TEDS, Windows configuration files are used to store the encoder configuration data.

TEDS simplified developing applications to test the units under test (UUTs). NSK replaced multiple applications with one LabVIEW application that can conduct all load tests, regardless of UUT design, transducer range, or manufacturer. Several different torque test applications were likewise replaced with one streamlined LabVIEW application. New transducers can be added to either application by simply configuring new TEDS files.

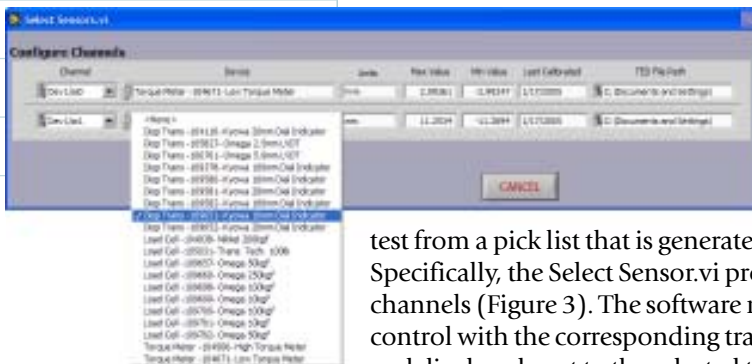


Figure 3. The operator can select a transducer from the Device ring control on the Select Sensor.vi front panel.

test from a pick list that is generated by scanning the TEDS file folder for available TEDS files. Specifically, the Select Sensor.vi prompts the user to select the transducers and the PCI-6221 channels (Figure 3). The software reads the TEDS files from a directory and populates the Device control with the corresponding transducer names. A subset of data is read from the TEDS files and displayed next to the selected transducer.

The operator zeroes each sensor prior to each test by clicking the Zero button from the main graphical user interface. This establishes a reference point for all subsequent measurements. The R&D laboratory environment contains a considerable amount of electromagnetic signal noise and interference. The operator may optionally configure a filter and averaging routine to minimize the effects of the interference on the measurements.

Pressing the Pen Down button begins data recording. The operator applies a load to the UUT as data is recorded to file and displayed on a live graph indicator. The data generated during testing can be printed and saved to file, or cleared without saving, by clicking the Print, Save Data, and Clear buttons, respectively. Additionally, previous test data can be loaded and reviewed by clicking Review Data.

### Software

Virtual TEDS files support NSK's existing transducers that are not IEEE 1451.4 standard-compliant. The transducers are wired into 5B signal conditioning modules, and the High Level Voltage Output Sensor template (IEEE Standard template 30) is used to generate the Virtual TEDS files. Calibration data is stored within the TEDS files using the Calibration Curve template (IEEE Standard template 41). To save new Virtual TEDS files, Bloomy Controls developed a simple application where the operator enters basic transducer data that is used to populate the IEEE templates.

The Virtual TEDS files greatly simplify configuring channels in DAQmx. Only the file path to the Virtual TEDS file is needed to configure all aspects of each channel. This includes transducer type, engineering units, and physical and electrical range. Once configured, the

### System Operation

The load and torque tests are separated into Load and Torque applications, each of which functions as a virtual chart recorder that plots load or torque against angular or linear deflection of the UUT. The primary graphical user interface of the Load application is shown in Figure 2. The operator chooses which transducers to use for any given

## Results

Bloomy Controls replaced dozens of applications in NSK's R&D laboratory with two flexible, easy-to-use LabVIEW applications. Operators can configure new transducers for their ever changing test requirements without editing the source code. Transducers can be interchanged or replaced as test requirements demand or hardware failure necessitates. Each test station maintains a folder of Virtual TEDS files allowing transducers to be interchanged between stations and accurately calibrated at the stations where they are applied. Time is saved in not having to develop new software for every new test requirement, and test stations are now easily replicated. Consistent user interfaces reduce operator error and training requirements. Overall efficiency in the R&D laboratory has increased with less time being spent searching for the correct version of an application or trying to determine the proper calibration data. ↪

*Use LabVIEW and TEDS to simplify your test lab. Contact Bob Hamburger (860) 298-9925 or [inquiry@bloomy.com](mailto:inquiry@bloomy.com) to discuss your needs.*

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