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*Bloomy Controls engineers earn first Certified LabVIEW Architect credentials from National Instruments, page 3.*

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# Bloomy Solutions

For Computer-Based Test, Measurement, Automation, and Control Users

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## Mobile DAQ Station Meets UTC's Comprehensive Measurement Needs

by Robert Gough, Certified LabVIEW Architect

The United Technologies Research Center (UTRC), which supports all of United Technologies Corporation's business units and their products – from elevators and fuel cells to helicopters and jet engines – needed a data acquisition (DAQ) system capable of logging 160 channels of synchronized data to disk at high and low speeds. Because UTRC works on a wide range of projects, the system must be able to measure a variety of data and be portable and rugged so it can be transported and used by numerous groups within the research center. By combining LabVIEW, PXI, SCXI, and MXI-3, Bloomy Controls created a multipurpose, mobile DAQ station that meets UTRC's comprehensive measurement needs.

### Hardware

The DAQ station measures four types of inputs – pressure, temperature, voltage, and current. Up to 32 strain gauge pressure sensors, 64 thermocouples, and 64 generic voltage and current signals can be connected to the station at any time.

The station hardware was chosen according to signal types, number of signals, maximum required sampling rates, and synchronization. An SCXI-1520 module provides strain gauge

measurements, supporting up to 8 channels. Four modules are used to measure all 32 pressure signals. The station must measure frequencies as high as 10 kHz, requiring a minimum sampling rate of 20 kHz for any of the pressure signals. Each SCXI-1520 connects to its own DAQ module and runs in parallel mode on the SCXI chassis. Signals connect to the SCXI-1520 through mil spec quick connects.

Thermocouples are connected into two SCXI-1102B modules through thermocouple jack connectors, enabling easy connection and removal of up to 64 thermocouples. Two SCXI-1102C modules measure voltage through BNC connectors and loop-powered current transmitters through DIN XLR-style connectors. Because voltage and temperature measurements

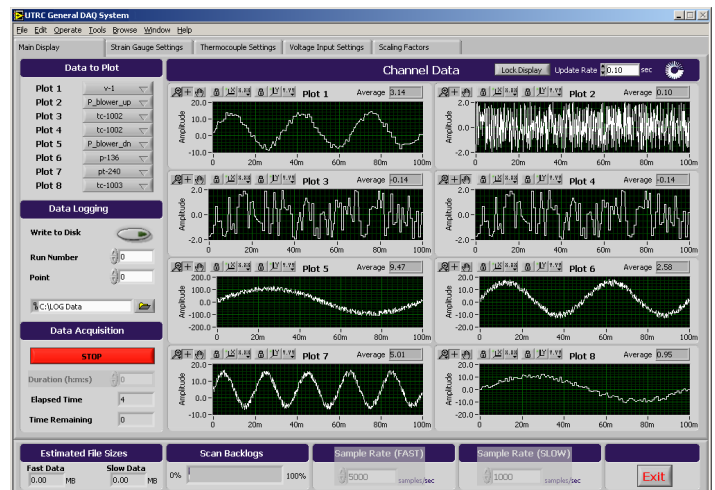


Figure 1. Main display of UTRC multipurpose DAQ station

Continued on page 2

*Bloomy Controls, customers honored at NIWeek 2003, page 3.*



## Mobile DAQ Station (Continued from page 1)

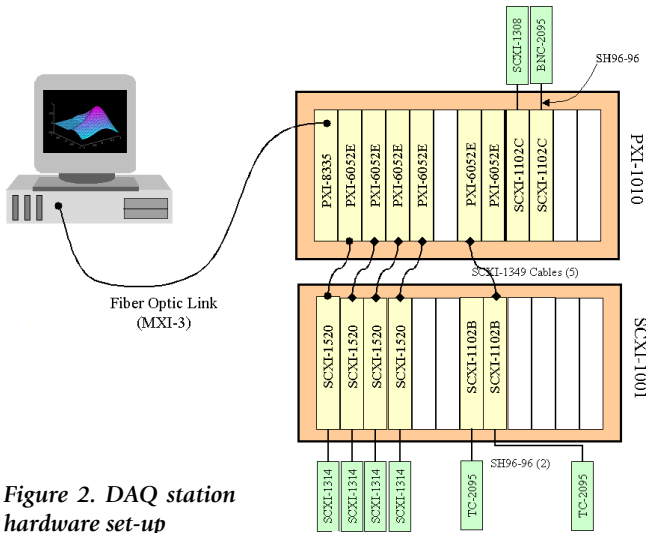


Figure 2. DAQ station hardware set-up

may require higher sampling rates, the SCXI-1102 modules are multiplexed onto two DAQ modules. A total of six DAQ modules are used in the station!

All of the hardware is combined into a PXI-1010 chassis with an external PC controller and an SCXI-1001 chassis (Figure 2). The PXI-1010 provides mobility, PC control with ample slots for six DAQ modules in addition to other hardware not built into the station, and an SCXI back plane. The SCXI-1001 chassis houses four SCXI-1520 modules, operating in parallel mode, and two SCXI-1102C modules for voltage and current inputs, which are multiplexed onto a fifth DAQ module. Two SCXI-1102B modules for temperature measurement are located in the PXI-1010 SCXI chassis multiplexed onto the sixth DAQ module through the SCXI back plane. Six PXI-6052E DAQ modules allow the maximum possible sampling rate on all SCXI channels. The external PC controller was chosen over an embedded controller because of the sheer amount of data being written to disk, in the case that all channels are being logged at maximum sampling rates. The PC has an 80 GB SCSI hard drive, 512

MB RAM, and a dual 1.8 GHz Pentium IV processor to store data, which is transferred from the PXI chassis to the controller via a high-speed, fiber optic MXI-3 link. Synchronization is a non-issue as PXI has a built-in RTSI back plane that synchronizes the DAQ modules. The sample and hold technology of the SCXI-1520 modules further enhance synchronization.

### Software

Bloomy Controls developed the DAQ station software using LabVIEW (Figure 1, page 1) because of its seamless integration with the station hardware. LabVIEW configures and acquires data from the DAQ modules, streams data to disk, and provides a user interface that promotes the flexibility of the station. The tight integration between LabVIEW and NI-DAQ makes DAQ control inherent. LabVIEW code efficiently streams large amounts of data to disk and provides user interface tools that, in a simple way, present the user with the vast choices he or she is given in this application.

With data being acquired on so many channels at high acquisition rates, it is important to ensure that processor utilization is kept to a minimum, while simultaneously acquiring data, updating graphs, and logging data to disk. Logging data to disk in binary format reduces overall file size and frees computer resources because smaller data chunks are written to disk. Combining these additions allows the program to be responsive and efficient.

The hardware used in the DAQ station presents many configuration options, which must be changeable to reflect the user's specific measurement needs. LabVIEW is used to present the user with configuration options and dynamically configure channels. This allows the user to configure all channels as well as change and test hardware settings very quickly. The adjustable settings include excitation voltage, gain, and thermocouple type. In order to display all key parameters on the user interface, a series of tab controls is used.

### Results

The PXI-based DAQ station designed by Bloomy Controls gives UTRC an extremely powerful, mobile measurement station. The station achieves seamless integration among signal conditioning, data acquisition, and synchronization that bench top instruments would not have achieved. By choosing this flexible, PXI-based DAQ station, over using bench top instruments, UTRC saved hundreds of thousands of dollars. ↩

*To discuss your DAQ challenge or to arrange an obligation-free visit from one of our engineers, call (860) 298-9925 or email [info@bloomy.com](mailto:info@bloomy.com).*

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