

# Building a Low-Cost Test System for Battery Manufacturer

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**The Challenge:** Integrating the functionality of numerous independent subsystems of a large-scale battery test system into a single, easy-to-use program (VI), while increasing the capabilities of the earlier system.

**The Solution:** Using a PXI-based system that incorporates National Instruments SCXI, FieldPoint™ I/O, and LabVIEW to develop an integrated test system with the capability to cycle test 1,280 batteries simultaneously.

## Introduction

Exide Industries, one of India's largest manufacturers of automotive and industrial batteries, wanted an automated system to cycle test its batteries during production. In the typical test, batteries connect to a charger in series, and they follow charge/discharge/rest cycles. Meanwhile, data loggers measure the terminal voltage of each battery at specified times to determine how well each battery stores charge. At the end of the test, batteries receive classifications based on these voltages. Because operators test up to 1,280 batteries simultaneously, the task was tedious and time-consuming to perform manually, with a high possibility of errors. Another limitation was the inability to alter the test cycle sequence because the programmable logic controller (PLC) was preprogrammed.

**Through a clever measurement system suggested by the National Instruments ATE (Switch) Group, we saved approximately \$28,000.**

## PXI-Based Automated System

We chose a PXI-based system because of the harsh environmental conditions – temperature and dust – in the factory. Using two fully loaded 12-slot SCXI chassis with SCXI-1127 multiplexer modules and a PXI-based DMM, we constructed a large-channel count measurement system. The batteries connected in series to the charger, so we did the voltage measurements in differential mode. Each SCXI-1127 multiplexer can accept 32 differential inputs, which means we normally

would have needed 40 SCXI-1127 modules. But, through a clever measurement system suggested by the National Instruments ATE (Switch) Group, we reduced the required number of modules to 24. The reduction saved approximately \$28,000 in the process and increased our competitive edge in our bid for this large project.

The wiring arrangement, shown here, describes how to make the voltage measurements by closing the switch. Using an external multiplexer (with relays), we read the voltage across two wires going to different SCXI-1127 multiplexer modules. We created a “virtual” channel in the process, thereby reducing the number of “real” channels used. The common mode voltage in the system could be as high as 300 V, which the SCXI-1127 modules and the PXI-based switch module NI 2565 can handle.

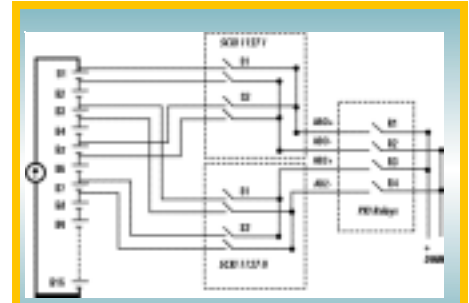
To control the four chargers, we used the NI FieldPoint distributed I/O system. We used relay control modules to switch the charger between charge/discharge mode. Additionally, we used digital input modules to sense for alarm conditions and analog output modules to set the value of the charging/discharging current.

## Flexibility in LabVIEW

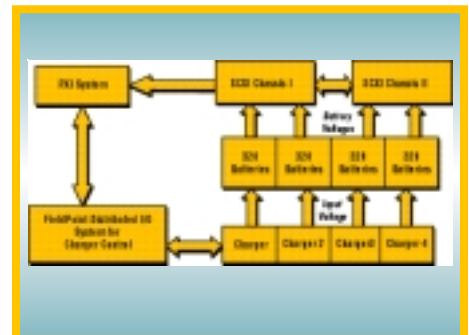
The software, written in LabVIEW, is highly modular, so we can expand the system easily. And, we can apply any test sequence to any charger, irrespective of the state of the other chargers. The test set-up screen for the test sequence offers complete flexibility in the test sequence and number of steps, as shown above. The main time saver was classifying the batteries by terminal voltages recorded at various times during the test. The VI-based system performed analysis in a matter of seconds and gave a printout of the classification (color-coded), eliminating tedious manual classification using the numerous printouts from stand-alone data loggers. These reports are also accessible using a Web browser over the factory network.

## Conclusion

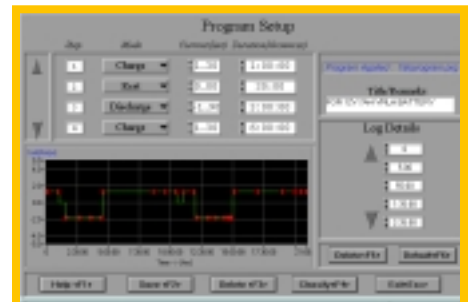
The VI-based system provided value to the



Make voltage measurements by closing the switch.



Schematic of the Effective Battery Test System



Test Set-Up Screen Offers Test Sequence Flexibility

customer by addressing all the shortcomings of the earlier stand-alone system. With LabVIEW, we integrated all the hardware pieces into the application effortlessly and developed a professional-looking application quickly, delighting our customer in the process. ▶

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