

Tensiometer Controller

By

Brandon Dineff
Engineer, Measurement & Automation
Data Science Automation
USA

And

Gregory C. Cala, Ph.D.
Vice President, Operations
Data Science Automaton
USA

And

Richard M. Brueggman
President and CEO
Data Science Automaton
USA

Category: R&D/Lab Automation

Products Used:

National Instruments LabVIEW 6.1
National Instruments GPIB interface
RS232 Serial interface
Daytronics
Instron Series 9 Controller
Transverse Extensimeters
Longitudinal Extensimeters

The Challenge

A leading metal alloy manufacturer uses tensiometer testing to validate alloy property consistencies across production facilities and for research purposes. The legacy system was FORTRAN-based, using a plotter. The drawbacks of this system are sensor limitations, lengthy configuration times, and cumbersome operational and management procedures. The logging, analysis and conversion from the load cell and extensimeters are tedious, manual procedures.

The Solution

Data Science Automation has developed a LabVIEW based solution to incorporate data acquisition, control, and sophisticated analysis that incorporate RS-232 and GPIB interfaces to Instron and Daytronic devices.

Abstract

The purpose of this solution is to increase efficiency by decreasing the setup time for each test, increase reliability in the results by reducing the chance for human error, and to incorporate a user interface that is easy to use.

User Interface

The LabVIEW tab control is a flexible and powerful user interface tool that permits the operator to sequentially execute the test procedures for the desired material. A load cell calibration file exists for all load cells and extensometers, and contain necessary data for configuring the device used for testing in the right manner. As seen in Figure 1 the user will select a load cell.

Figure 1 – Load Cell Select

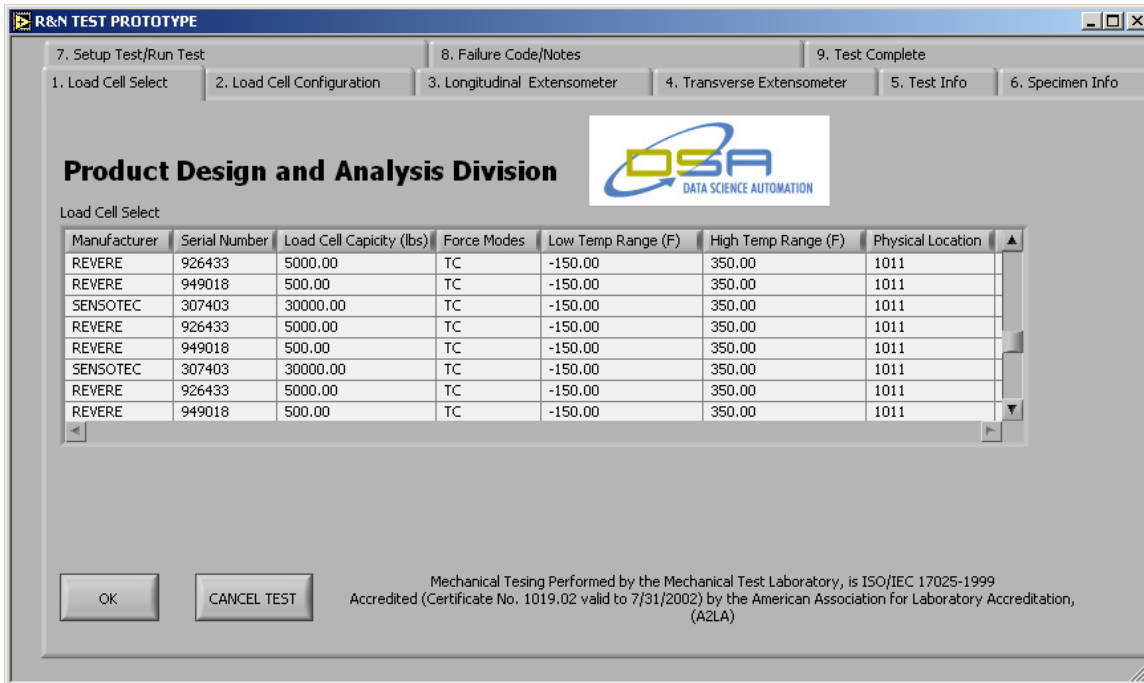
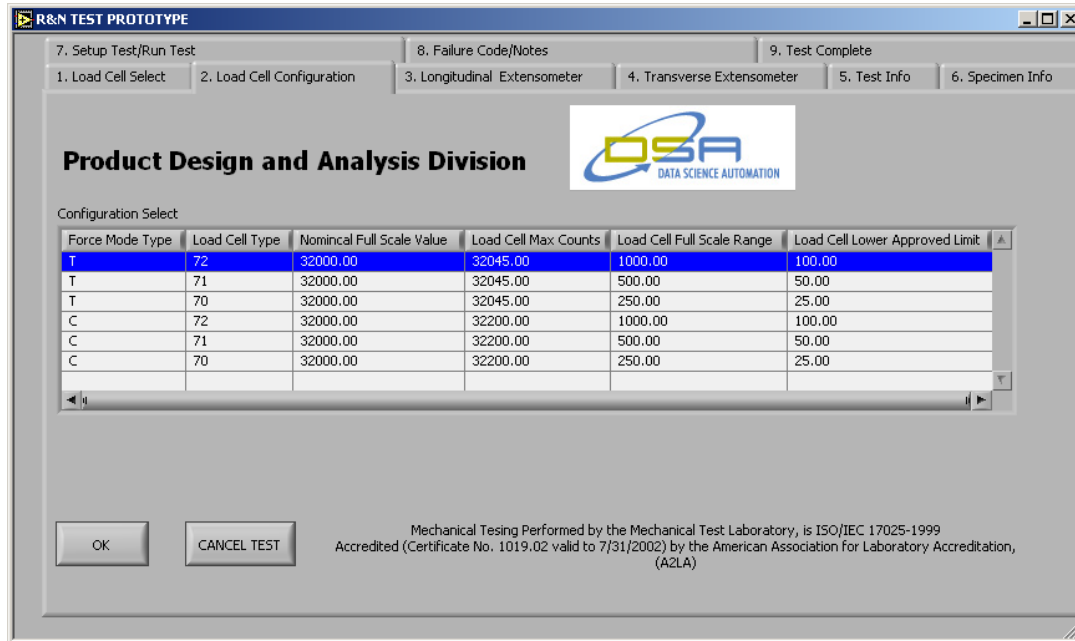
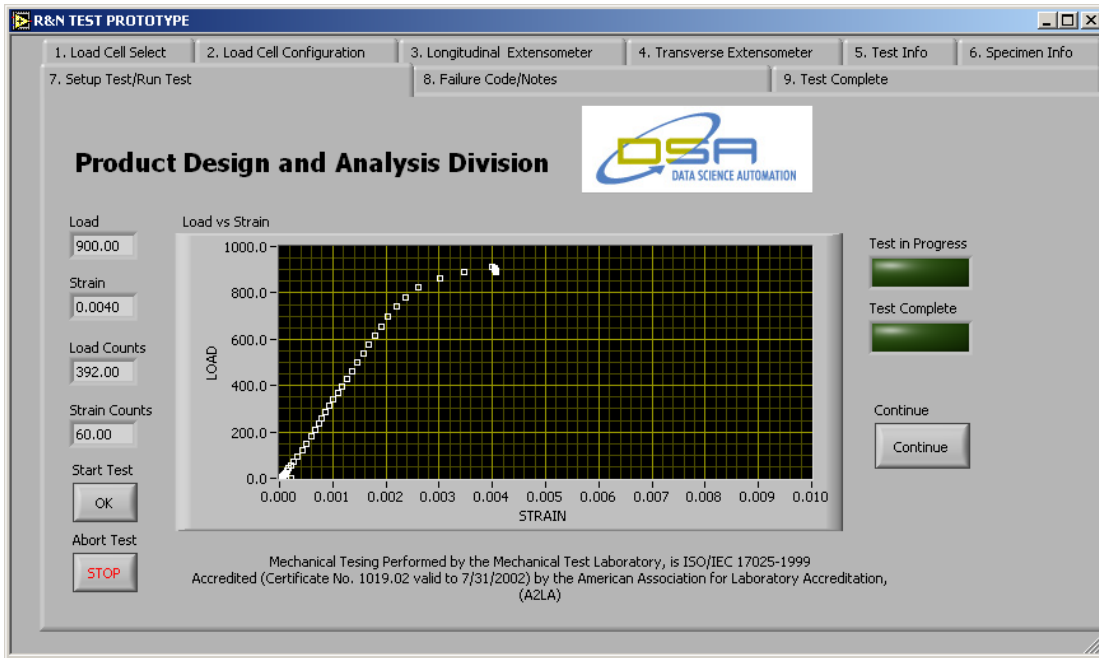


Figure 2 – Load Cell Calibration



The next process, shown in Figure 2, is to use the proper configuration for the load cell selected. This process is simplified to avoid erroneous data resulting from incorrect load cell configurations. This familiar and simple process is used for longitudinal and transverse extensometer selection, calibration and configuration, and a few other setup procedures. During test execution, data display is available as shown in Figure 3. Each test configuration/process can be stored and retrieved for subsequent use. This will greatly improved the efficiency of the testing process.

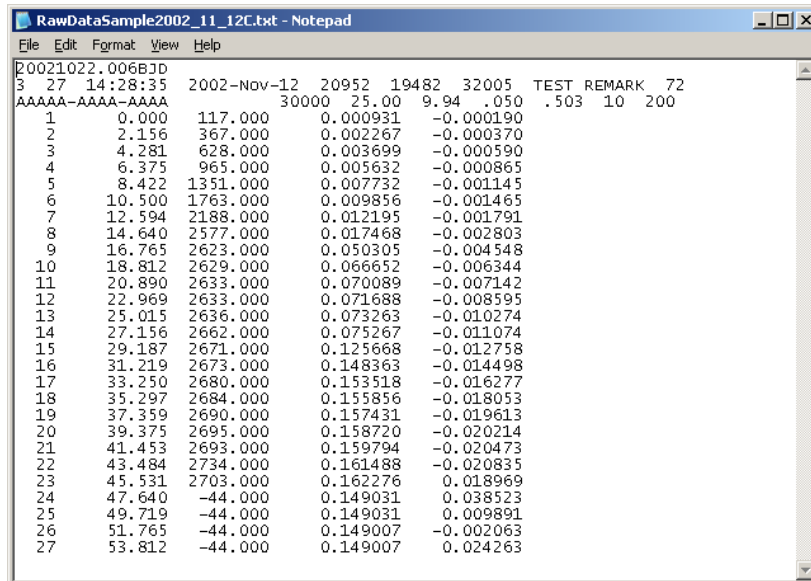
Figure 3 – Test Executed



Analysis Testing

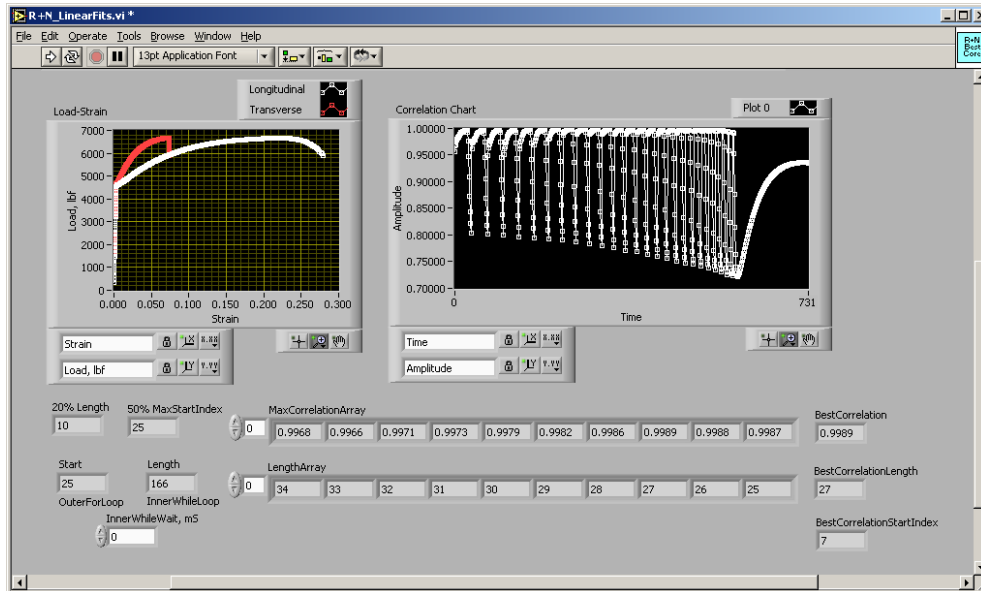
After each test, a raw data file (illustrated in Figure 4) is generated to display the values from all devices in the system. This data file contains data such as sample #, time of sample, load cell reading (lbs), and extensometer readings from a transverse and longitudinal device. The header of this file is all of the setup information for the test.

Figure 4 – Output File



Once a data file is created the analysis can be executed. In Figure 5 an example of analysis shows the relationship between load and strain over a period of time. ASTM standards and proprietary parametric analyses were applied to derive physical properties such as Young’s Modulus, Poisson’s ratio, yield point, ultimate strength, fracture point, stress, strain, strain rate, etc..

Figure 5 – Linear Fit Analysis



Conclusion

The versatile NI-based system has the necessary flexibility to supports both Instron and less expensive third-party sensors with equal ease, reducing their dependence on one sensor vendor.