LabVIEW Simplifies Automation of Igniter Testing and Sorting

by Peter Blume, President, Bloomy Controls, Inc., Brian Kochan, Equipment Design Manager, Saint-Gobain Igniter Products, Kevin Boette, Equipment Design Technician, Saint-Gobain Igniter Products, USA

The Challenge: Increasing measurement reliability and reducing high labor costs of manual testing and sorting of hot surface igniters.

The Solution: Using LabVIEW to automate the testing and sorting of hot surface igniters in a dusty, high electromagnetic production environment.

Saint-Gobain Igniter Products, a manufacturer of hot surface igniters commonly used for gas and diesel ignition, contracted Bloomy Controls, a National Instruments Select Integrator, to help create a new automated resistance test and sort machine. The company required a machine that provides accurate and repeatable resistance measurements; sorts multiple products that have distinct specifications within the same batch; reliably handles material; offers a user-friendly human-machine interface (HMI); performs at a high-volume throughput; and executes data analysis, data logging, and testing verification. Most importantly, the machine must perform reliably in a very dusty production environment that contains a large amount of electromagnetic interference.

Early Testing of Ceramic Materials
Saint-Gobain hot surface igniters contain advanced ceramic materials, mainly Silicon Carbide. Most gas ranges, including ovens and broilers, use the company’s 501 Range Igniter. It has a fixed resistance of 40 to 75 Ohms at room temperature. Once power is applied to the igniter, it dissipates heat and immediately begins decreasing in resistance as it increases in temperature. Ignition occurs at approximately 1,000 ºC for gas ranges, at which point the appliance’s controller removes power from the igniter.

Saint-Gobain must test its igniters in the early stages of manufacturing to determine electrical characteristics before it implements value-added manufacturing processes. Most frequently, these early evaluations include time to temperature and room temperature resistance tests.

An igniter’s time to temperature represents the time required for an igniter to reach its designed ignition temperature after “turn-down” power – 15 percent less power for which the igniter is designed – is applied. In general, the shorter the time to temperature, the faster the igniter lights gas.

Directly related to time to temperature is room temperature resistance (RTR), which is much simpler and faster to measure than time to temperature. The lower an igniter’s RTR, the larger the initial inrush current once power is applied, and the faster the igniter’s temperature increases and corresponding resistance decreases.

The Saint-Gobain igniter manufacturing process includes RTR testing and inspection of the igniters. Previously, Saint-Gobain performed this function manually, giving rise to three primary problems – ergonomic issues, measurement reliability, and high labor costs. Automation offered a desirable solution to these problems.

Instrument Integration with Motion Control
A Keithley Model 2000 multimeter performs 4-wire resistance measurements. We fully programmed the 6.5-digit multimeter using a controller connected via an RS-232 or IEEE-488 (GPIB) interface. In this configuration, the multimeter is capable of ±.050-Ohm overall measurement accuracy. To ensure repeatable positioning of the igniter underneath the measurement contacts, we designed a custom test fixture.

Using LabVIEW, we were able to develop the motion control, digital logic, timing and sequencing, as well as HMI using a single programming methodology.

Products Used: LabVIEW™ • PCI

Custom test fixture integrates NI data acquisition and motion control

Custom test fixture integrates NI data acquisition and motion control
A National Instruments PCI-7344 4-axis controller card that resides in a PCI slot in a Windows PC controls motion. We used thirty-five digital I/Os for a variety of purposes, including safety interlocks, proximity switches, and optical sensors. A NI PCI-6527 48-bit digital I/O board that resides in another PCI slot inside the PC monitors a wide variety of digital signals. These signals include npn-type transistors (npn are open collector transistors with n-, p-, and n-type semiconductor materials for the emitter, base, and collector, respectively); contact closure (relays); and transistor-transistor logic (TTL) digital signals with 0-Volt level for nominal low logic and 5-Volt level for nominal high logic. To protect the system from noise spikes, we optically isolated all I/O.

**LabVIEW Simplifies Software Development**

The controller must communicate with all subsystems, including the resistance meter, HMI, and motion control hardware. However, developing the HMI software typically involves techniques different from those used to program the PLC, which is normally accomplished using ladder logic. Also, while PLCs can perform motion control directly or by interfacing with an external motion controller, if performed directly, it requires substantial ladder logic programming. For example, a simple homing routine may require numerous lines of tedious ladder logic. If performed through an external motion controller, the routines may require fewer programming steps; however, we again must use a different development technique to program the motion controller than the PLC and HMI. Hence, three different programming languages could have been necessary to complete the application. Furthermore, all three languages would vary based on the choice of PLC make and model, motion controller, and HMI.

To solve this potentially vexing problem, we used National Instruments LabVIEW graphical programming environment. With LabVIEW, we created Virtual instruments (VIs) that run within the LabVIEW environment, or once compiled into executables or DLLs, execute on computers not containing LabVIEW. Using LabVIEW, we were able to develop the motion control, digital logic, timing and sequencing, as well as HMI using a single programming methodology. Furthermore, using a LabVIEW instrument driver for the Keithley multimeter, we also could control our multimeter with the same programming environment. Therefore, LabVIEW provided the best software platform for developing the entire application.

**Conclusion**

A capability study completed on the automated test equipment found the system much better than all previous methods of testing. The system not only exceeded the expectations of the manufacturing department, but labor reduction also exceeded expectations because the machine did not need a full-time operator.

For more information, contact:

Peter Blume
Bloomy Controls Inc.
839 Marshall Phelps Rd.
Windsor, CT 06095
Tel: (860) 298-9925
E-Mail: peter.blume@bloomy.com