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## A High-Volume Production Test System for LED Automotive Lighting

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### NI Product(s) Used:

CompactDAQ  
LabVIEW

### Category:

Automotive  
Structural and Physical Test and Monitoring

### The Challenge

Accomplishing large-scale automated testing of LED automotive lamp drivers.

### The Solution

Combine LabVIEW, NI CompactDAQ Ethernet-enabled hardware, custom electronics and test fixturing to create a robust, efficient, and automated system capable of testing batches of 46 driver units simultaneously.

### Introduction

Data Science Automation (DSA) is a premier National Instruments (NI) Alliance Partner that specializes in automating and educating the world leading companies. Clients choose DSA because of DSA's deep knowledge of National Instruments products, disciplined process of developing adaptive project solutions, staff of skilled Certified LabVIEW Architects and Certified Professional Instructors, and unique focus on empowerment through education and co-development.

### Background

A leading manufacturer of automotive lighting products needed to launch a new product line of LED headlamps and turn signal lamps, but did not have the proper test capacity or test equipment to ramp up production to match the anticipated customer orders. Missed production dates and backorders were imminent if product testing was not overhauled soon.

The lighting manufacturer chose Data Science Automation, an NI Alliance Partner, to provide a turn-key solution for production test beds due to DSA's reputation as a successful provider of automated test solutions and "adaptive" automation systems throughout North America. The manufacturer was also interested in an NI-based solution, as their previous small-scale testing had been done using PLCs and tag-based PLC software which was not as scalable as desired for their anticipated testing needs.

### Replacement of Existing Test Solution

The existing PLC-based test solution was a single-fixture tester that could only provide simple readings and switching capacity for the lamp electronics and logged very little data. In addition, it was unable to easily communicate with and send data to the customer's existing Aegis EDS system, which required test results submitted in a custom XML format. The need to ramp up the volume and speed of testing, combined with the inflexibility of the current test setup, caused the customer to seek a new enterprise test solution.

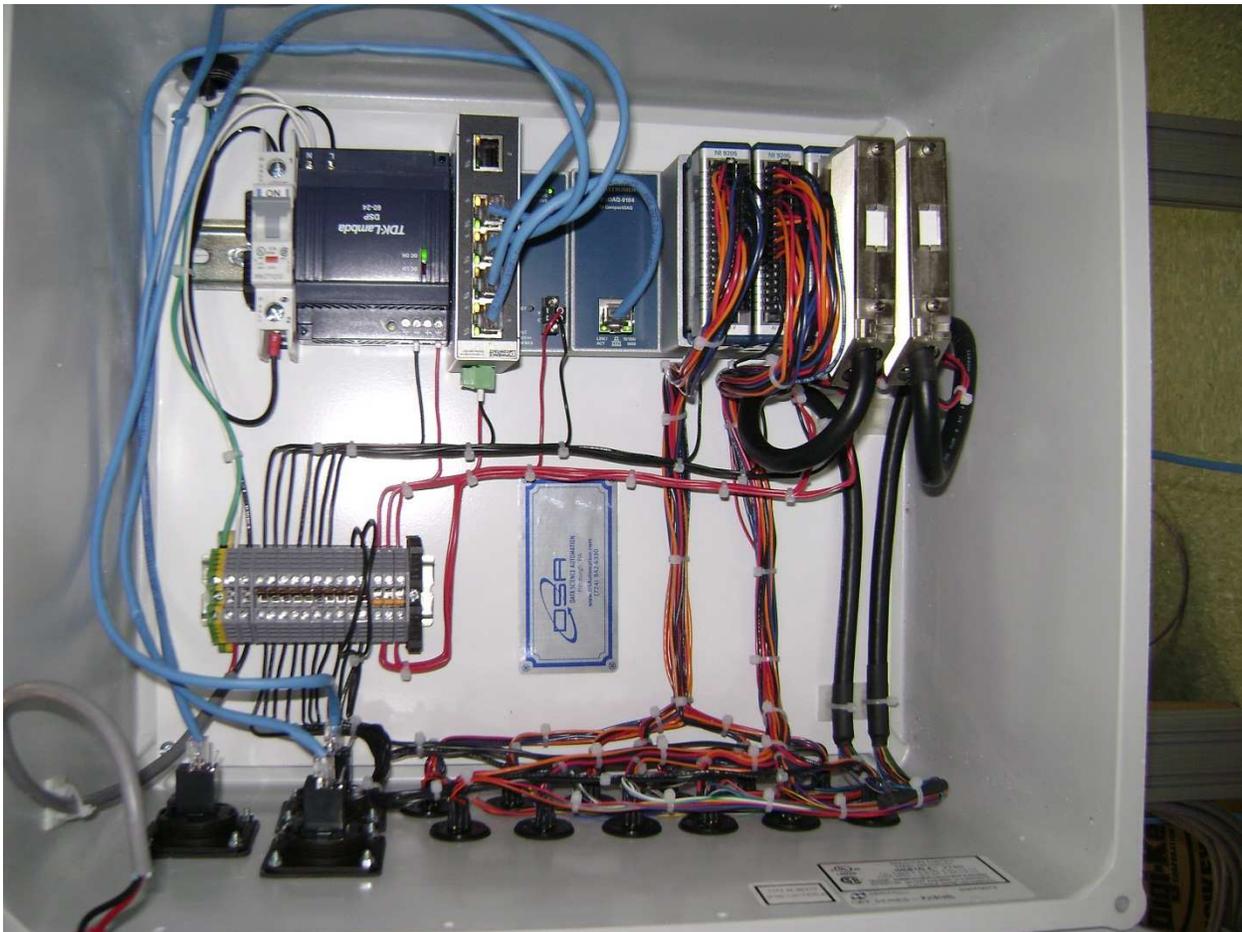
### Getting up to Speed on LabVIEW

In the past the manufacturer had used PLC solution providers and had little in-house knowledge of any automation software. The customer expressed the desire to use their own in-house engineering staff to maintain and make tweaks to the test system, but the lack of software knowledge got in the way. One reason DSA was chosen to provide the solution was DSA's promotion of "Adaptive Automation", where customers are encouraged to learn LabVIEW with the help of DSA's certified LabVIEW instructors and are empowered, when desired, to maintain their own system after the initial start-up.

While the test system was being developed by DSA engineering staff, the manufacturer sent their engineers to DSA's Certified NI Training Center to take LabVIEW Core 1 and 2 classes, and came up to speed on the world of LabVIEW programming. The graphical nature of LabVIEW made for quicker learning and less stressful introduction to maintaining the test system than they would have received with any other approach. In addition, the flexibility of LabVIEW allowed more advanced data logging capability and access to third party software communication than they had experienced with PLC solutions.

### **Building a Networkable Solution with CompactDAQ**

NI CompactDAQ (Figure 1) was chosen for its seamless LabVIEW integration, I/O flexibility and modularity within an Ethernet networked platform. Along with an Ethernet-enabled programmable power supply, the CompactDAQ networkability enabled each test bed to communicate with a host computer running LabVIEW using only an Ethernet switch. In addition, the host computers could network back to the corporate LAN to deposit data directly into the EDS servers, allowing the entire system to use a single unified communication architecture. This cut down on the complexity and maintenance costs of the test system significantly.



**Figure 1. Ethernet Compact DAQ**

### **Building the Test Floor**

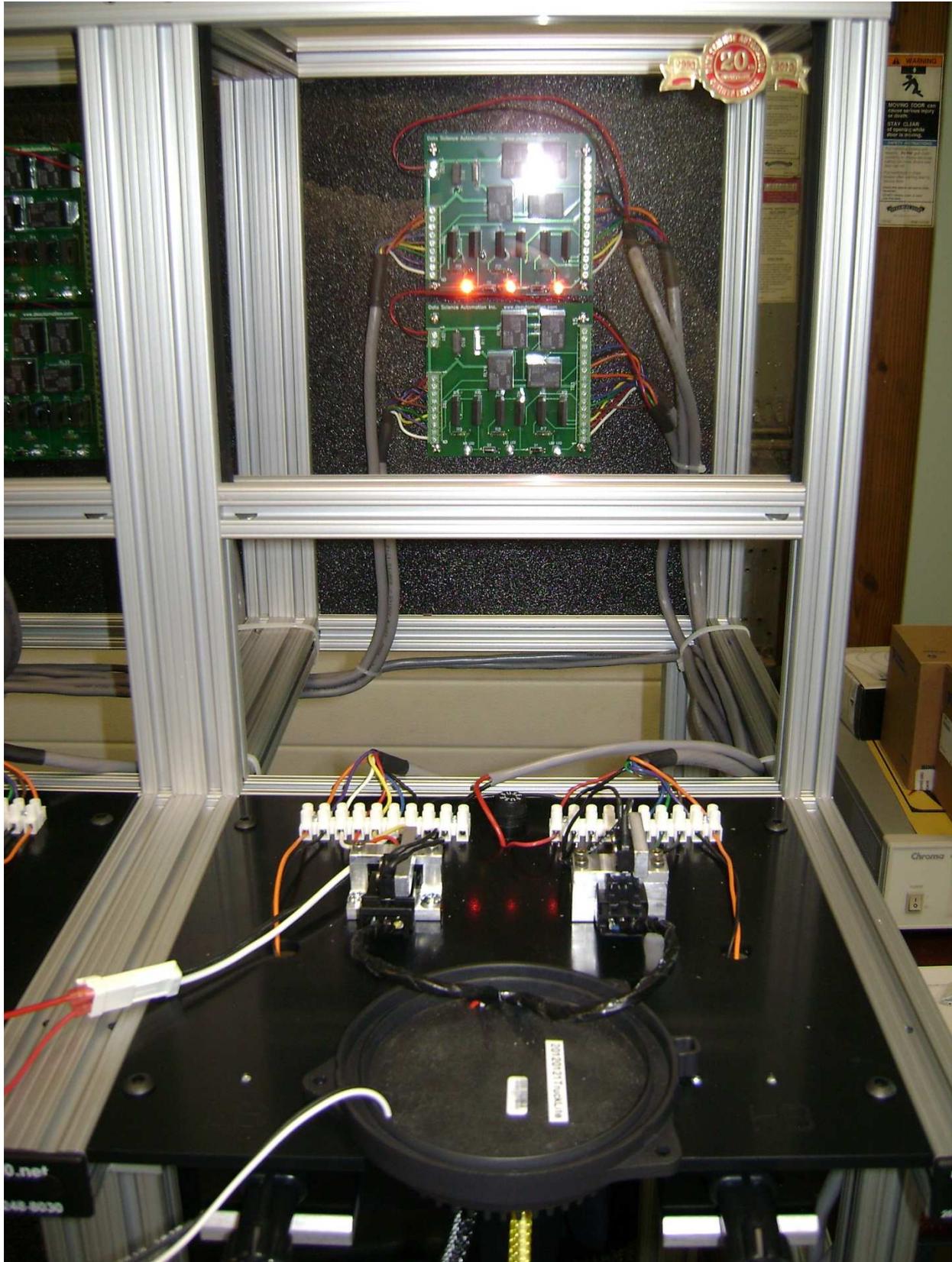
Testing of multiple units in parallel was a requirement to achieve enough throughput to meet production schedules, so four large "racks" of fixtures were created, three holding up to twelve test units and a fourth holding up to ten test units for a total of 46 total tests in parallel (Figure 2).



**Figure 2. Three of the Four Test Racks.**

Each rack contained programmable high-current power supplies for sourcing voltage to the test units, and an NI CompactDAQ chassis for making current measurements from all of the units at once and switching power via relays where necessary. DSA also provided a custom-designed loading and switching circuit that interfaced between the power supply, CompactDAQ chassis, and test units.

Custom-machined test fixtures (Figure 3), also provided by DSA, allowed each test unit to be placed securely on the cart and be powered with keyed connectors to ensure correct hookup. Because powering the LED drivers without a load can damage the drivers, a micro-switch on each connector was implemented to prevent power from being applied by the software unless the load side of the unit under test was connected.



**Figure 3. Custom Test Fixture**

The four test racks were set up to be portable, so that they could be moved around on the test floor and be relocated easily. Each rack had a single computer attached to it as a control and display device for the test cart, running the LabVIEW-based test software created by DSA.

Detailed test results for each unit were saved to TDMS measurement files, and basic test summaries for each unit were directly uploaded through a LAN to the manufacturer's AEGIS EDS server for direct integration into the existing enterprise-wide production tracking system.

### From Bench Test to Production Test

After an initial deployment on-site, the test carts were put into action with batches of test units, and the manufacturer was able to test the units immediately as they went through production, something that would have been impossible with the original bench tester based on a small PLC.

Because of the flexibility of the Compact DAQ chassis architecture and the DSA software provided (Figure 4), modifications could be made to the test system to include additional measurements for upgraded lamp driver products without moving to a new measurement platform or modifying the software architecture. DSA's concentration on "adaptive automation" and NI's commitment to flexible hardware solutions left this automotive supplier with not just a test system, but an automated testing solution for high-volume LED electronics testing.

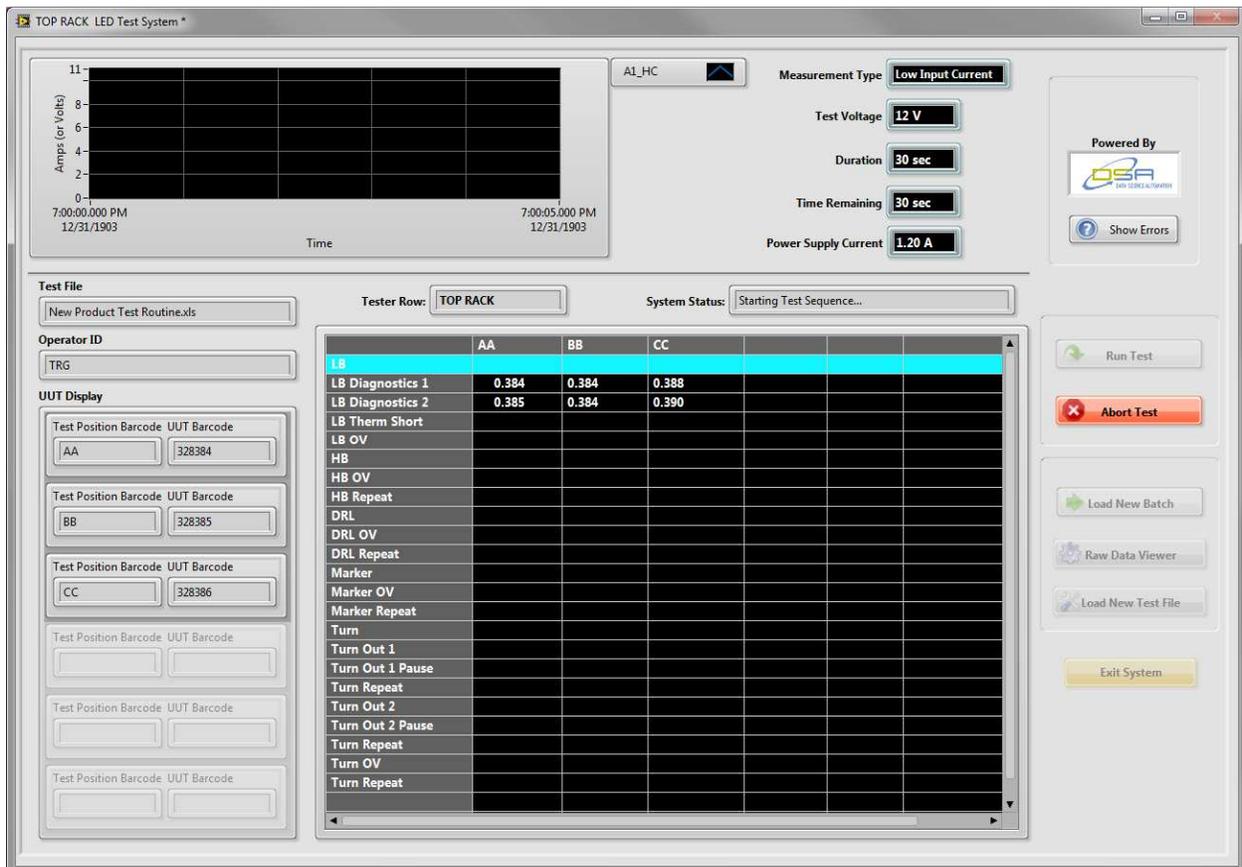


Figure 4. Main User Interface for the Automated Test Solution

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