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## Keep Those Canisters Moving! Automation of Military Respirator Tests

### Author(s)

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### NI Product(s) Used

LabVIEW  
LabVIEW DSC  
NI OPC Server

### Industry

Aerospace and Defense

### Application Area

Factory Production

### The Challenge

Monitor and record data from an assembly line by interfacing with existing PLCs.

### The Solution

Using NI OPC Server to interface with the customer's existing PLCs we were able to deploy an application to record data from each station in their assembly line. LabVIEW's ability to integrate with both the OPC Server and 3<sup>rd</sup> party serial devices accelerated development and provided a stable solution.

### Introduction

For 25 years, Data Science Automation® (DSA) has been a premier automation systems integrator, leveraging commercial off-the-shelf tools in the design and implementation of custom-engineered, complete, and highly-adaptive solutions in laboratory automation, embedded/new product development, manufacturing and test automation. The company provides an extensive array of automation engineering, programming, consulting & training services to dramatically improve research, manufacturing, government & business operations. DSA is fast and methodical, staffed with exceptional, multi-disciplinary, NI Certified professionals that consistently apply CSIA-certified best practices to deliver the lowest total cost of ownership.

Our customer had an existing assembly line that produced respirator filter canisters. This assembly line performed product testing as part of their assembly process. Prior to our involvement, the customer would manually record data from three stations on their assembly line: two identical measurement stations, a serial number printing station, and a weigh station. This process was time consuming as the rest of the line could be run at relatively high speed (a new unit every 5 seconds or so) but they had a bottle neck at these three stations, it would take 5 employees over 30 seconds per unit to manually run product through these three stations while recording all of the necessary data. The customer wanted to improve product throughput, reduce staffing needs, and increase the accuracy of the data recorded.

The customer wanted to implement a monitoring solution that was totally passive and could be turned off for trial runs and would not interfere with their normal operations. They also did not want our system to interfere with their existing logic that load balanced between the two measurement stations. As such, they wanted all monitoring to be done with minimal changes to their current system software and hardware.

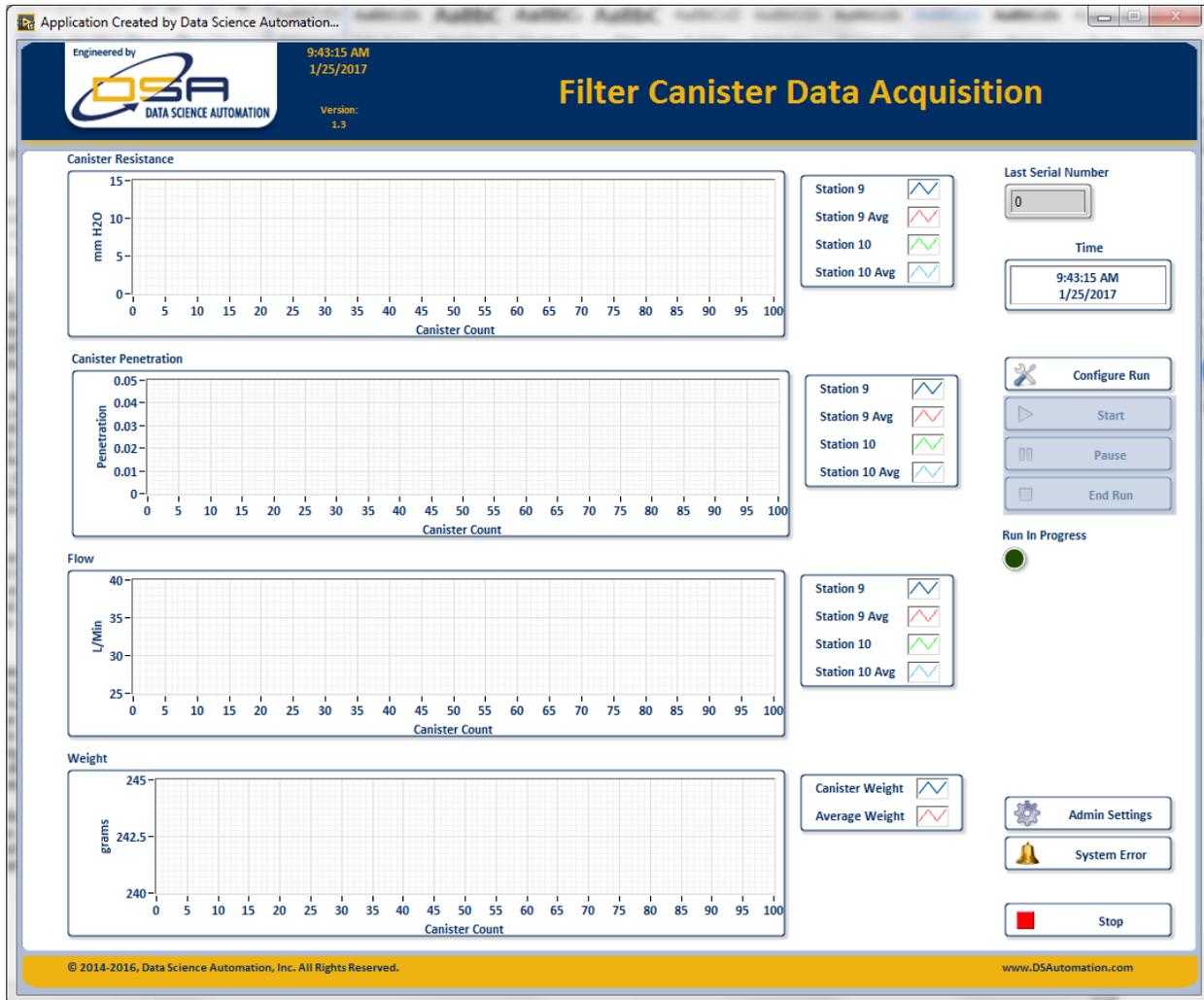


Figure 1: Front Panel

### Choosing Hardware Interfaces

To achieve a passive monitoring solution we first needed a way to keep track of canisters as they traveled down the assembly line. Previously, the customer had used barcode scanners at each station to keep track of the pallets that carried the canisters through their system. The customer liked this approach as they had used it in the past and it presented a minimal modification to their system. To monitor the data that was being collected at station, we decided to use NI OPC Server to interface with their existing PLCs. This allowed us to passively monitor and collect all of the data from their PLCs without any change to their existing hardware or software.

In addition to the PLCs controlling each station, and the barcode scanners that would be placed at each station, the serial number printer and the weigh station had an Ethernet interface that could be used to monitor the data at each station. All of this monitoring would need to be done in a coordinated manner with all data points collected for a single canister across all stations then being logged to a single file. This file would need to be in the Excel format as they wanted the data to be presented in an existing template format.

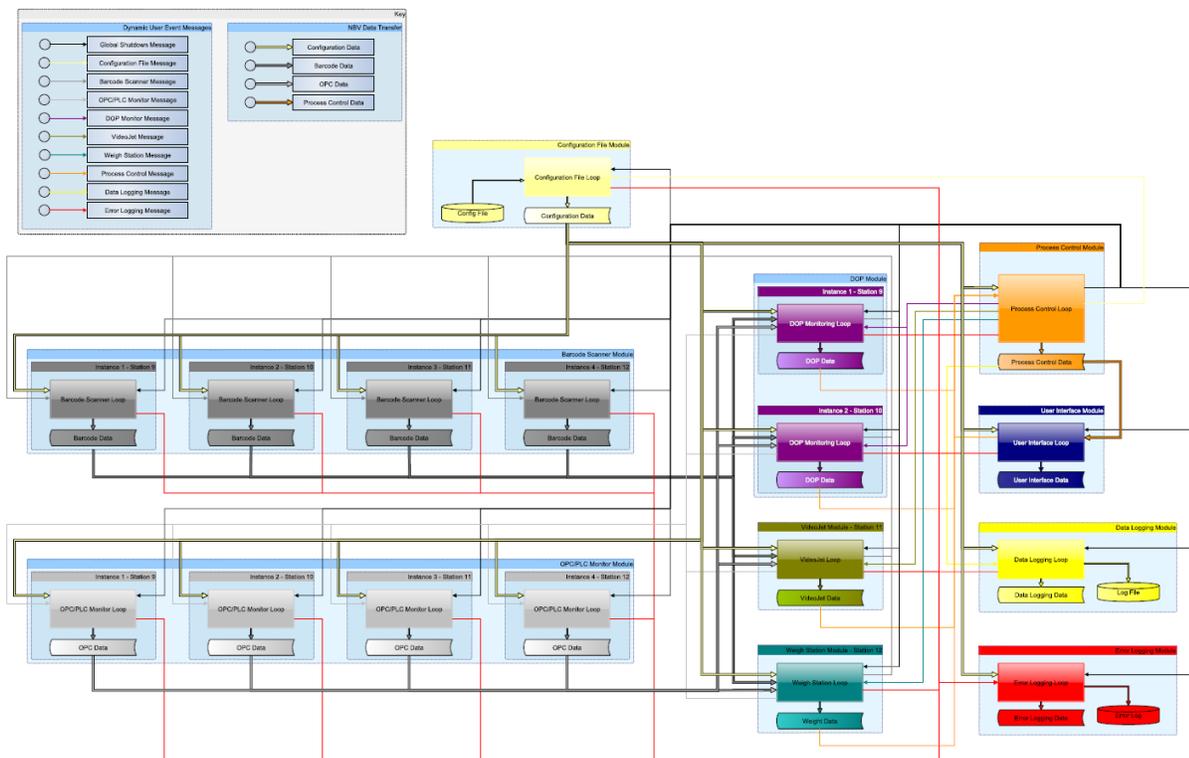
### A Modular Reentrant Approach

To fully leverage one of the benefits of LabVIEW to accelerate development and testing time we chose a reentrant modular approach. We decided to break each portion of the code into a separate module. Each station had its own monitoring

module as well as modules for data logging, process control, configuration loading, displaying the user interface, and error logging. The station modules also had child modules for monitoring the barcode scanners and OPC server. Because each of the four stations monitored the barcodes and the OPC server in the same way, we were able to create a single module that could be used as many times as necessary re-entrantly. This greatly reduced the need for custom code for each station.

Each station had its own module (we again leveraged reentrancy to use two instances of the same module for the two measurement stations) and communicated to its reentrant copies of the barcode and OPC monitoring modules via custom user events. The barcode and OPC monitoring modules published data publicly via a custom non-blocking functional global variable equivalent.

In the same way the communication worked between station modules and the barcode/OPC modules, the rest of the modules communicated in the same way. As a station module collected data, it sent it as a message (via user events) to the process control module. The process control module handled combining the data from each station for a canister into a single data packet which was then sent to the data logging module to be logged to file.



**Figure 1: Inter-module Communication Diagram**

As each module used the same structure, responded to messages sent via user events, and published data via a non-blocking variable, we were able to again leverage LabVIEW to create base module library that could then be copied and extended for each module. This accelerated our development time as the only code that had to be created for each new module was the code specific to that modules functionality. Individual developers did not need to worry about the overall system architecture or inter module communication as that was already put in place for them. Additionally, we were able to build a Test VI into the based module library so each module that was developed could be tested individually apart from the whole application. These individual test VIs proved to be invaluable during deployment debugging.



**Conclusion**

Leveraging the modularity provided by LabVIEW we were able to quickly deploy an extremely complex data logging system in a short period of time. The ability of LabVIEW to interface with not only serial devices (barcode scanners), but Ethernet, and OPC devices allowed this project to be a success.

**Contact Information**

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