

Analyzing and Improving a Control System using Spreadsheet Express

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The Challenge:

Analyze and compare hundreds of collected datasets captured in 3rd party software within Microsoft Excel in order to quantify and present the improvements made to a medical device's fluid pressure control algorithm.

The Solution:

Using Aledyne's Spreadsheet Express Toolkit for LabVIEW, Excel charts can be created programmatically within a very short time so that results can be realized and presented.

Aledyne Engineering, Inc. is a leading embedded systems provider using National Instruments LabVIEW software and modular instruments, which enrich user experience and are configured to meet the unique needs of every client. Each solution is developed and refined with the end user in mind, delivering time savings and a tailored user experience.

A prominent medical device designer and manufacturer selected NI Alliance Partner, Aledyne Engineering, to optimize the performance of one of its fluid management systems prior to market launch. Although the system does not use LabVIEW within the product, Aledyne was selected because it has expertise in embedded systems, medical devices, and LabVIEW and thus could provide a complete solution from making improvements to their products to developing unique LabVIEW based tests systems and solutions for data analysis.

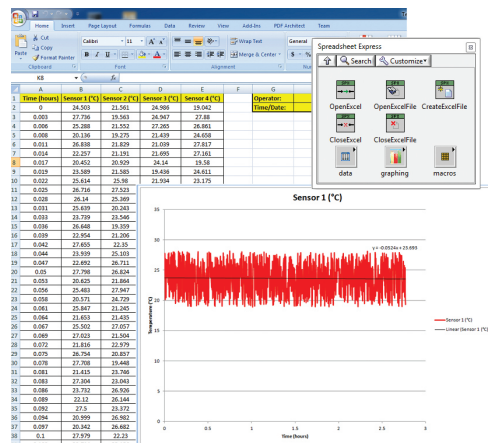
The medical device is designed for removal of tissue with continuous fluid flow and pressure control in a patient's body. It must directly control pressure to overcome the body's blood pressure during an operation to provide adequate visualization for the doctor performing the procedure. To achieve optimal pressure control and visualization, two independent pumps must be controlled in complete synchronization to maintain pressure while clearing the visual field of debris.

One of the main challenges faced by Aledyne was to improve the performance of the overall control system algorithm that regulates pressure via fluid flow. As design changes were made to the pressure control algorithm in the embedded real-time software, the pressure that the device was measuring along with the control signals had to be continuously measured and analyzed. The only way to extract the measured pressure and control data from the device was to use a proprietary software application over a physical interface to log the data to a csv file.

It was a requirement that the data be compared and analyzed in Excel for presentation purposes, and since several hundreds of operation modes had to be analyzed, graphing the data manually would be too tedious and time consuming. Instead of developing a separate LabVIEW application to capture and log data from the device, Aledyne made use of the existing test methods and turned to the Spreadsheet Express toolkit. In less than an hour, this provided an automated means of creating Excel charts from the generated csv files to graph and compare the data as iterations of software changes were executed. This allowed focus to be placed on the embedded software rather than the test setup used to capture and analyze data.

Spreadsheet Express – Aledyne Engineering

Automate Excel Data Processing and Charting From NI LabVIEW



- Programmatically graph data already in an Excel spreadsheet or delimited file
- Advanced automation of graphing features such as trendlines and macros
- Easy-to-use macro and Excel template interface
- Examples show batch processing of Excel files
- Output formatted results to same Excel file or create a new file

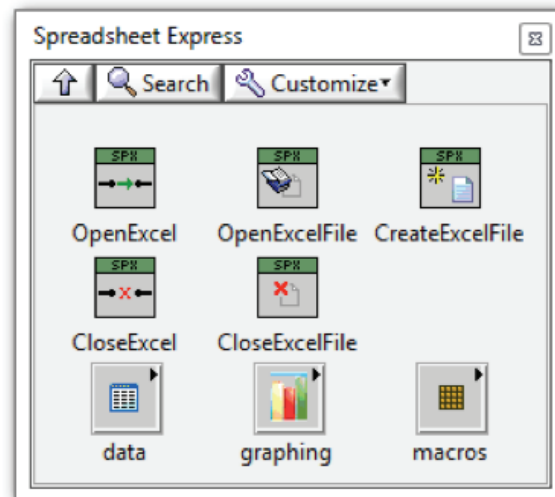


Figure 1 – Spreadsheet Express toolkit

Aledyne engineering

As changes were made to the pressure control algorithm to improve the damping of the control system, each test case was run and data was collected using the existing test methods. Then a simple LabVIEW application using the Spreadsheet Express toolkit extracted the data from each csv file and created an Excel chart overlaying the original control system response (in blue) with the improved control system response (in red). For each change made the data was instantly analyzed by auto-generating comparative Excel charts for each test case that was run.

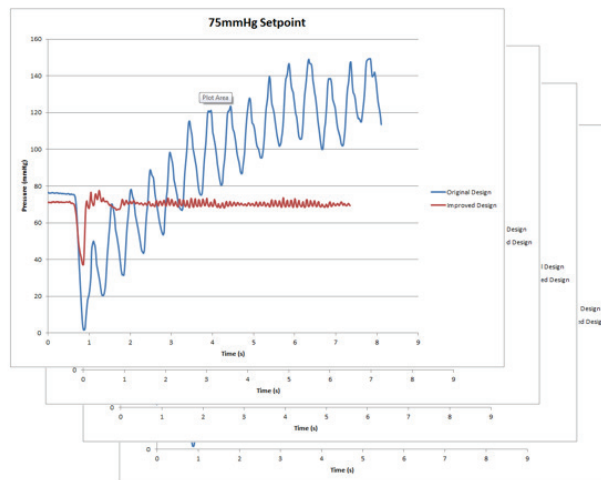
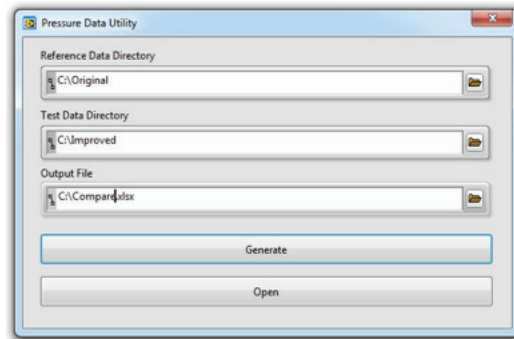


Figure 2 – LabVIEW Application using Spreadsheet Express

Overall, Spreadsheet Express helped create comparative reports in Excel quickly to evaluate design changes as they were made to a medical device without having to modify current test systems that were already in place. Existing data collection systems could be maintained and Spreadsheet Express was critical to enhancing the representation of the data for engineering and presentation purposes while providing speed and efficiency to the product developers.