

LabVIEW Creates a High-Throughput Liquid Handling System

National Instruments Article

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The Challenge: Developing a high-throughput liquid handling system that applies sample solutions to 20 microscope slides at a rate of one slide per second.

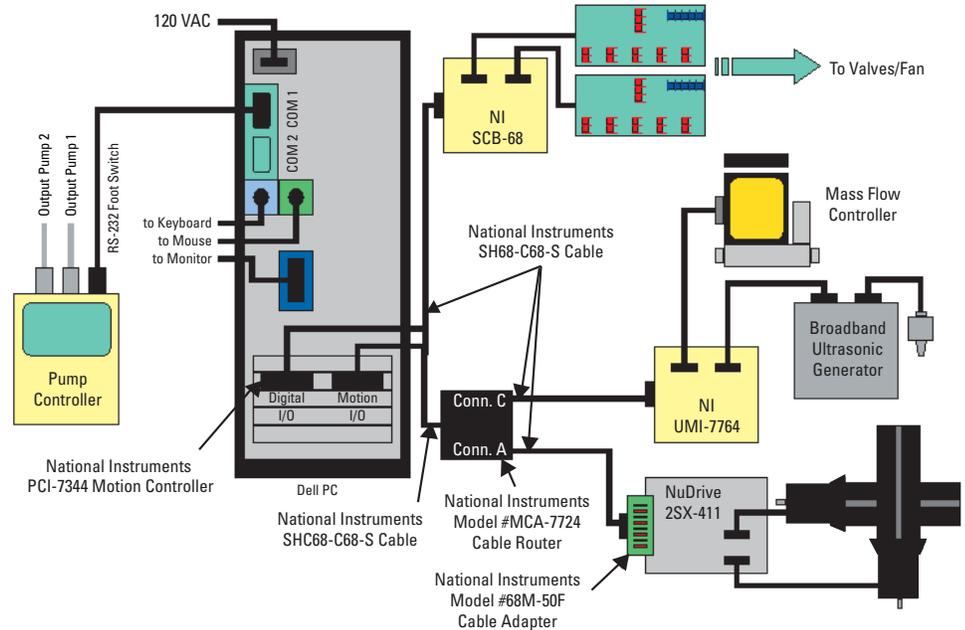
The Solution: Creating a flexible, PC-based slide coating system using a National Instruments PCI-7344 motion control board and an NI NuDrive 2SX-411 motor drive to handle X-Y motion as well as system digital and analog output, NI-VISA drivers to interact with third-party serial equipment, and LabVIEW 6.0.2 to create reliable, intuitive, and modular control software.

Improving Cost and Speed

Proteomics technology plays a vital role in biomedical diagnosis and therapy – a role forecast to grow significantly in coming years. Despite a flurry of development, there exists a major need for a rapid and low-cost means of measuring the activity of enzymes. Enzymes are the proteins on which most drugs are designed to act and the clinical markers of much disease. Our company, Morewood Molecular Sciences, Inc., has developed a novel means of examining enzyme activity, improving on the speed and cost of existing methods.

At the heart of Morewood's breakthrough technology sits a unique and cost-effective liquid handling system that applies sample solutions to microscope slides. To prototype this liquid handling system, we approached a company called Data Science Automation to develop a fully automated and integrated solution meeting the following requirements:

- Low-cost, fully documented solution incorporating current technologies and off-the-shelf components
- System throughput of up to twenty slides at a rate of one slide per second



Solution Schematic

- Serial control of a third-party pump controller controlling multiple syringe pumps
- Control of a third-party spray nozzle and a third-party gas flow control valve via analog output
- Control of multiple multi-port valves and a fan via digital output
- Coordinated control of the motion of an X-Y stage
- Professional-looking, intuitive sequence editing and execution software, allowing an operator to create, save, and run a variety of different sequences, as well as monitor their execution time and log their results

solution to a spray nozzle (valve control), engaging the nozzle (nozzle control), engaging gas flow (gas flow valve control); then moving the slides to be coated in a zigzag pattern underneath the nozzle (motion control). We had to define in a sequence the type, rate, and volume of the solution used, as well as the order of events.

We accomplished controlled motion of the X-Y stages quickly and easily using well-integrated motion tools from National Instruments. We selected, easily configured, and tested the NI PCI-7344 motion controller using NI Measurement & Automation Explorer (MAX) version 2.1.

Because of the large motors used on the project, we needed a high-powered motor drive, so we chose National Instruments NuDrive 2SX-411

two-axis motor drive, and the 68M-50F bulkhead cable adapter, for easy connectivity. We then created motion configuration and execution virtual instruments in LabVIEW using NI FlexMotion version 5.1.

The FlexMotion software made access of each analog and digital output a simple and reliable operation, reducing overall development time and cost.

Controlled Motion

The basic operation of the system defined by Morewood included withdrawing an operator-specified solution into a syringe pump (pump and valve control), directing the flow of

