Behlen Industries Chooses LabVIEW Real-Time for Deterministic Networked Machine Control

by Greg Harasym, Systems Engineer, Advanced Measurements, Inc.

The Challenge: Replacing a 25-year-old, obsolete production line digital controller and updating production line components to reliably connect to a network and provide next generation user interface.

The Solution: Using a PC-based control system with software developed on LabVIEW Real-Time for rapid development, simple integration, and lower project cost.

Introduction

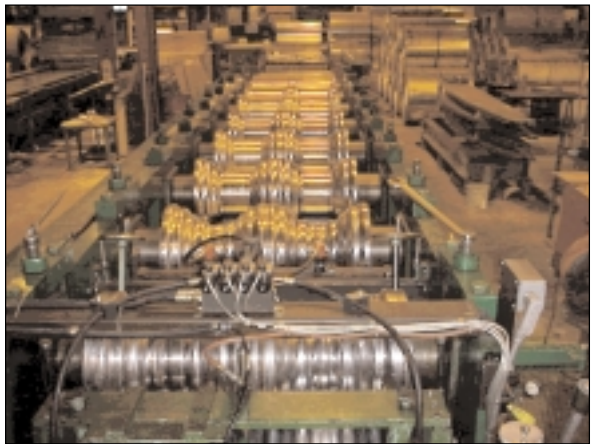
Behlen Industries, a manufacturer of self-supporting sheet metal buildings, wanted to replace a 25-year-old control system on their production line with a PC-based control system. The line produces building panels from flat sheet steel by corrugating the sheet through a series of die rollers, punching bolt holes in it, and cutting the formed sheet to length. The old system used two hydraulic punches to punch bolt holes in the panels, and then a hydraulic "flying" shear for cutting to length. This system had lost some of its functionality and had an antiquated operator interface. We replaced this old system with a new control system that uses a National Instruments PCI-7030/6040E real-time board and custom software developed with LabVIEW Real-Time.

Controlling Hole Punch Timing and Shearing

The Behlen Industries production line had several key quality requirements, such as keeping bolt hole locations and panel lengths within a tolerance of 1/16 in. We had to maintain these tolerances with the mill running at a speed of 8 in./s and while starting and stopping. Hydraulic punches were activated by a solenoid for 200 ms, so the punch could pass through 12 gauge sheet steel, and the interval between hole punches could be as little as 250 ms. When a panel reached the desired length, the LabVIEW Real-Time application executed the shear process (including acceleration, shear, and deceleration) in less than 1 s.

Deterministic Control and Parallel Process

The quadrature encoder provided displacement information that told the system when to punch bolt holes and shear panels. The encoder generated 1,000 pulses per revolution, approximately 64 pulses per inch of sheet, or 2 ms interval. To meet the customer's tolerances, the LabVIEW Real-Time engine provided a deterministic control loop of 2 ms or less. The punch and shear controls had to operate simultaneously and independently, and so we programmed them to run as parallel processes. Using LabVIEW Real-Time to develop the control software greatly facilitated the programming and troubleshooting of the parallel processes.



Flat sheet steel is corrugated through a series of die rollers.

The networked control solution using LabVIEW Real-Time easily accommodated parallel control processes and made possible a 2 ms deterministic control loop.

Simple Operator Interface and Networking

Using LabVIEW Real-Time, we developed a powerful operator interface for fast and intuitive operation and control of the system. The operator interface, running on the host PC, takes production orders from the factory's networked database or the user through a job configuration screen. With the interface, the user can perform calibration of the control system, monitor production runs, and modify control parameters. With LabVIEW Real-Time, rapid integration with other plant computer database systems was also possible. Database tools and networking capabilities were essential in the control system's effective communication with other plant systems, linking the engineering drawings database, work order database, and production reporting database.

Using LabVIEW Real-Time, we developed a powerful operator interface, and rapid integration with other plant computer database systems was possible.

New Networked Control Solution

The PC-based solution using LabVIEW Real-Time made possible a 2 ms deterministic control loop, while easily accommodating parallel control processes. The programming flexibility of LabVIEW Real-Time helped us create a completely new high-speed control system, meeting all customer requirements, within a two-month time frame and giving us a networked next generation user interface.

For more information, contact Greg Harasym, Advanced Measurements Inc., 6205 10th Street SE, Calgary, AB, T2H 2Z9 Canada, tel (403) 571-7273 ext. 227, fax (403) 571-7279, e-mail greg.h@advmeas.com, Web advmeas.com