Implementing Data Historian Functionality with LabVIEW

by T. J. McGivney, Union Carbide Corporation and L. A. Drake, Process Automation Corporation

The Challenge: Monitoring, displaying, recording, and reporting data previously plotted on a multipen Chessell strip-chart recorder.

The Solution: Developing a LabVIEW-based SCADA system that uses the NI Modbus server to acquire data from the recorder serial port.

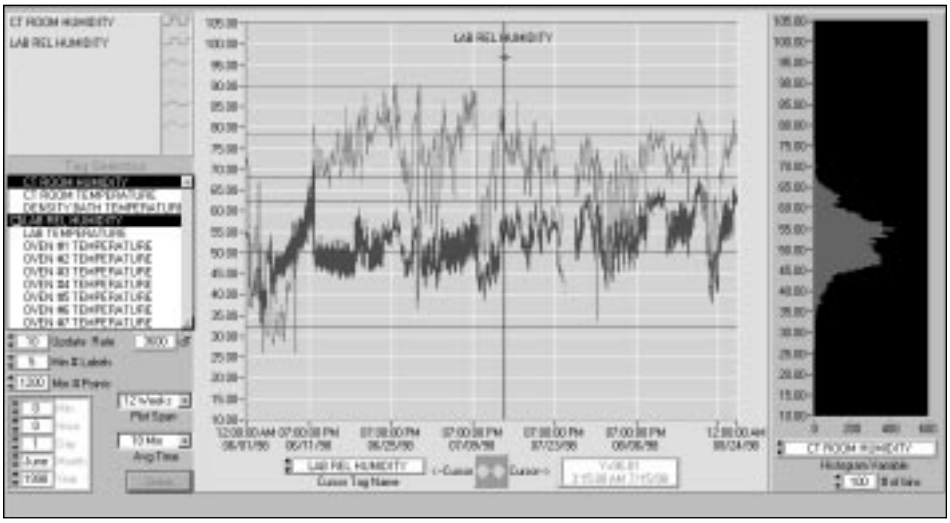
Introduction

Union Carbide Corporation identified the need to improve a critical temperature and relative humidity (RH) monitoring system in a production QA Lab at the Bound Brook, NJ plant during September 1997. The existing system consisted of a Eurotherm Chessell paper strip-chart recorder, which received the data from RTD probes in several ovens, a density column bath, and room air temperature and RH sensors and plotted it with a three-color ink cartridge.

Paper jams, which had become a regular occurrence because of variations in paper consistency and the age of the Chessell instrument, made it difficult to monitor the inputs without interruption and loss of data.

We purchased the National Instruments Modicon Modbus RTU industrial automation (IA) server software for communicating with the serial port link to the Chessell recorder so that all the sensor data was available to LabVIEW.

When a critical variable went out of tolerance, a significant amount of time could pass before an operator discovered and corrected the error. Then the operator had to conduct an investigation and write a lengthy corrective-action report. Archiving the paper also presented a problem because the ink faded over time; the archived charts were difficult or impossible to read. Of course, operators could never extract data off the strip-chart recorder to plot on a computer or incorporate in printed reports.



Relative Humidity Plots

System Overview

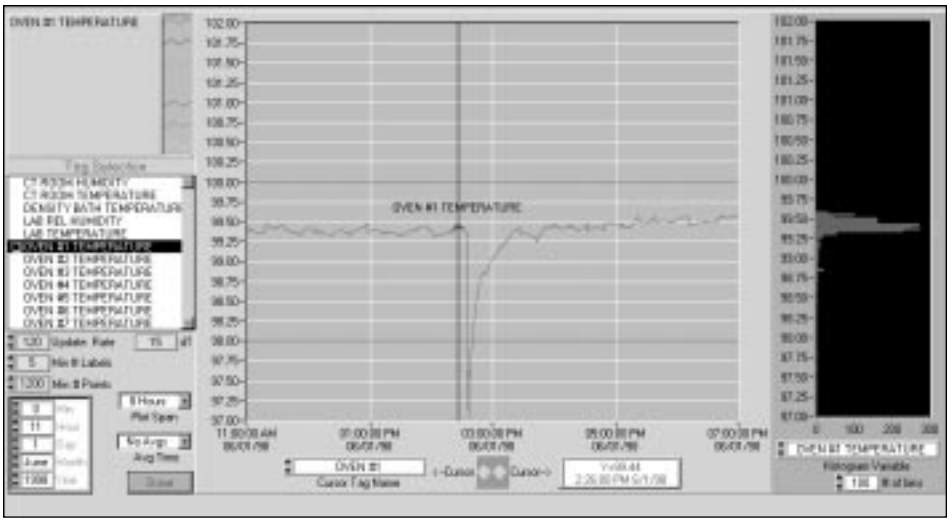
Union Carbide hired Process Automation to replace the data presentation functions of the strip-chart recorder with a PC-based SCADA system using LabVIEW from National Instruments. Goals for the new system were to:

- Bypass the paper charting system
- Reduce the number of corrective action reports through improved monitoring
- Make the storage and retrieval of data an easier task

To achieve these objectives, we decided to continue to use the Chessell chart recorder (which had a built-in Modbus serial port) as the sensor conditioning and digitizing component of the system. We purchased the National Instruments Modicon Modbus RTU industrial automation (IA) server software for communicating with the serial port link to the Chessell recorder so that all the sensor data was available to LabVIEW. We installed LabVIEW on a 100 MHz, 16 MB, 2.0 GB desktop PC in the laboratory and adapted Process Automation Corporation's SCADA Tool Kit for LabVIEW to perform the following tasks:

- Data retrieval from the IA server into its real-time database
- Alarm monitoring and reporting
- Automatic data/time spreadsheet report generation
- Historical data compression and archiving
- Data trend plotting and printing

The operator can select several variables, either individually or in groups, for viewing in a multicolor graphical trend plot. The greatest benefit comes from the ability to view one or more data trends – in spans from minutes up to one year – on screen in a clear and concise manner. The system captures out-of-tolerance readings and stores them in a separate alarm table that the system can import to Excel or Word. In addition, the operator can automatically generate a tabular report covering a user-defined time span for all or some of the variables as necessary. The operator can archive data either within the program or by using the Windows file manager. The system automatically compresses data into 24-hour files (indexed by date) and archives the data in directories named after the variable. The SCADA Tool Kit can retrieve the



Oven Temperature Plot

Because of the ease of development and the flexibility of LabVIEW, along with the "jump start" provided by the SCADA Tool Kit, we implemented the new system in only eight days.

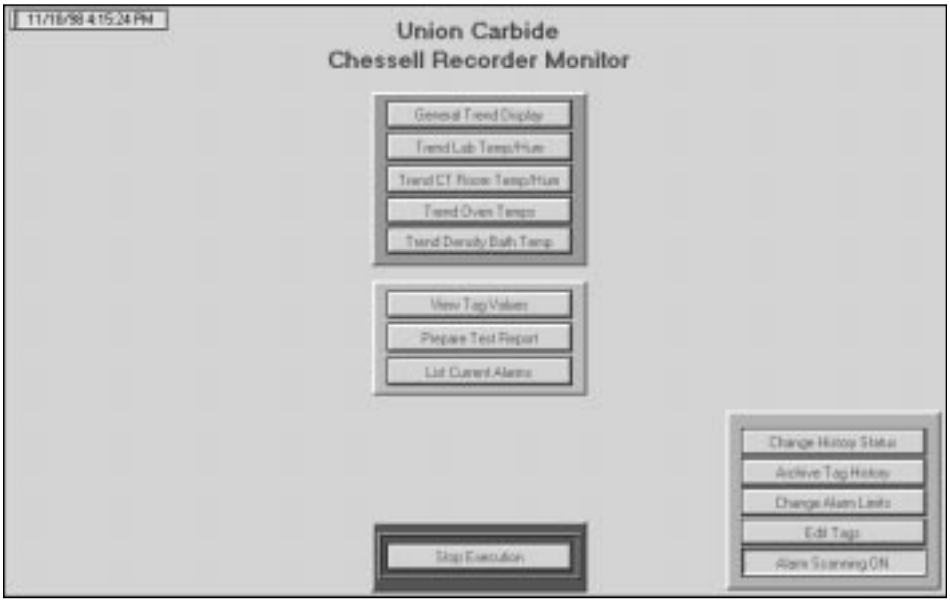
For more information, contact L. A. Drake, Process Automation Corporation, 36 Sleepy Hollow Lane, Belle Mead, NJ 08502, tel (908) 359-1011, fax (908) 359-1599, e-mail sales@processauto.com, www.processauto.com

compressed files and convert them to spreadsheet data. The alarm spreadsheet file details out-of-tolerance readings by logging the time a variable went out of tolerance and the time it came back into tolerance.

Results

Because of the ease of development and the flexibility of LabVIEW, along with the "jump start" provided by the SCADA Tool Kit, we implemented the new system in only eight days. The SCADA upgrade dramatically improved data acquisition and analysis, made out-of-tolerance readings much easier to identify, and helped minimize the number of corrective-action reports for the lab. Union Carbide personnel were pleased beyond all expectation with their improved monitoring capabilities.

With the LabVIEW-based system, laboratory personnel estimate that they save approximately two weeks of downtime per year previously spent attempting to recover lost data and writing extra reports. With this improvement, Union Carbide continues to progress in meeting ever-increasing customer demands for better quality and reliability in products. They can also satisfy the demands of environmental monitoring organizations for more comprehensive, easy-to-interpret laboratory test reports.



User Interface of PC-Based Recorder System

U.S. Corporate Headquarters • Tel: (512) 794-0100 • Fax: (512) 683-9300 • info@natinst.com • www.natinst.com

Branch Offices: Australia 03 9879 5166 • **Austria** 0662 45 79 90 0 • **Belgium** 02 757 00 20 • **Brazil** 000 811 781 0559 • **Canada** 905 785 0085 • **China** 0755 3904939 • **Denmark** 45 76 26 00 **Finland** 09 725 725 11 • **France** 01 48 14 24 24 • **Germany** 089 741 31 30 • **Greece** 30 1 42 96 562 • **Hong Kong** 2645 3186 • **India** 91805275406 • **Israel** 03 6120092 • **Italy** 02 413091 **Japan** 03 5472 2970 • **Korea** 02 596 7456 • **Mexico** 001 800 010 0793 • **Netherlands** 0348 433466 • **New Zealand** 09 914 0488 • **Norway** 32 27 73 00 • **Singapore** 2265886 • **Spain** 91 640 0085 **Sweden** 08 587 895 00 • **Switzerland** 056 200 51 51 • **Taiwan** 02 2377 1200 • **U.K.** 01635 523545