MCCDAQUMENTARY

Real World Application Story

Hunt Technologies chooses MCC for accuracy, reliability, and overall cost-effectiveness

Application story by Buz Mormann

Automatic Meter Reading Systems

Hunt Technologies, Inc. provides Automatic Meter Reading solutions to utility companies worldwide. They utilize the existing power lines to transmit data from the meters in homes and businesses to the utility companies for billing and continuous data reporting. The systems Hunt Technologies installs, allow for fast and cost-effective reading of meters in both rural and urban areas without the need for meter visitation. During installation of these systems, precise measurements from the power lines may be required. For these measurements, Hunt Technologies chose Measurement Computing's USB-1608FS hardware and Universal Library software for their accuracy, reliability, ease of use, and overall cost-effectiveness in addition to their compact size and portability.

Feeder Line Noise and Signal Study

Hunt Technologies installs at each meter within a utility company's power grid, a data collection and transmitting device called a "Turtle" or endpoint transmitter. The Turtle collects electricity usage and transmits this data via power-line carrier communication to the Turtle receivers in a substation. From the substation the data is transmitted via modem to the utility

Two Turtles (left: TS1 endpoint transmitter; right: TS2 endpoint transceiver) and a meter with Turtle installed.

company's headquarters for billing and monitoring of the power grid system.

Hunt Technologies needed a cost-effective, compact, portable data acquisition system that could be used by installation crews to study the noise and signal levels from the feeder lines leaving a substation. Ideally, the system would be able to connect to a laptop computer via USB cable. The collected data can be analyzed and used to quickly and accurately determine which feeder combination is optimal for transmission of data from the Turtles in homes and businesses, to the utility company for billing and data reporting.

In order to capture the signals leaving the feeder lines in a substation, the current in the line needs to be collected, stepped down and converted to a voltage. This is done by using the pre-existing current transformers installed at each substation. The signals from the current transformers are between 0.05 and 1 volt. On some occasions the signal is slightly greater than 1 volt.

One of the specifications for the data acquisition board that Hunt Technologies needed was a resolution of 16 bits. This would allow for 65,536 discrete steps over a selected range. This allows for as precise a measurement as possible from the current transformers.

Once sufficient data is captured from a study, the software can perform an analysis. James Glende, Senior Engineer at Hunt Technologies, wrote the program in Microsoft Visual C++. The software uses a combination of filters and arithmetic to transform the data into useful histograms and tables.

A Portable Test Solution

Through an online search, Hunt Technologies, Inc. discovered Measurement Computing's USB-1608FS. It is compact, portable and utilizes USB technology to communicate with a computer; all requirements for Hunt Technologies' feeder study kit.

The existing current transformers on the feeder lines in a substation are used to convert the current leaving the substation into a voltage for measurement. The voltage output is between 0.05 and 1 volt which can be captured using the ±1 volt range on the USB-1608FS. Periodically, the measurement exceeds 1 volt, so the ±2 volt range is required. The USB-1608FS offers a total of four software selectable ranges from ±1 volt to ±10 volts. To select the appropriate range, each feeder can be run to determine if the measurement will exceed 1 volt. If this is the case, the ±2 volt range can be selected within the software during the study setup. Hunt Technologies prefers the ±1 volt range in order to capture the more precise measurement.

Measurement Computing's Personal Measurement Device brand USB-1608FS, USB-based DAQ module with eight channels of 16-bit analog input.

The USB-1608FS can resolve a selected range to 16 bits or 65,536 discrete steps. The Feeder Study Kit operated in the ±1 volt range with a signal of 0.05 to 1 volt, or 47.5 percent of the available range; this equates to 31,129 steps, or 0.0000305 volts per step. Since this is the full resolution of the USB-1608FS, it meets their requirement. When the measurement exceeds 1 volt, a range of ±2 volts must be selected. If the value of the signal were to be 1.2 volts, the new signal range would be from 0.05 to 1.2 volts, or 28.7 percent of the ±2 volt range. This results in 18,808 steps or 0.0000611 volts per step. Since this step size is larger then the ±1 volt range, it results in a less precise measurement. Whenever possible, Hunt Technologies chooses the ±1 volt range.

The USB-1608FS supports 8 inputs, but for this application 16 inputs are required. The USB-1608FS is capable of synchronizing with a second USB-1608FS in order to allow for a total of 16 inputs. One device is labeled as the master and the other the slave. This allows for the two USB modules to simultaneously acquire data from 16 sources, meeting the requirement for Hunt Technologies' feeder study kit.

In order to capture all the noise and signal level data from the feeder lines, it is imperative to have many data points. It was determined that 7,680 samples per second per channel were required to capture enough data points for a complete and accurate analy-

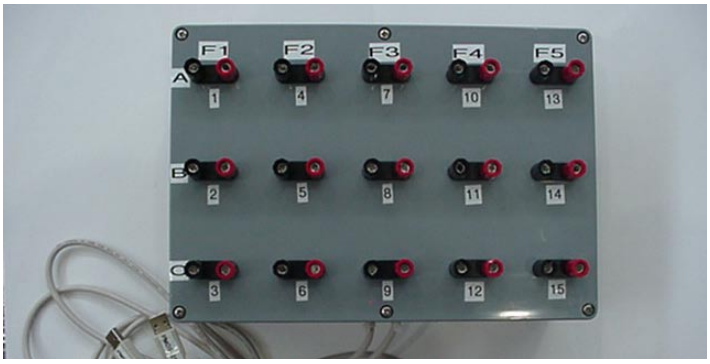
sis. For a continuous scan, each of two USB-1608FS modules has a max sample rate of 100,000 samples per second. Each is responsible for sampling data at 7,680 samples per second on 8 of the analog inputs for a total of 61,440 samples per second. This sample rate is well within the 100,000 sample per second limit of each USB-1608FS.

During a feeder line study, data is captured from the feeder lines and stored in a file on the laptop. After the test, which lasts approximately 45 minutes, is complete the operator can, at his or her convenience, do an analysis of the collected data. This analysis is done using Hunt Technologies' custom software developed in Microsoft Visual C++, utilizing Measurement Computing's Universal Library driver to interface with both of the USB-1608FS data acquisition units.

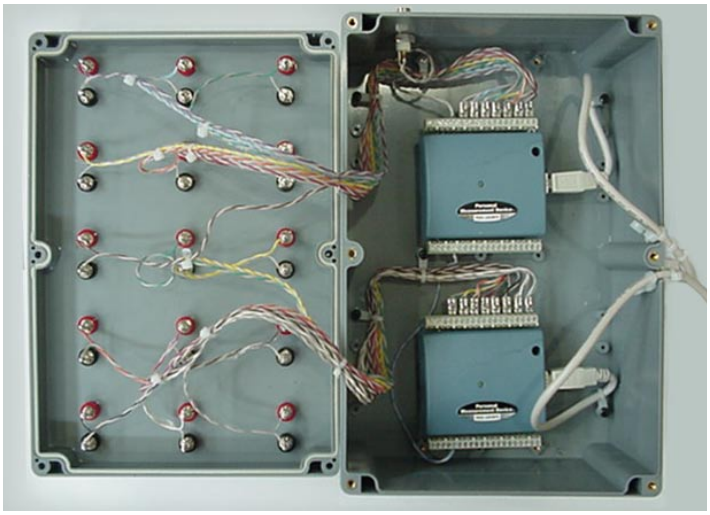
Feeder Line…

In April 2004, the Feeder Study Kit, which uses two Measurement Computing USB-1608FS's, became the primary resource for feeder line studies. According to James Glende, the Kit reduced the amount of time required to complete a full-blown feeder line study from a few days of manpower to a few hours, and has enabled them to economically conduct feeder line studies on all lines, not just those that presented problems. The USB-1608FS units contributed greatly to the impact of the Kits, he added, not only for their small size and low price, but also because "they're easy to use, they're reliable, [and] they do what we tell them to do."

Feeder Study Kit on benchtop with Turtle-equipped end point in background.



Feeder Study Kit, top view, showing the USB cables, which will transfer the collected data to a file on a laptop computer for analysis.



Interior view of Feeder Study Kit showing placement of USB-1608FS modules and the 16 input channel connections (banana jack 1–15 on lid, BNC 16 on enclosure side panel.