Application Note AN2009-11

Distributed Data Acquisition Using the SEL-2411 PAC and SEL-2440 DPAC

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INTRODUCTION

Modern automation systems have the potential to be distributed over an expansive geographical area. These automation systems are expected to monitor and process all input signals, execute logic, and enable or disable outputs. In some instances, it is necessary to perform data acquisition on the status or value of the connected I/O. Troubleshooting automation systems requires analysis of sequential events records in order to correct problems.

In very high-speed process control, it is difficult to determine a sequence of events when dealing with distributed I/O. This is especially true when I/O are dispersed over many miles or placed in remote locations. Additionally, it is critical to have synchronized time stamps to create accurate sequential events records.

This application note covers the data acquisition features of the SEL-2411 Programmable Automation Controller (PAC) and the SEL-2440 Discrete Programmable Automation Controller (DPAC), including event buffer, event report, and Sequential Events Recorder (SER).

SEL SOLUTIONS

It is easy to configure distributed I/O data acquisition using the SEL-2440 DPAC for discrete I/O, the SEL-2411 PAC for analog I/O, the SEL-3530 Real-Time Automation Controller (RTAC) for data collection, and the SEL-3354 Embedded Automation Computing Platform with Windows® 7 as the SCADA (supervisory control and data acquisition) host.

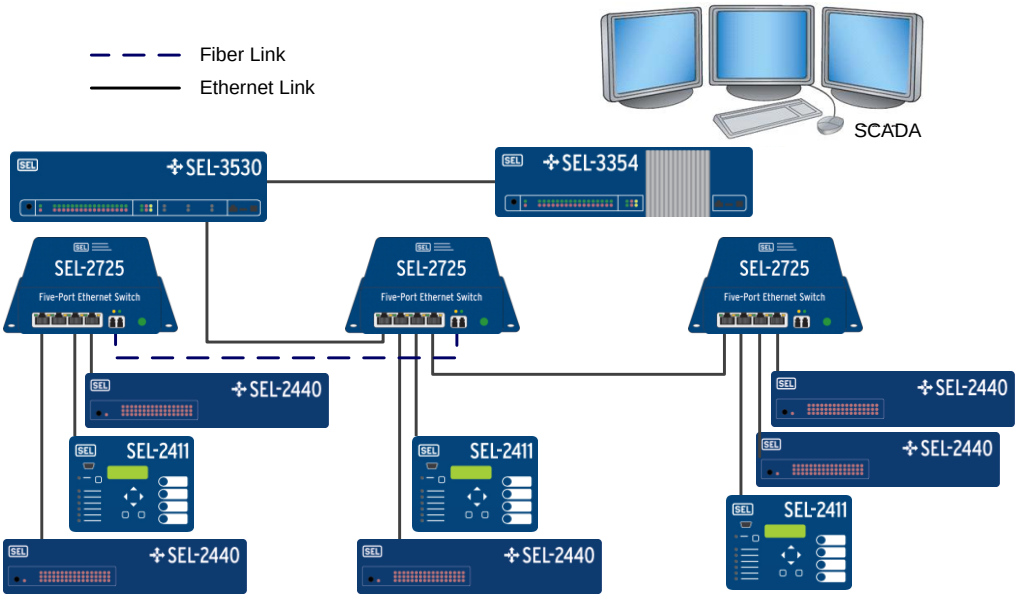

Figure 1 Distributed I/O Using the SEL-2411 PAC, SEL-2440 DPAC, SEL-3530 RTAC, and SEL-3354

DNP3 Event Buffer

Use the DNP3 event buffer to easily transmit analog, binary, and counter information on a periodic or change-of-state basis. A DNP3 event buffer in each SEL-2411 PAC or SEL-2440 DPAC tracks up to 1,024 device word bits, 100 analog channels, and 32 counter values.

In order to minimize network transmissions, specify when to send the buffer based on event age or number of events.

Utilize DNP3 communication to easily consolidate binary, analog, and counter event data from remote SEL-2411 PACs and SEL-2440 DPACs into a single SEL-3530 RTAC for collection and logging. Simply send these data to an SEL-3354 acting as the SCADA host for monitoring and trending.

SER

The SER records time-stamped change-of-state information with microsecond precision on up to 96 device word bits for 512 events per SEL-2411 PAC or SEL-2440 DPAC. The controllers also record when the device is turned on or settings are changed.

Consolidate the time-stamped event records from various controllers into the SEL-3530 RTAC and view them as one concise, system-wide sequential events record. This is particularly valuable when performing failure analysis on a large distributed system, such as a power transmission network. Assign aliases to device word bits for easier comprehension when reviewing a large event record.

```
SEL-2411                          Date: 04/03/2005  Time:  07:21:19
DEVICE

#         DATE         TIME              ELEMENT             STATE
17     04/03/2005  06:25:51.1200 RB01                      Deasserted
16     04/03/2005  06:25:51.1250 OUT102                    Deasserted
15     04/03/2005  06:26:03.0490 RB01                      Asserted
14     04/03/2005  06:26:03.0530 OUT102                    Asserted
13     04/03/2005  06:51:17.7480 Device Powered Up
12     04/03/2005  06:51:20.3610 OUT101                    Asserted
11     04/03/2005  06:51:21.3660 OUT101                    Deasserted
10     04/03/2005  06:54:10.7530 Device Settings Changed
9      04/03/2005  06:54:10.7620 OUT101                    Asserted
8      04/03/2005  06:54:11.7370 OUT101                    Deasserted
7      04/03/2005  07:06:01.7390 OUT101                    Asserted
6      04/03/2005  07:06:02.7440 OUT101                    Deasserted
5      04/03/2005  07:06:14.9930 Device Settings Changed
4      04/03/2005  07:06:15.0020 OUT101                    Asserted
3      04/03/2005  07:06:15.9770 OUT101                    Deasserted
2      04/03/2005  07:13:22.9470 OUT101                    Asserted
1      04/03/2005  07:13:23.9510 OUT101                    Deasserted
```

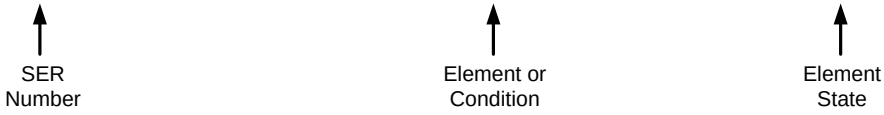

Figure 2 Example SER Report

Event Reporting

The SEL-2411 PAC has a powerful tool for analyzing the cause of device operations in an ac power system. Record analog and digital waveforms at 32 samples per cycle for up to 64 power system cycles.

Event reports contain ac currents, ac voltages, and digital I/O. The report automatically adjusts the content to the I/O cards in use. Reports are stored in nonvolatile memory to protect data even if power is lost. Event reports are optimized for recording power disturbances and relating them to the process.

Set the report to capture either 15 or 64 power system cycles of data around the trigger event. For a 60 Hz system, the event report lengths are 0.25 seconds and 1.07 seconds. For a 50 Hz system, the report lengths are 0.30 seconds and 1.28 seconds.

Satellite-Synchronized Clocks

The entire SEL automation controller product line has IRIG-B satellite-synchronized clock inputs for time stamps precise to the millisecond. The user can know the entire network is time-synchronized.

Standard Communications Protocols

The SEL automation controller product line uses industry standard communications protocols, including DNP3, IEC 61850, and Modbus®. The user can implement these protocols over a variety of mediums, including fiber optic (single or dual 100BASE-FX and fiber-optic serial port multimode ST® connectors), Ethernet (single or dual 10/100BASE-T), and serial (EIA-232 and EIA-485).

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