Solar Tracking Using the SEL-2411 PAC and SEL-3530 RTAC

Tyler Kee

INTRODUCTION

Solar panels absorb and concentrators reflect the most sunlight when perpendicular to the sun. In order to optimize solar panel or concentrator efficiency, it is necessary to track the sun throughout the day.

Solar farms can be hot during the day and cold during the night. The electronics used for tracking equipment control need to be robust enough to withstand these dramatic temperature fluctuations.

Because of the potential number of solar tracking systems in one farm, communications between the controllers and master need to be reliable, scalable, and not consume a tremendous amount of communications bandwidth.

This application note covers features of the SEL-2411 Programmable Automation Controller (PAC) and SEL-3530 Real-Time Automation Controller (RTAC) and the benefits of using this hardware for PV (photovoltaic) solar panel or concentrated solar power (CSP) tracking applications.

SEL SOLUTIONS

Rugged, Dependable Hardware

All SEL hardware is built to exceed stringent IEC and IEEE protective relay standards. With an operating temperature range of –40° to +85°C, optional conformal coating on all electronics, and ten-year warranty, the user can have peace of mind for the life expectancy of the installation.

Robust Communications

Easily integrate the SEL-2411 PAC using any of the utility 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). If using DNP3, each SEL-2411 PAC can be set to only broadcast a message if there is a problem, significantly reducing network traffic.

Trigonometric Calculations

The SEL-3530 RTAC can solve the sine, cosine, and arc cosine calculations required to track the sun and output those values to the SEL-2411 PAC to move the panels or concentrators into the correct position.
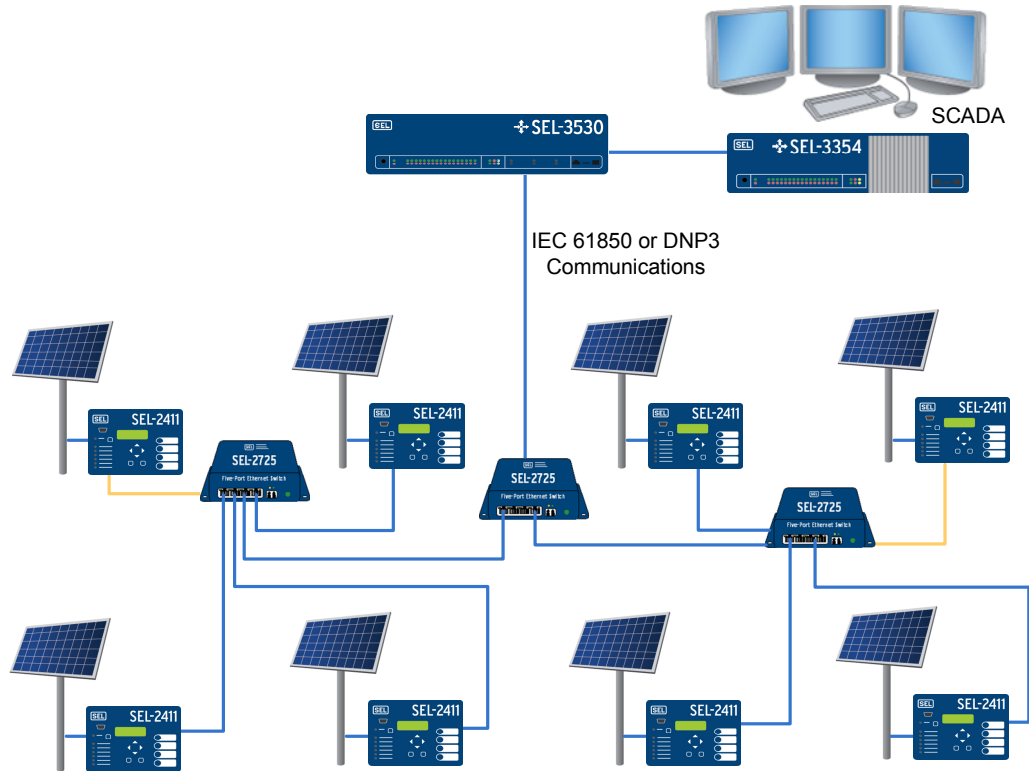

Figure 1   Control Architecture Utilizing the SEL-3530 RTAC and SEL-2440 Discrete Programmable Automation Controller (DPAC) for Solar Tracking

High-Resolution Analog I/O

The SEL-2411 PAC has built-in analog outputs to control your electric or hydraulic tracking system and 16-bit analog inputs to monitor the position feedback systems.

Satellite-Synchronized Clocks

The SEL-2411 PAC and SEL-3530 RTAC controllers have an IRIG-B input for satellite time synchronization. This is very useful to keep your panel or concentrator tracking synchronized.

LAN2009-23