



## *Use Synchrophasors in SCADA/EMS*

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### **INTRODUCTION**

Utilities can integrate synchrophasors into existing SCADA/EMS (supervisory control and data acquisition/energy management systems). This integration improves the accuracy and coherency of SCADA systems and allows system-wide application of synchrophasor data. An example would be using synchrophasor data as an input into state estimators to improve estimation results.

### **PROBLEM**

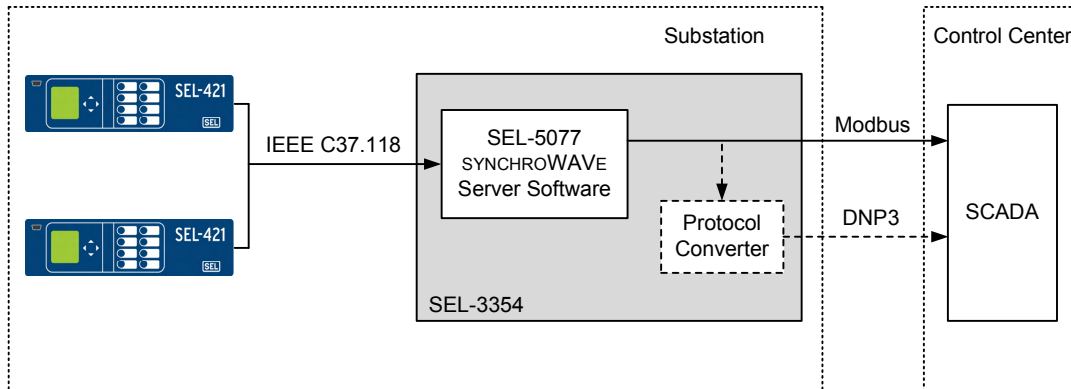
SCADA systems poll data from RTUs (remote terminal units) at relatively low rates, typically once every 2 to 4 seconds. Data collected from RTUs are not time-aligned, which may significantly affect calculations. Compared to RTUs, synchrophasors provide time-aligned data at higher rates (up to 60 times per second) and with higher accuracy. Synchrophasors can also send real phase angles directly to SCADA, instead of having the system estimate the phase angles. In addition, many of the SEL relays and meters deployed through the power system already have built-in PMU (phasor measurement unit) functionality or can easily have it with a firmware upgrade. Therefore, utilities have the opportunity to use synchrophasor data in their SCADA systems without additional RTU installations. To take advantage of this opportunity, SCADA systems need to be able to poll data from PMUs. However, synchrophasor data are usually sent using a stream-based protocol such as IEEE C37.118 or SEL Fast Message, but most SCADA systems do not have an interface for these protocols.

### **SEL SOLUTIONS**

We can concentrate synchrophasor data from PMUs using a PDC (phasor data concentrator) and convert its output into Modbus<sup>®</sup> or DNP3, which are commonly adopted communications protocols among SCADA vendors.

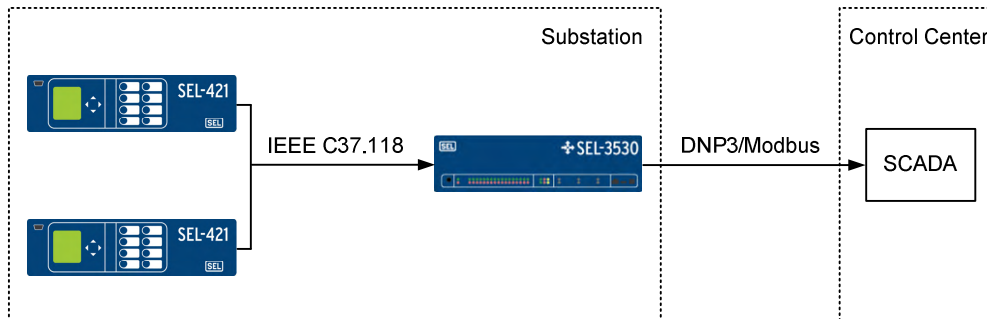
Here are two methods for making synchrophasor data available to SCADA systems.

The first method, shown in Figure 1, is to concentrate synchrophasor data from PMUs into a Modbus output by using SEL-5077 SYNCHROWAVE<sup>®</sup> Server Software, which sends the Modbus output to SCADA directly. If the specific SCADA implementation does not have a Modbus interface, then convert the Modbus output to DNP3 protocol using protocol converting software. Both SYNCHROWAVE Server and the protocol converter run on the SEL-3354 Embedded Automation Computing Platform, which is a rugged computer for substations.



**Figure 1 Sending synchrophasors to SCADA using an SEL-3354**

The second method, shown in Figure 2, uses one of the many features of the new SEL-3530 Real-Time Automation Controller (RTAC). This is the ability to collect synchrophasor data from PMUs and send the data to SCADA systems using Modbus or DNP3 protocols.



**Figure 2 Sending synchrophasors to SCADA using an SEL-3530 RTAC**