



Open Channel Flow Control Using the SEL-2411, SEL-3031, and RTAC

Amandeep Kalra

INTRODUCTION

Rising irrigation water costs and unpredictable rains call for efficient monitoring and control of open channels. With the advancements in modern automation systems, it has become possible not only to remotely monitor water flow, but also to remotely control water gate positions, which control the flow rate through open channels. Controlling water gates remotely helps satisfy new requirements set by governing bodies throughout the world for the efficient management of water resources.

This application note covers the data acquisition feature of the SEL-2411 Programmable Automation Controller and the programming capabilities of the SEL-3505 Automation Gateway, including its ability to run control algorithms. This application note also discusses using the SEL-3031 Serial Radio Transceiver to communicate between the various remote sites and the server. The SEL-3530 Real-Time Automation Controller (RTAC) acts as a data concentrator and is used as a protocol converter.

The proposed SEL solution results in the efficient management of water through open channels by enabling users to identify various issues associated with water conveyance systems such as channel leakages, channel blockages, and inaccurate flow measurements. Also, the ability to remotely monitor and control various sites reduces the labor and time associated with site visits.

SEL SOLUTION

Figure 1 demonstrates the SEL solution, where multiple flow control sites communicate to a centralized server using different communications methods, such as serial radios and fiber optics. The data from all of the sites are concentrated in the main server and are displayed on the supervisory control and data acquisition (SCADA) server. The user can monitor as well as control the sites through the SCADA server without physically visiting the site.

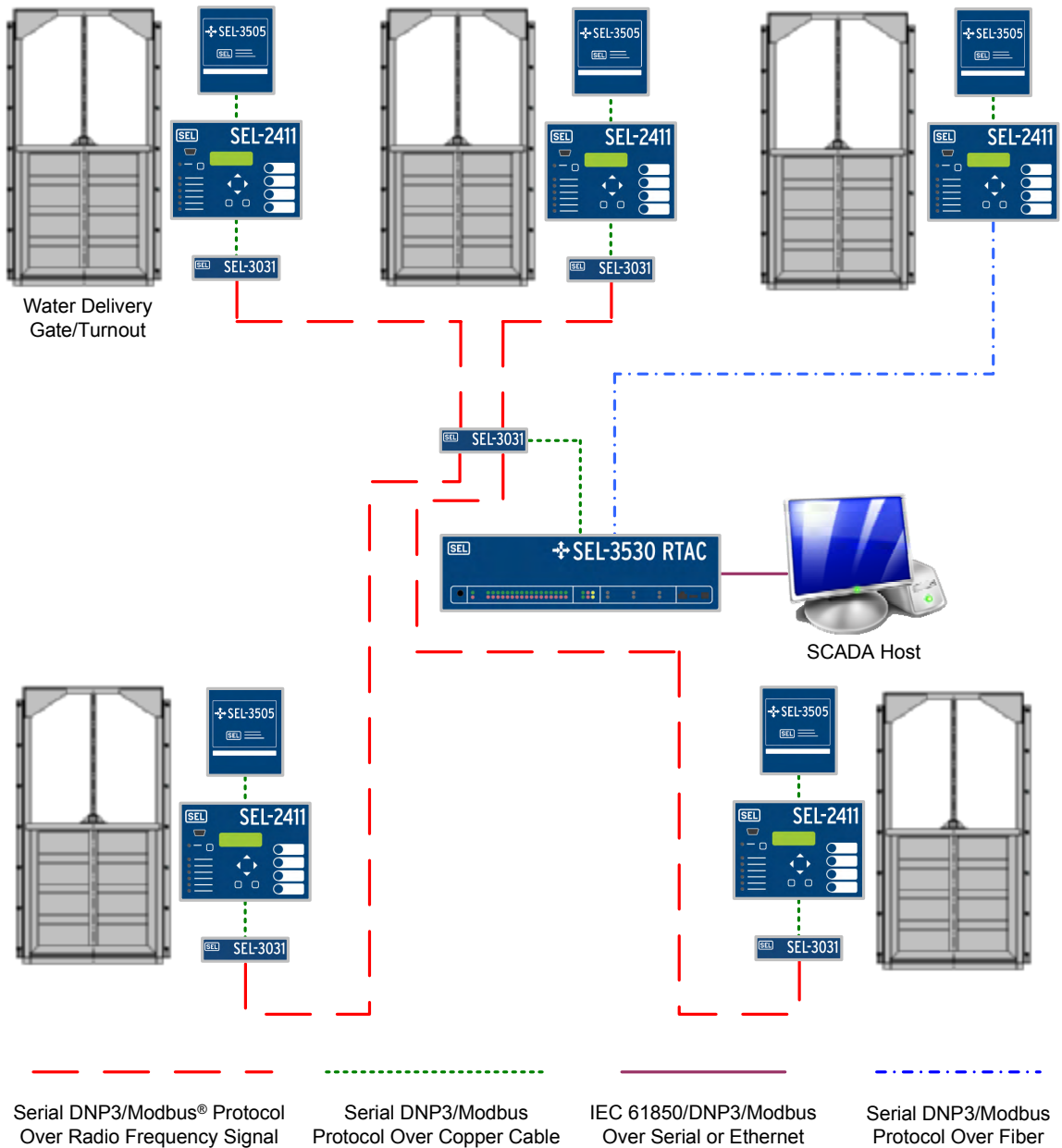


Figure 1 Open Channel Flow Control System Overview

Rugged Hardware

The SEL products specified in this application note have an operating temperature range of -40° to $+85^{\circ}\text{C}$, which makes them a perfect solution in harsh environments. Also, the rugged design of the products enables them to withstand mechanical vibrations caused by the movement of actuators. Moreover, the SEL-2411 meets the Class 1, Division 2 Hazardous Location Approval rating and comes with a ten-year warranty, resulting in the trouble-free operation of the control system.

Customizable Built-In HMI With Keypad

The SEL-2411 has a built-in human-machine interface (HMI), which provides on-site feedback about various parameters such as flow rate, gate position, and gate status. The front-panel pushbuttons are programmed to control the gate locally. Six front-panel light-emitting diodes (LEDs) are configured to show communications channel activity, gate status, critical I/O status, and/or different alarm conditions.

Communication and Integration

This system communicates over Ethernet and serial ports. The availability of a wide variety of communications protocols, such as DNP3, Modbus, and IEC 61850, makes it possible to integrate the SEL-2411 into any hardware or SCADA system. The RTAC acts as a protocol converter to integrate the system into existing setups without replacing existing hardware.

High-Speed Processors

High-speed processors within SEL products make it feasible to run complex control algorithms in a time-deterministic manner, which results in precise and efficient gate control and a better understanding of the management of water resources.

Cybersecurity

All SEL products support defense-in-depth features. Data processing, data aggregation, SCADA, and remote access layers support interlocking cybersecurity and intrusion detection. These features ensure the confidentiality of process information. For applications in the United States, they also satisfy the requirements set by the U.S. Department of Homeland Security.

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SCHWEITZER ENGINEERING LABORATORIES, INC.

2350 NE Hopkins Court • Pullman, WA 99163-5603 USA
Tel: +1.509.332.1890 • Fax: +1.509.332.7990
www.selinc.com • info@selinc.com