APPLICATION PAPER

Wireless Communications Provides Safe Petrochemical Loading

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The time to replace an entire control system is a difficult decision to make. When the control system provides an emergency stop for petrochemical loading on ships, the reliability of the network can not be compromised. The safety of the whole operation is governed by the reliability of the hardware. After struggling with a poorly supported control network, a Houston based petrochemical company decided to remove the proprietary controllers currently installed and use proven, off-the-shelf hardware of Allen-Bradley™ programmable logic controllers (PLCs) and ESTeem™ Wireless Modems.

Within the last few years, a Petrochemical-manufacturing facility, operating out of Houston, Texas, made the decision to automate their chemical loading process. The chemical plant's primary method of delivery of their products to customers is by tanker ships using the Houston ship channel. The petrochemicals are transported the two miles from the plant to the loading dock through a system of pipes (Figure 1). A 2000 hp pump located in the petrochemical plant pressurizes the pipeline. The pipeline can deliver one barrel (42 gallons) of petrochemical product to the ship every second. With this rate of flow, stopping the pump for the safety of the loading personnel and equipment needs to be accomplished in the shortest amount of time possible. Before a control system was installed, the only method of stopping the loading operation was an operator at the loading dock calling on a hand-held radio to the control room to manually stop the pump. The primary intent of the control system was to provide the operators an emergency stop at the loading dock to immediately stop the pump in case of emergency.

The original control system design consisted of a small, proprietary controller that could take the input of a button (emergency stop) being pressed at the loading dock and send this signal to a second controller located in the petrochemical plant's control room that would turn off the pump. The controller was designed to communicate using a serial, RS-485 interface. The two miles between controllers made direct cabling very cost prohibitive. Leased phone lines and radio modems were two other methods of communication investigated to provide the data link between the controllers.

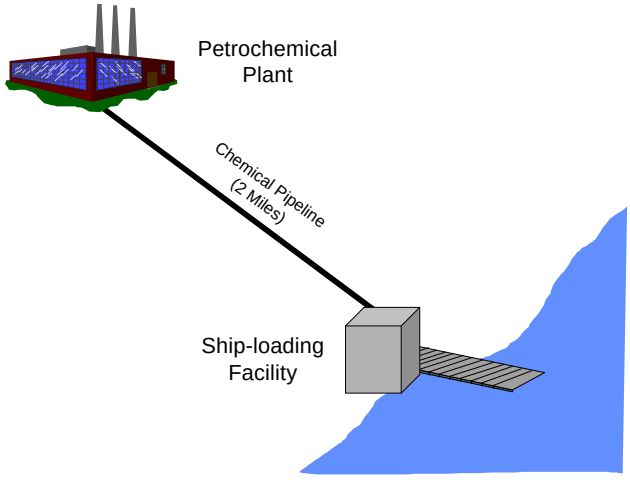

Figure 1: Site Layout Diagram

After researching both methods of communications, the customer concluded that the phone lines in the area were usually down and selected radio as the most reliable communication method for the area. The customer selected the ESTeem Model 96C, UHF (450-470 MHz) radio modem, manufactured by Electronic Systems Technology (EST), to provide the communication between the loading dock and the plant's control room. The customer had an existing UHF frequency license that could be used for this project and all ESTeem products have an RS-485 port standard.

During the system integration, numerous problems were encountered. All equipment was configured according to the documentation, but the controllers would not communicate. Through phone support with EST and by utilizing diagnostic programs in the ESTeem Utility Program, it appeared that the radio link was working correctly, but the communication between the controllers was still not functioning. EST was asked to provide on-site assistance and found the controller was not using a standard RS-485 interface. The controller interface used modified RS-485 electrical specifications for their own proprietary use.

The customer was now faced with either paying the expense of running cable between the two controllers or replacing the proprietary controllers with more open control hardware. The customer had successfully integrated Allen-Bradley

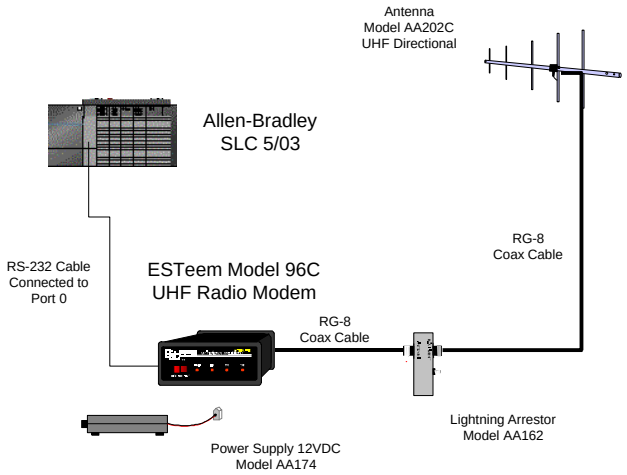

Figure 2: Equipment Layout Diagram

PLCs in other areas of the plant and as the customer stated, "they never break". The decision was made to replace the proprietary controllers with Allen-Bradley SLC 5/03 at both the loading dock and plant's control room. The SLC 5/03 controllers could be directly interfaced to the ESTeem Model 96C through the RS-232 port (Figure 2). All ESTeem wireless modems have an integral Allen-Bradley, DF1 protocol driver that allowed the ESTeem to fully emulate the protocol by simply modifying the software commands in the ESTeem. Once the Allen-Bradley controllers were installed and connected to the ESTeem, the system began communicating.

The new control system provides the operators at the loading dock with two indicating lights for the system running, system shutdown, and an emergency stop button (Figure 3). When the emergency stop button is pressed a message is sent from the loading dock SLC 5/03 to the control room's SLC 5/03. The SLC 5/03 in the control room shuts down the 2000 hp pump and returns a message to the loading dock to illuminate the system shutdown light. This entire shutdown process can be accomplished in less than 1 second. By using an Allen-Bradley open PLC architecture the system is now expandable to become fully automated in the future. Although the emergency stop is currently manually controlled, future plans have the system gathering information from flow meters along the pipeline to identify a problem in the flow of petrochemicals and automatically stop the pump. These future upgrades can easily be accomplished with a minimum of additional hardware and expense.

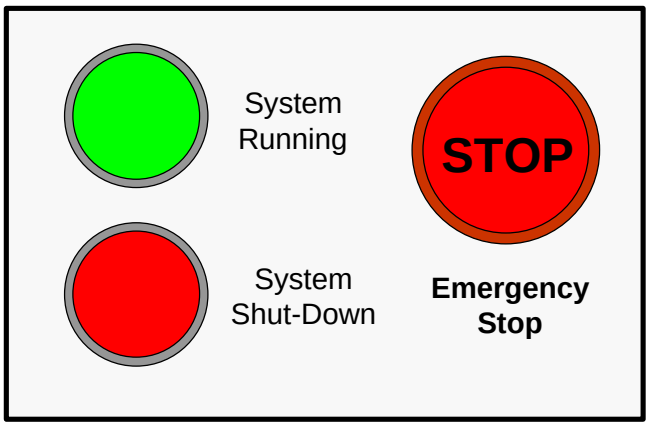

Figure 3: Operator Panel Layout

By replacing the control system with Allen-Bradley and ESTeem hardware, the customer was provided with the following benefits:

- The system operator was provided with indications on system status and an emergency stop button
- Response times for system shutdown were greatly improved
- Increased safety for the operators and equipment
- Proven reliability of Allen-Bradley and ESTeem Hardware has provided 5 years of uninterrupted service
- Open control network for future expansion of the control system

No one wishes to replace a new control system in any application, but the replacement of poorly supported and proprietary hardware with Allen-Bradley PLC and ESTeem wireless modems not only served the customer's current requirements but also gave them the flexibility for future expansion. With increased workloads, today's industrial automation customer does not have the time or will not commit the time to working with poorly supported and proprietary equipment. A vendor must be able to provide a high level of service and open standards like those found in Allen-Bradley and ESTeem hardware used in this project.

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