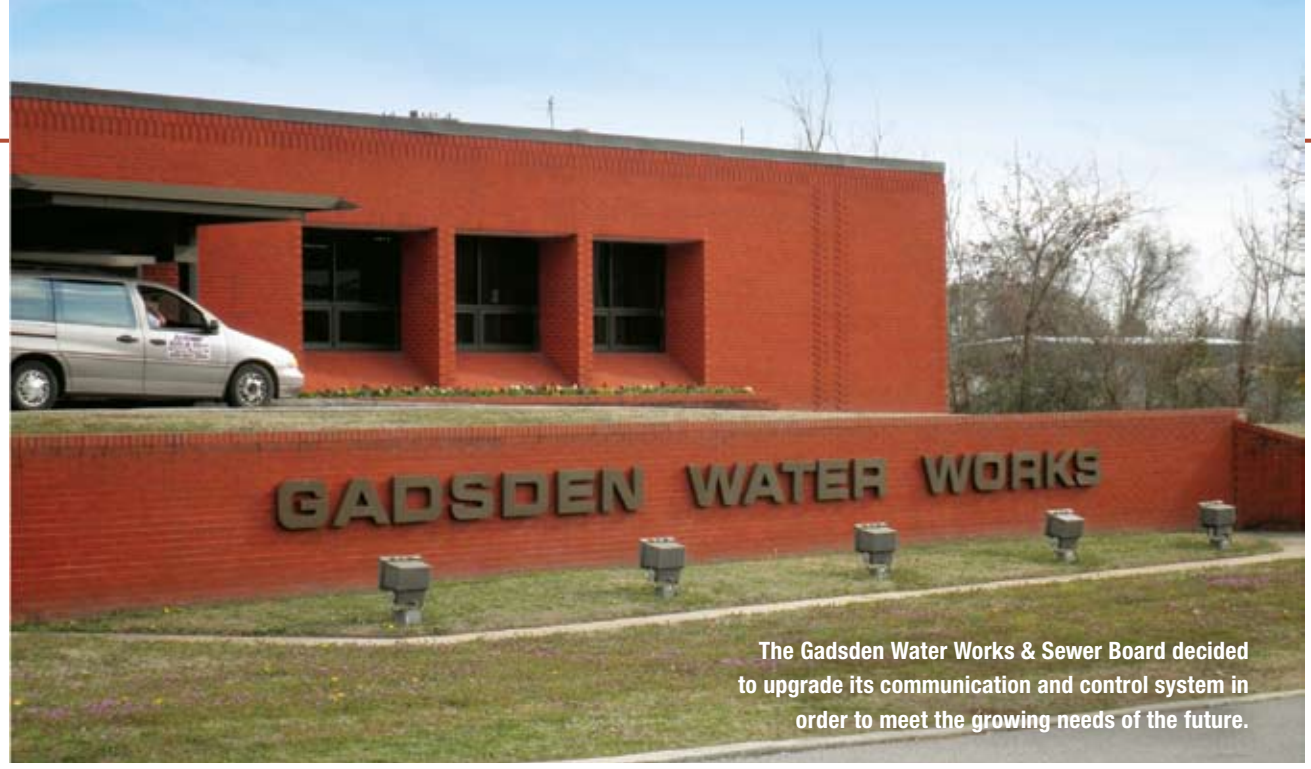
Ethernet Evaluation Reaps Results



The Gadsden Water Works & Sewer Board decided to upgrade its communication and control system in order to meet the growing needs of the future.

By Vickie G. Olson

Over the years, pneumatics, relays and 4-20 mA analog outputs from instrumentation have been used for automated control. More recently, digital outputs such as Modbus, Fieldbus and Profibus have been used to communicate with programmable logic controllers or digital control systems on a separate server. Although Robert Metcalfe and his associates introduced Ethernet communication in 1972, improvements in speed and quality since 1995 have made it a more practical method for communication, allowing instrumentation information to go directly into a plant's network via copper wire or fiber-optic cable.

Improving water quality using Ethernet communication system with analytical instrumentation

ARTICLE SUMMARY

Challenge: The Gadsden Water Works & Sewer Board wanted to upgrade its communication and control system with Ethernet.

Solution: Gadsden set up a SCADA system for pH and ORP information coming from its UDA2182 analyzer.

Conclusion: Communicating through Ethernet allows GWWSB to receive digital data, confirm excellent water quality and avoid electromagnetic interference from electrical surges, along with a other benefits.

The Gadsden (Ala.) Water Works & Sewer Board (GWWSB) was interested in upgrading its communication and control system. The GWWSB has a grade IV surface water plant with capacity for 24 million gal per day (mgd), averaging about 14 to 15 mgd. The plant processes raw water from the Coosa River. The plant was collecting instrumentation data manually; however, a new water plant is in predesign, and Gadsden was able to set up an Ethernet communication system for the existing plant to test its effectiveness. The plant chose to use fiber-optics cable rather than wireless to avoid data loss due to possible lapses in communication.

Gadsden is scheduled to upgrade to a graphic-user interface, multifunctional HMI SCADA system for the water and wastewater treatment plants by the end of 2012. Currently, the instruments being used with Ethernet communication are pH and oxidation-reduction potential (ORP) probes with UDA2182 digital dual analyzers. The pH analyzer is assisting pH control after alum addition at the coagulation basin. The ORP analyzer monitors the level of oxidation from potassium permanganate in addition to the raw water intake. The plant is also in the process of installing flowmeters with Ethernet communication to add to the control system.

System Installation

Setting up the SCADA system for the pH and ORP information coming from the UDA2182 analyzer involved first using the analyzer software transmitted to the plant's intranet system. The analyzer provided:

- Web pages to monitor readings, alarms, statuses and events;
- Web pages to set up Ethernet port settings;
- E-mail to send alarm status changes;
- Modbus TCP protocol to read signals and read/write variables;
- Remote communication via Process Internet Explorer; and
- 10/100 base-T auto-negotiation.

The Ethernet port was connected using a standard RJ45 connector with shielded twisted-pair, Category 5 (STP CAT5) straight-through or crossover Ethernet cable. Ethernet parameters were configured via the front panel and Web browser.

To access the Web pages on a network, the plant administrator could use the supplied IP address, a static IP address assigned by IT, or a dynamic host configuration protocol (DHCP) if the network has a DHCP support. Upon entering the IP address in the computer's Web browser, a welcome page appears, followed by a parameter page (see Figure 1 on page 31). Data on the parameter page is set to update every 10 seconds.

In addition to reading data off the SCADA system, the plant administrator also could view the last 12 events from the analyzer output, such as power outages, alarms and diagnostics (see Figure 2 on page 31).

By entering network configuration to a group of pages (see Figure 3 on page 31), the administrator could assign an IP address and also set up an analyzer e-mail address and e-mail alarm recipients. As a result of establishing an IP address, the plant was able to send information directly to the SCADA system.

Evaluation Results

Jack Davis, superintendent of production and treatment at GWWSB, found three advantages of communicating through Ethernet versus more traditional methods.

1. Digital data. Receiving digital data provides quick and accurate information directly to the plant's network, so those with password-protected access can check plant operation on their desktop or laptop computers. They are able to view event history, temperature, calibration information, diagnostic faults, and pH and ORP data. The ease of communication allows for remote adjustment for calibration and immediate knowledge of water chemistry excursions.

2. Water quality. Although there was not enough available data on whether chemicals were

Figure 1. Parameters Page

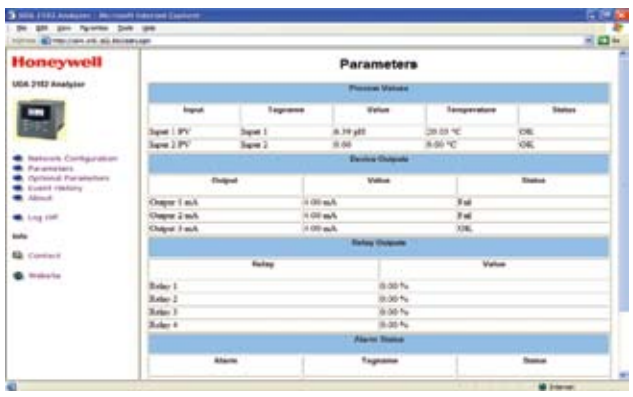


Figure 2. Event History Example

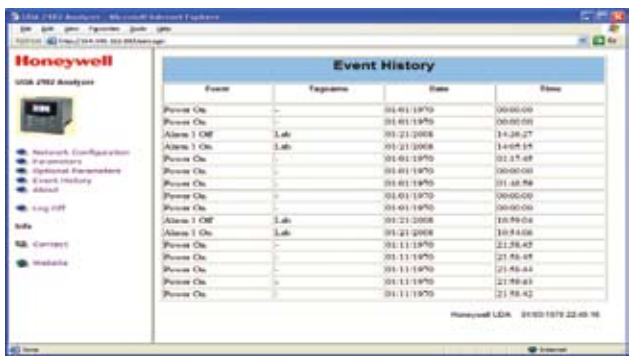
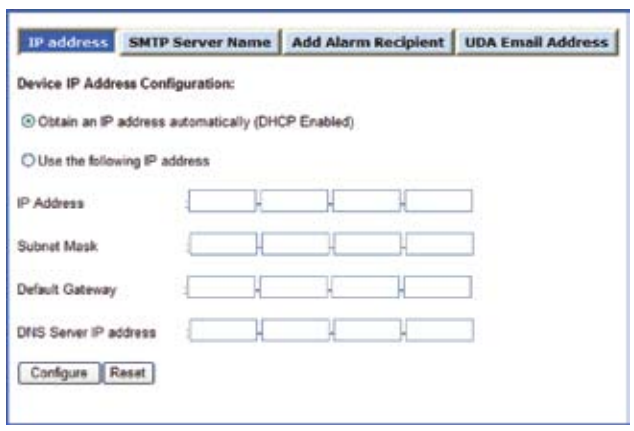


Figure 3. Network Configuration



saved by faster, more reliable response, water quality has been excellent during the use of the Ethernet system for chemical control.

3. Electrical surge. Data carried over copper cable typically receives a great deal of interference due to electromagnetic interference from electrical surges and radio frequency interference. Electrical surges are common in drinking water plants due to the large pumps being turned on and off at frequent intervals. Over the course of the evaluation, Ethernet digital data carried over fiber-optic cable did not have electromagnetic interference, and data was received more accurately for improved control.

Other Advantages

Justifications to specify industrial Ethernet protocol and/or fiber-optic cable for the new system include:

- Ability to use standard routers, switches and optical fiber;
- No need for a server;
- Better interoperability;
- Fiber-optic cable is smaller and lighter;
- Fiber-optic cable uses less power and provides less signal degradation than copper cable; and
- Fiber-optic cable offers better security.

Successful Results

Because of the successful evaluation of using Ethernet with analytical instrumentation, the GWWSB is planning to include this system at the new water plant and add it to its two existing wastewater treatment plants. WWD

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