

# Wireless Technology in the Pump Industry

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Comparing traditional wired sensor and pump controller applications with wireless alternatives for engineers, operators and maintenance personnel.

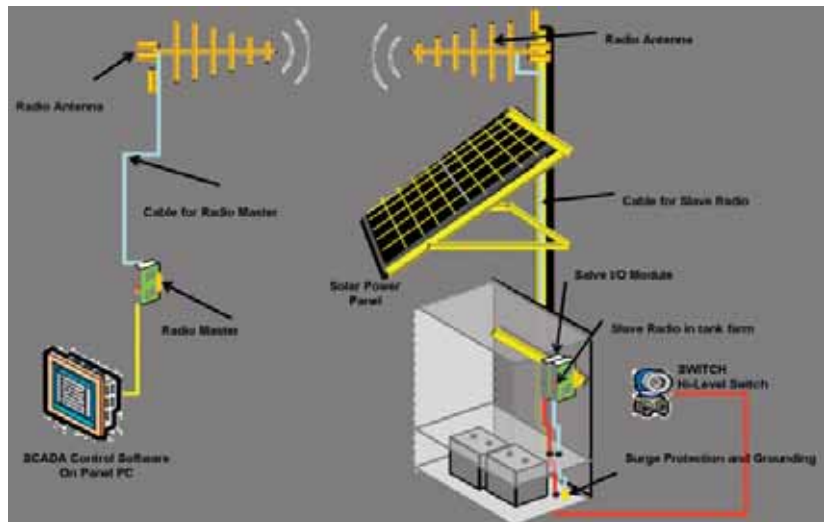
Wireless technology is part of our everyday lives in the home and office. From garage door openers and television remote controls, to cellular telephones and wireless Internet access, radio frequency (RF) technology has been accepted as a reliable, efficient and easy-to-use medium.

In recent years, this technology has begun the logical progression from the home and office into the industrial world—onto the plant floor and into the field. It adds convenience, reduces installation time and provides solutions to common problems. Replacing or eliminating cables with wireless technology has many attractive features beyond the obvious installation speed (hours versus days/weeks) and cost savings (labor, permits, material). However, debate continues about the reliability of wireless products for control-based applications.

## Wireless Reliability

Wireless modems and radio telemetry devices have been used in control systems of mission critical pumps for more than 30 years, yet fear of the unknown remains. There have been thousands of successful wireless implementations in open loop applications, which require data delivered in an acceptable one to two seconds. Alternatively, a closed loop application requires micro or millisecond response times and is not as well suited for wireless. It is important to note the difference between a deterministic, or time-critical, application and one that requires only high data reliability.

The nature of the RF environment dictates that there is no absolute guarantee that any given piece of data will be successfully transmitted and received over the air. However, a well-designed radio will have built-in error checking and retry



Tank level control schematic

capabilities that continue sending a piece of information until it is successfully received. This makes it possible to send important data over a wireless link, as long as the entire system can tolerate some amount of latency or delay.

## Wireless Advantages

A wireless network can provide technical advantages and cost benefits for pump monitoring and control applications. Installing wireless systems to replace both communication and sensor signal cabling can reduce the time it takes to engineer and develop the expansion or construction of a pumping plant.

The upfront cost of a wireless system is often immediately lower than cabling and conduit costs, and the savings in labor and permits are enormous. A signal that previously took days to bring online using traditional wiring can now be commissioned within hours. With this time savings and flexibility, maintenance

**An omni antenna at a pump station for a wireless modem that allows remote control of the pump (East Valley Water Well Pump, San Bernardino, Calif.)**

crews can deploy wireless nodes for temporary troubleshooting or add “stranded” measurement points for safety or improved efficiency.

Utilities are reducing costs and improving productivity to survive in a more competitive and economically challenged environment. Acquiring data and using that data to control or make decisions can reduce operations cost and optimize important assets like pumps and motors.

To maximize pump efficiencies and balance the run times on pumps, most systems come with on-board, standalone control capability. Even so, operators cannot always be onsite to ensure that run-time conditions are acceptable. To monitor and control pumps remotely, most companies communicate through fiber, copper or some hard-wired cable. Ideally, important sensors that monitor suction/discharge pressure, tank levels, system pressure, flow rates and temperatures can be tied back to the pump controller via wire. A hard-wired network of pump control panels is also ideal if it can communicate cost-effectively.

But in a world that is not always ideal, wireless can be the next best thing to wire. In fact, many locations have found wireless connections provide a more reliable connection than a wired circuit.

Managing lift stations is one of the biggest problems water utility operators face. Lift stations are built-in remote locations spread out around cities and business areas. A lift station typically includes two pumps that pump sewage into massive underground tanks. Clogging or infiltration can gradually reduce a pump's efficiency, until the pump eventually stops operating.

When a pump stops, the old-fashioned system alarms the site; however, at this point, it might be too late. Diagnosing and repairing the problem might take too long, causing spillage to occur. Often, the pumps do not completely fail; rather, they lose efficiency. The old-fashioned system will allow the



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anomaly to go unnoticed until a spill is detected by residents or other means. Spills reported by the public often lead to fines, lawsuits and even criminal charges for the wastewater engineer or superintendent.

Tougher EPA and Clean Water legislation have dramatically increased the need for the monitoring and control of sewage collection systems. Combined Sewer Overflow (CSO) applications currently require the monitoring of retention basins, sewer levels and the control of pumps, valves and back-water gates. Industrial wireless solutions have become the preferred option for these applications.

A spill occurs every day somewhere in America. Cost ranges from \$50,000 to \$100,000, not to mention the seemingly irreparable environmental damage. The cost includes the price of pumping out the lift station, new pumps, rush shipping of parts, area cleanup, overtime and other ancillary charges. Wireless pump control products can prevent a spill altogether, which reduces downtimes and contains a problem before it hits the headlines.

For example, a large Midwest sewer district faced a challenging data communications problem during the early 1990s. The district had pumping equipment and wastewater units at approximately 165 unattended locations. It used on-site data collection and a telephone link to a single computer to monitor and control all of these sites. Officials needed better information



**Pump station with outdoor mounted antenna installation (LaVerne, Calif.)**

about the status of the remote facilities to prevent bypassing of wastewater or discharge of improperly treated wastewater.

The district installed a license-free, frequency-hopping spread-spectrum, radio-based, telemetry system that achieved the desired control and security. The system paid for itself. The district not only avoided fines, but also saved \$86,400 in annual telephone expenses. The radio system operated for 15 years.

Historically, radio-based Supervisory Control and Data Acquisition (SCADA) systems have been used primarily in the

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oil pipeline, electric utility and water/wastewater industries, where the remote location and the distances involved made cabling virtually impossible. Field instrumentation signals are hard-wired into a localized PLC or I/O system, and then sent to a central monitoring location or dispatcher via a telemetry link. The advent of wireless devices to eliminate the hard-wire to the field transmitters has made it possible to reduce costs even

further in development, installation, engineering, mounting, start-up and maintenance in this type of application.

### Finding the Right Technology for the Job

Understanding the environment and application of the wireless network plays a crucial part in deciding which wireless technology will perform best. Many technologies, both vendor-specific proprietary and standards-based, have been developed and time-tested during the past decade.

Today, proprietary license-free radio devices are most commonly used in industrial wireless applications. The radio technology is unique to the device manufacturer and will not operate with another manufacturer's devices, adding an element of security. Proprietary radios can be customized to fit a specific application, ranging from Ethernet connectivity down to sensor signals, making them suitable for both in-plant and remote site applications. These devices are often more efficient at transferring data, as the radio platform is optimized for the types and quantities of data that it will transmit. The device can be adjusted to the maximum levels allowed by the local governing body (FCC, IC, etc.), so longer range RF links are typically possible.

Licensed radios are proprietary systems that require a frequency license from the local regulatory body to operate on

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a single fixed frequency. The agency issues these licenses to mitigate interference. Licensed radios are considered high power, typically up to 5 watts. This power translates to a long transmission range, often up to 40 miles.

GSM/GPRS is commonly known as “cell phone” technology. It transmits process data via the cellular network infrastructure. A GSM/GPRS device works like a cell phone, requiring a SIM card and, consequently, a monthly billing plan to operate. With this technology, pump management systems can maintain communications even with locations on the opposite side of the globe.

### Securing the Network

Despite the increasing acceptance of wireless technology, security is still a primary concern. While data encryption is often the top security concern, there are other security facets to consider.

Physical security is important to prevent damage to antenna systems and radio equipment. A radio network is only as strong as its weakest RF link. RF security is possibly the most important, and most frequently overlooked, aspect of security. A well-designed wireless network will pay close attention to the types of antennas that are used and where they are mounted.

### Implementing a Wireless System

The use of wireless technology in industrial applications will proliferate during the next five years, as will the variety of devices and technologies. There is not a “one-size-fits-all” wireless technology available. A variety of radio platforms exist for specific applications.

A careful analysis of the operational and maintenance requirements is important before implementing any wireless project. A detailed feasibility analysis of the environment, application needs, security concerns and possible technologies will save time, money and headaches during the design and implementation of the project.

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