Daniel Myers, Bethanne Slaughter and Mark Granger, Emerson Automation Solutions, USA, discuss how to optimise product movement and logistics by leveraging wireless technologies.
Recent advances in valve automation and pump health monitoring have made it possible for terminals and tank farms to reap real dividends in efficiency, maintenance and capital costs.

The transportation and storage business is at a technological turning point. As networking and data analytics become more powerful and operations become more complex, it is clearer than ever that the choice is not whether to invest, but rather where and how to invest. Staying competitive means coming up with a successful strategy for extracting the greatest possible return on investment (ROI) from today's technology. The good news is that wireless technology can do amazing things.

There are several prime opportunities for terminal and tank farm operators to deploy wireless automation solutions to produce measurable results. Valve monitoring and pump health management are among the best because they can have an immediate impact on both maintenance and operational consistency – particularly when it comes to product movement.

The basic function of any terminal is to move products from point A to point B safely, accurately and on time. Terminals receive products via pipeline, rail, truck or ship, before transferring the products to another location, either a storage tank or a customer delivery point. A terminal may take ownership of certain products while other products remain the property of the terminal's client. In any case, the terminal serves its function by executing a tightly choreographed series of movements that direct products wherever they need to go to meet market demand.
The challenges of complex terminal logistics

Transferring products is not as easy as it used to be. Terminals are pressured to deliver on ever tighter schedules, handle an increasing number of transfers, and manage a wider range of products and modalities. This has made it more important for terminals to be flexible in product lineups and delivery schedules. Concurrently, perennial concerns, such as safety, high staff turnover, and changing regulatory standards, continue to challenge operators worldwide.

To illustrate how wireless automation strategies can address these issues, Figure 1 presents what is involved in a typical product movement scenario—the transfer of a quantity of product from one storage tank to another.

Once an order is received, the route that the product will take through the terminal is identified, including the valves, manifolds, and pipe segments that will be used in the lineup. Then, the type, amount, owner of the product in the origin tank is verified. Each valve must be opened in the correct order to execute the movement. If any valves need to be operated manually, a person is dispatched to the field to open them and radio their positions to the control room. This person is usually followed by a second individual who confirms that everything has been done correctly. Only then are the pumps turned on, the movement completed, and each step performed in reverse until the final quantity is verified at the destination tank.

With any process like this, mistakes can be expensive. Mismanaging line fills or making a small error in executing a lineup—something as simple as opening the wrong valve at the wrong time—can lead to contamination. This would then require products to be reprocessed at a cost of millions of dollars. Accidentally pumping from an empty tank or pumping into a closed delivery valve because of a bad lineup can damage or destroy the pumps themselves, which, in turn, can cause delivery delays that accrue demurrage. Safety is also a major concern, as always. Personnel can get injured operating valves in hazardous areas, and equipment malfunctions can lead to spills or fires.

Wireless automation strategies and solutions

Automation can help solve these problems by giving operators real-time information about the status of the valves and pumps that are critical to executing product movements. This makes it easier to identify and diagnose issues before they cause bottlenecks. For example, wireless valve position transmitters can sense the position of final control elements in remote locations around the facility and send that data over a wireless network to the control room, eliminating the need for multiple field technicians to manually verify the valves in a lineup.

Wireless position monitors are easy to install and take up minimum space, positioning them as ideal for applications where wired position feedback is not feasible. They can also provide redundancy for valves that are already set up to relay feedback data. Advanced position transmitters, such as Emerson’s Fisher™ 4320 wireless position monitor, deliver full-scale position readings of 0-100% with +/−1% accuracy, as well as discrete ‘off’ or ‘on’ readings, thanks to a limit switch that has adjustable dead-band and trip point positions. The device is equipped with internal device temperature sensors and cycle counters to let operators know how often each valve is being used, as well as battery status alerts and selectable data update rates.

Remote sensors can also be leveraged to enhance the reliability of actuators on motor-operated valves. Wirelessly relaying information about critical actuator parameters, such as torque, set point, and position, gives operators better visibility of both the availability and status of the key valves in a lineup. They are inexpensive to install and can help increase the effectiveness of actuator maintenance by sending diagnostic data (including torque profiles, event logs and partial stroke test results) anywhere and anytime the maintenance team needs them.

Emerson’s DCMLink™ software uses a common platform to control, configure, diagnose and monitor the electric actuators in a facility from a central location, independent of different communication protocols or host systems. Valve data is presented using easy-to-interpret displays that include analogue or digital indicator dials on a full-colour dashboard with status reports for dozens of alarms.

In general, the more actionable data that terminal operators have about critical assets, the better. This is certainly true when it comes to the pumps that are relied upon to move product.
Fortunately, wireless pump monitoring technologies are now cost-effective, easy to implement, and combine predictive analytics to identify faults in real-time so that failures and health, safety, security and the environment (HSSE) incidents are avoided, along with significantly streamlining maintenance.

Wireless vibration monitoring provides modern detection of faults, such as cavitation, bearing defects, imbalance and seal failure. Depending on pump criticality, wireless pump monitoring can be as simple as installing a single transmitter with two vibration sensors. Additional vibration or process variable transmitters add visibility, which is required for critical pump systems or monitoring for strainer plugging and tank levels.

Wireless transmitters are effective solutions for monitoring pumps that might otherwise involve extensive engineering, cabling, or installation costs. Emerson’s AMS 9420 wireless vibration transmitter sends a broad array of pump vibration information, including high resolution spectra and PeakVue™ data, directly to the control room via WirelessHART™ networks. To cut through the complexity of pump analysis, the AMS 9420 uses PeakVue technology, which provides a simple and reliable indication of pump health via a single trend.

A key to successful wireless pump monitoring lies in how measurements are analysed and presented to operations and maintenance personnel. Integrated control platforms, such as the pump monitoring applications within Plantweb Insight and Plantweb Advisor, use proprietary algorithms to detect changes and trends in data gathered from vibration transmitters installed on critical pumps (Figure 2). The information is displayed in a way that allows operators in the control room to quickly flag equipment that needs attention prior to executing product movements and aids in coordinating actions with personnel on the ground.

**Wireless benefits: cost-effective insight**

The above solutions have one thing in common: they provide a cost-effective way for users to gain insight into what is actually happening in the field so that they are able to make better operational decisions. When it comes to product movement, wireless automation has many benefits. The most obvious is minimising lineup errors that cause delivery delays and production contamination issues. This alone could save an average terminal or tank farm millions of dollars a year in revenue, in addition to improving safety and regulatory compliance.

Wireless solutions are ideal for enhancing terminal maintenance. Putting diagnostic data in the hands of technicians wherever they need it makes it easier to troubleshoot issues quickly and effectively and allows managers to allocate resources more efficiently. Advances in wireless technology give terminal operators the ability to monitor critical valve and pump applications that were previously not technically or economically feasible.

Of all the advances in automation technology that stand to transform the storage and transportation business in the years to come, wireless applications are sure to play an increasingly important role. For terminal owners, this represents an unprecedented opportunity to take their operations to the next level in terms of reliability, availability and performance. ⚡
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