Overspill level protection for remote tank storage installations

How the latest wireless enabled guided wave radar level transmitters and vibrating fork switches, help operators maximise tank capacity, while minimising the risk of overfilling and potentially hazardous spillages, even in remote installations

In tank storage applications within the oil and gas, chemical, petrochemical and pharmaceutical industries, having access to accurate tank level data is important for process control and inventory management.

Overflow presents a risk to the environment, damage to the plant and is potentially harmful to workers and people living nearby. Several high-profile accidents involving storage tanks have highlighted the need to increase the protection to primary containment systems. More stringent legislation covering overspill protection on critical applications now requires a level of redundancy to be installed.

For many customers the combination of guided wave radar (GWR) transmitters, for continuous level monitoring and vibrating fork point level sensors for high and low level alarms, provides an ideal solution for many applications. However, one aspect that has held back the application of increased level instrumentation is a lack of an existing cable infrastructure connecting the remote tanks. The cost of installing new wiring can include ducting, cable trays and the digging of trenches, which can be cost-prohibitive. There is also the inconvenience and issues of performing the work while the site is operating.

Wireless technology overcomes many of the issues associated with installations at remote locations but the absence of wireless enabled GWR transmitters has prevented the technology from being deployed to solve this particular problem.

Now at least one manufacturer has overcome the issues of signal strength, power consumption and battery life, by introducing a fully integrated wireless GWR transmitter for continuous level and interface monitoring.

Well established technology

Wireless technology is now established as a cost effective, reliable and versatile way to provide access to additional data across a range of industrial applications. Introduced in 2007, the technology was first adopted for use in harsh, remote environments where wired instrumentation was not feasible. Six years on and customers are increasingly adopting wireless technologies, not only for hard-to-reach extreme applications, but also for critical day-to-day process control and monitoring requirements.

Wireless eliminates the need for wire-related installation activities. Studies have shown that wireless technology enables savings of 30% or more over the installed cost of a wired alternative. Once a wireless network has been established at a site, additional wireless-enabled instrumentation can be installed quickly to provide continuous monitoring or used temporarily to identify particular issues.

Factory-commissioning, remote configuration and diagnostics, and simple set-up procedures make commissioning of wireless devices faster and easier, even for those with less experience. In general, automation reduces the number of trips into the field, and the now well-proven reliability of wireless technology is ensuring those trips out to 'fix' unreliable equipment are kept to a minimum.

Approved in 2010, the internationally recognised IEC 62591 WirelessHART standard is now widely implemented in refineries, oil fields, offshore platforms, chemical plants and other industrial facilities to obtain real-time plant data to optimise operations, improve worker and plant safety, and reduce emissions and other environmental impacts.

Initially, many companies applied wireless within small monitoring applications that incorporated just a few devices, to prove the concept in their own plant and operating environment. As confidence in the technology has grown, and the benefits enabled by wireless devices have been recognised, those so-called 'starter' systems have expanded into site-wide facilities.

Extending this technology further, wireless-enabled level measurement and control devices have been developed to meet the need for level monitoring in tank storage applications where overflow presents a risk to the environment, damage to the plant and is potentially harmful to people.

Level sensors for overspill protection

In tank storage applications the challenge for operators is to maximise tank capacity, while minimising the risk of hazardous spillage and overfill.

GWR devices are accurate, reliable and are being increasingly specified for these applications. The level data they generate is used for inventory management and to generate high level alarms to prevent a potential overspill condition. They are also used for low level alarms to prevent a possible pump overheating condition.

Level switches may also be installed as a high level alarm for overspill protection. Installed in combination with a GWR, they provide a second layer of protection and can act as an emergency shutdown switch.

GWR level transmitters are ideal for storage and buffer tanks containing oil, condensate, water or chemicals and can also measure both level and interface level in, for example, separator applications. They are also a good choice for waste tanks and underground tanks, such as sump pits, and can be used in both chamber and pipe installations.

Users have a range of GWR probe options to choose from to cover different applications. For example, co-axial probes provide a stronger signal in low dielectric fluids and are not affected by nearby objects or narrow, restrictive nozzles. However, they are susceptible to clogging and product build-

up. If the application involves liquids that tend to be dirty, sticky or can coat, then the preferred choice is a single lead probe type which has a minimal risk of contamination.

Wireless-enabled level measurement devices

Many tank storage installations are in remote locations where a cabling infrastructure may not be available. Although wireless level transmitters based on vibrating fork technology were introduced over three years ago, wireless enabled GWR devices have only recently become available. These devices have all the functionality and features of their wired equivalents but with the additional benefits provided by wireless technology.

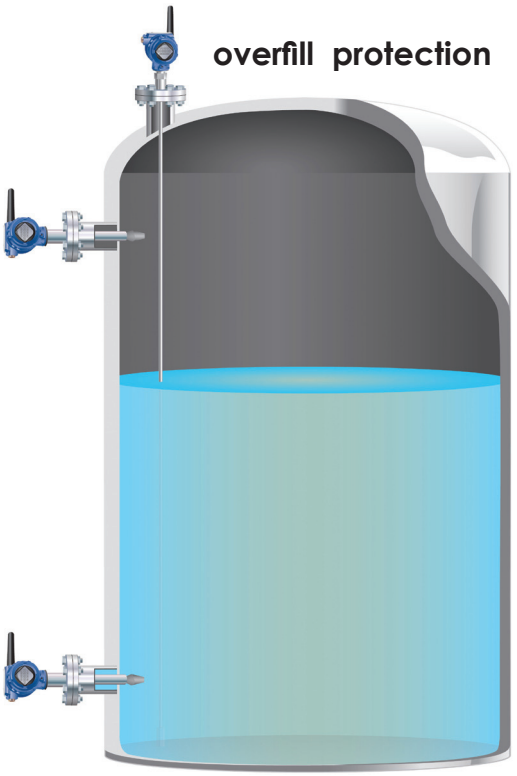
Wireless level transmitters can be configured and accessed from the gateway and are typically installed and operating in just a few hours – reliably transmitting data via a wireless gateway to a control system or data historian. Status information and device diagnostics are easily accessible from the control room, reducing maintenance requirements and enhancing operator safety by eliminating unnecessary field trips.

On existing installations, replacing older technology with the latest level measurement devices reduces maintenance and enables accurate measurement. Where no cabling exists, wireless presents a way to add visibility in tank storage applications.

Following extensive research and product engineering, Emerson has developed the industry's first true wireless GWR transmitter for continuous level and interface monitoring, the Rosemount 3308 Wireless GWR transmitter, with enhanced configuration and diagnostics feature.

The transfer of unique and proven solutions from the wired Rosemount 3300 and 5300 Series GWRs has made long battery life possible without compromising measurement reliability. By combining low power circuitry and unique Direct Switch Technology (which uses high speed switching for transmitting and receiving), power consumption and signal strength are balanced for optimal performance, providing a typical battery life of nine years. Battery life can be checked remotely and Device Dashboards help to reduce errors by providing a step-by-step configuration process from the control room or central location.

Wireless GWR transmitters are ideal for continuous level monitoring of storage tanks



Schematic showing wireless GWR and vibrating fork level transmitters

For overspill protection on critical applications, more stringent legislation now typically requires a level of redundancy to be installed. In addition, many companies are adopting technology diversification to further minimise risk. It is recommended that independent high level switch devices should be fitted to all tanks. These provide a safeguard from spills in the event of a fault or problem with the contents measuring instrumentation, or in case there has been an error in the translation of level measurement into volumetric contents. This provides a secondary method of overspill protection. Alarms are derived from fixed position switches or probes within the tank, which operate when the liquid makes contact with them. These should be used in addition to the measurement-derived high level alarms.

A good example of a wireless enabled vibrating fork point level sensor is Emerson's Rosemount 2160. Suitable for almost all liquid applications, it is virtually unaffected by changes in flow and product variations. Easy to install and maintain, the DiBt approved switch features an integral LCD display that shows switch output states and diagnostics to provide real time, accurate verification of process conditions. Any build-up, fork blockage or excessive corrosion is shown immediately by a change in fork sensor frequency, indicating that maintenance may be required. Typical applications include overfill protection, high and low level alarms, pump control (limit detection) and pump protection or empty pipe detection.

Summary

The introduction of wireless enabled GWR level transmitters to determine level, combined with wireless vibrating fork level sensors for low level and overspill protection, meet the need for accurate, reliable level and interface monitoring in remote or difficult to reach locations. They combine low cost installation with fast and simple commissioning and robust measurement data, providing remote visibility into operations, safely optimising tank usage and helping to avoid spills.

For more information:
www.Rosemount.com/level