

Soak up the sunlight

Kevin Smith, SignalFire Wireless Telemetry, USA, presents a case study where wireless tank gauging systems improve the accuracy of tank content level and temperature monitoring at a terminal.

An industry leader in the handling and storage of bulk liquid products throughout North America chose to replace an obsolete hardwired tank gauging system with a wireless solution to increase the accuracy of tank content level monitoring to ≤ 1 mm and temperature readings to $\leq 0.9^\circ\text{F}$. In addition to meeting International Organization of Legal Metrology (OIML) custody transfer requirements, the improved accuracy was important for inventory control as well as overflow and runout prevention. The bulk storage terminal business stores a variety of products including petroleum, biofuels, commodity/specialty chemicals, and vegetable/tropical oil products in tanks located in terminals throughout the country.

The decision to replace an existing wired tank gauging system was based on costs and the system's limitations in communicating over long distances. The network required repeaters between tanks, which increased installation complexity and costs. The system also did not easily support the addition of new tanks to the network due to its complicated configuration requirements.

Meanwhile, a wireless and solar-powered tank gauging solution enables operators to remotely monitor tank levels and temperatures for increased operational efficiency and compliance while reducing costs associated with product loss and inaccurate information. The solar-powered tank gauging system powers and transmits data from radar level transmitters and smart temperature sensors to a control system located at the terminal.



Figure 1. A configuration of HART nodes with a solar panel system installed on top of one of the terminals.



Figure 2. For easier installation, a custom-fabricated mounting bracket assembly supports the HART nodes and solar panel to provide the required power to the temperature sensor. The nodes gather data from the sensors and wirelessly transmit it to a gateway for download into an inventory software system.

How a wireless telemetry system works

In operation, HART® nodes with a solar panel system collect and transmit data from level and temperature sensors for transmission to a gateway via a HART signal. The HART nodes and solar panel system are installed on the roof of the terminals (Figure 1). A custom-fabricated mounting bracket assembly supports the nodes and solar panel for easier installation on the tanks (Figure 2).

A Modbus TCP ethernet module transfers information from a wireless mesh network to an ethernet network, where it is received by an inductive automation ignition human machine interface (HMI) via a Kepware driver that passes it to a tank inventory management software. With data collected from all measurement instruments on the tanks through the wireless telemetry system, the software gives operators a complete tank content overview, providing inventory and custody transfer functions with API net volume calculation. It also offers HART configuration and calibration, alarm handling and reporting, and proof-testing from a control room.

The wireless gauging system provides reliable data transmission over long ranges under different weather conditions using a proprietary 900 MHz radio network system. Critical instrument data, such as tank levels or temperatures, is sent to a control system up to 3 miles away and, in some cases, a further distance due to mesh technologies inherently built into the wireless network. Radio-based telemetry systems using communication networks based on a 2.4 GHz frequency band can only travel approximately 700 ft and would require a network of repeaters to communicate the equal distance of a 900 MHz solution. A configuration of the tank gauging system with its components is shown in Figure 3.

Overview of telemetry system components

Radar sensors replaced obsolete radar level transmitters to provide a continuous level measurement of liquids with an accuracy of ± 1 mm that falls within OIML custody transfer requirements stated with standard R85:2008.

New smart temperature sensors installed in various points throughout tanks provide individual spot or averaged temperature data. Up to 15 smart temperature sensors are integrated within one stainless steel, flexible cable probe. Mounted atop the storage vessel, the temperature sensors offer precision temperature correction in tank gauging systems involved in the transfer of product by level (not metering) measurement.

The plug and play capability of the level and temperature sensors make it easy to configure, install and fine-tune the system with minimum programming or configuration effort while offering a pre-engineered solution to achieve the custody transfer requirements.

The temperature component of the system provides a measurement for every specified foot to ensure a

more accurate volume calculation. As the walls and floor of the tank expand and contract by temperature, the actual volume varies by location.

An intrinsically safe wireless pressure sensor and radio serves as a pressure indicator on a nitrogen

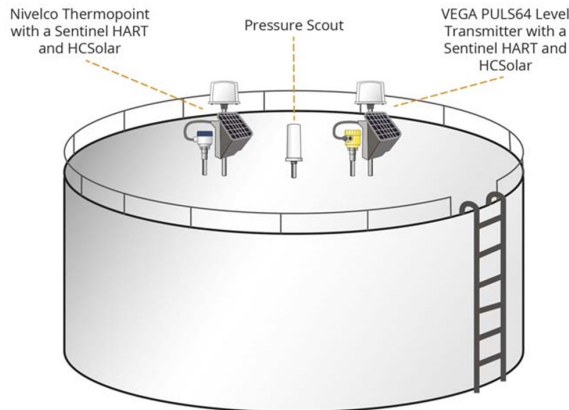



Figure 3. The new wireless tank level gauging system features HART nodes with a solar panel system that forwards data from level and pressure sensors to a gateway via a HART or analogue signal. The data is downloaded into a tank inventory software that gives operators a complete tank content overview, providing inventory and custody transfer functions with API net volume calculation.

pressure regulator for tank blanketing on some tanks, while a digital sentinel node provides a manual valve open-close indication of a chemical injection system for other tanks.

Tank upgrades now completed

One operator chose to install the wireless tank gauging system on 25 tanks at one site, which houses a total of 230 tanks. After a successful test, the company decided to install the systems on 21 tanks at an additional site, before upgrading another 25 tanks at the first location, retrofitting 71 tanks in total. A completely wireless telemetry solution, which powers the sensors by a solar source, can offer a more viable solution at a smaller cost compared to a wired solution that requires the level and temperatures to be hardwired to the tank.

By implementing a wireless solution, the bulk storage terminal company can add tanks to the network at its own pace, as it does not require conduit or other mechanical equipment for installation. Wherever tank level and temperature data are required from a remotely-located storage or process tank, a wireless tank gauging solution provides a cost-effective, time-saving, wireless, clean, and energy sustainable, solar-powered solution over traditional, hard-wired field topology.

The terminal company plans to implement the wireless tank gauging system in other terminals across the country in the future. 



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