

White Paper

How to Cure 7 Common Tank Gauging Headaches



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Many terminals and tank farms struggle because they use outdated equipment resulting in unreliable operation, inefficient routines and high operational costs. Solving these issues will improve performance and profitability.

There are many reasons why a refinery, chemical plant, bulk liquid storage terminal or other facility handling large volumes of liquids needs to know exactly how much product is in any given tank. When products change hands, or when petroleum products are moving in or out, commercial and safety issues are hugely important. Still, the devices and systems used to gauge tank contents often don't receive enough attention from facility owners and operators, causing problems in these and other areas:

- Despite substantial safety and regulatory concerns, and potential incidents, large numbers of tank gauging devices do not operate correctly.
- Despite the enormous monetary values of products changing hands regularly, many tank gauging devices lack appropriate levels of accuracy and reliability.
- Despite the high degree of sophistication available with modern tank gauging and inventory management solutions, many facilities depend on manual procedures and inefficient systems.

Those responsible for inventory management and custody transfer often do not give these systems much thought because they may believe the technologies are static and there is little to be gained from making improvements. As a result, they settle into familiar but ineffective work practices, believing the kinds of inefficiencies and uncertainties they deal with daily are simply part of life. Fortunately, this doesn't have to be the case.

Working with a variety of companies and industries, engineers and tank gauging experts from Emerson™ have compiled a list of seven issues common to a large number of locations. Fortunately, they can all be corrected, resulting in significant operational improvements and financial benefits.

Here are the seven most common issues, mistakes or misunderstandings which arise again and again across many different tank farms spanning the globe:

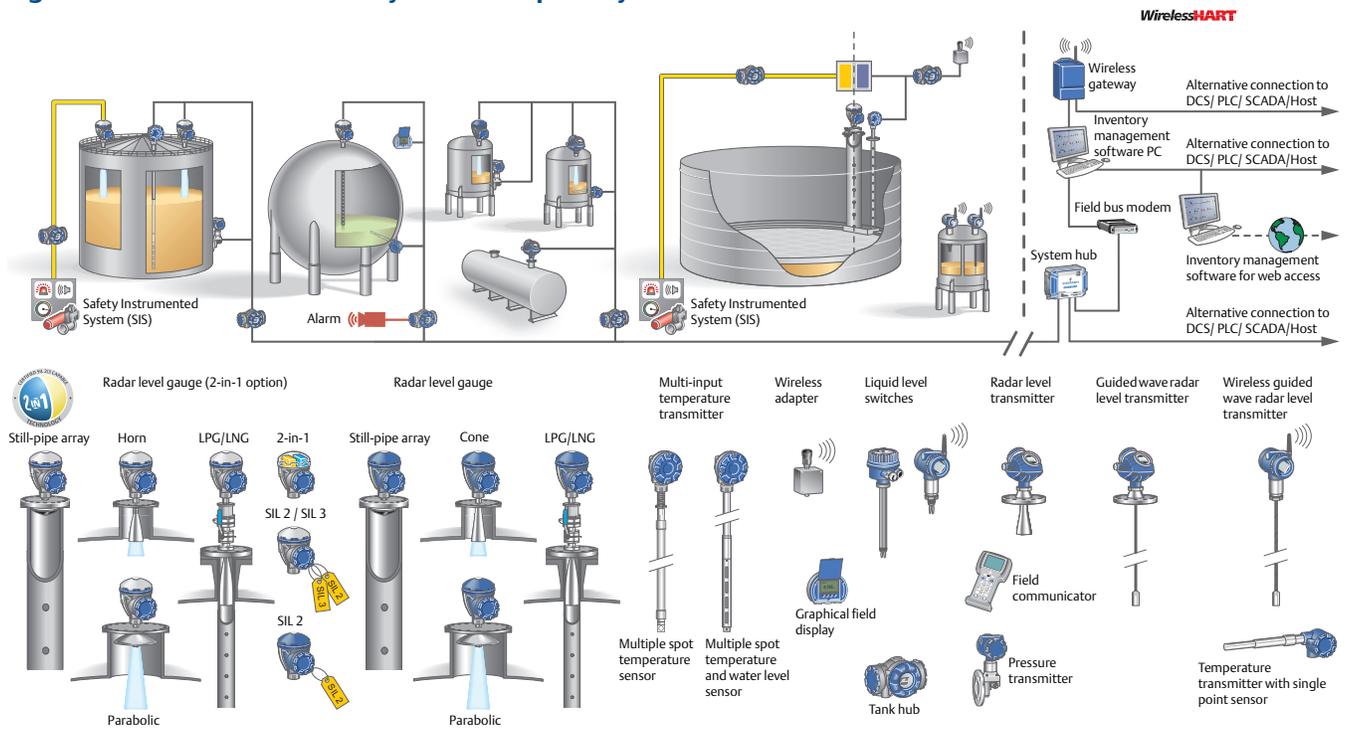
1. Systems lack scalability and flexibility
2. Inadequate safety systems
3. Inaccurate measurements
4. Obsolete components
5. Complicated software
6. Mechanical systems require frequent maintenance
7. Nonexistent lifecycle support

1. Systems lack scalability and flexibility

Keeping track of a large group of tanks requires a tank gauging system able to bring in all of the individual level and temperature measurements into one place, and to then convert each tank’s readings to net volume. Older systems lack flexibility to use different gauging technologies, and they lack the scalability necessary to add devices, instruments and measurements. Consequently, users believe they are stuck with their existing installations just as they are, and there is nothing they can do about it.

This is not true because those old platforms can be extended or replaced. Today’s systems are capable of working with a wide variety of new and old measuring technologies, and they make adding of new devices much easier. Selecting tank gauging devices should not be a one-size-fits-all approach, but should instead be a flexible process to accommodate a wide variety of applications and performance requirements.

Figure 1. Combine Devices Freely into a Complete System



Today there are a wide range of radar gauges available to solve specific problems related to different types of tanks and contents. These devices can be networked using a variety of protocols to seamlessly interface with the distributed control system (DCS), the supervisory control and data acquisition (SCADA) system, and the safety instrumented system (SIS). The options available now extend far beyond traditional methods available when most tank farms were built.

More current software can work with a variety of old and current protocols, bringing together many product families and specialized field devices. A data concentrator, for example a tank hub, can combine the data from multiple field devices connected to a specific tank, or even a group of tanks to make the installation cost effective and reliable. Level gauges, temperature sensors, water level sensors and other devices can be combined so they are accessible in a new or legacy network effectively.

Tanks involved in critical custody transfer applications can add supplementary measurements in addition to high precision level, such as high accuracy temperature sensors to calculate and convert net volumes.

In some cases, communication reliability can be improved without the need for additional wired infrastructure. Depending on local regulations and facility best practices, wireless adapters for existing devices, and natively wireless instruments, can extend sensing and monitoring capabilities without major additions to the plant's existing wired infrastructure. With the tank gauging system improvements now available, all these upgrades are possible and practical.

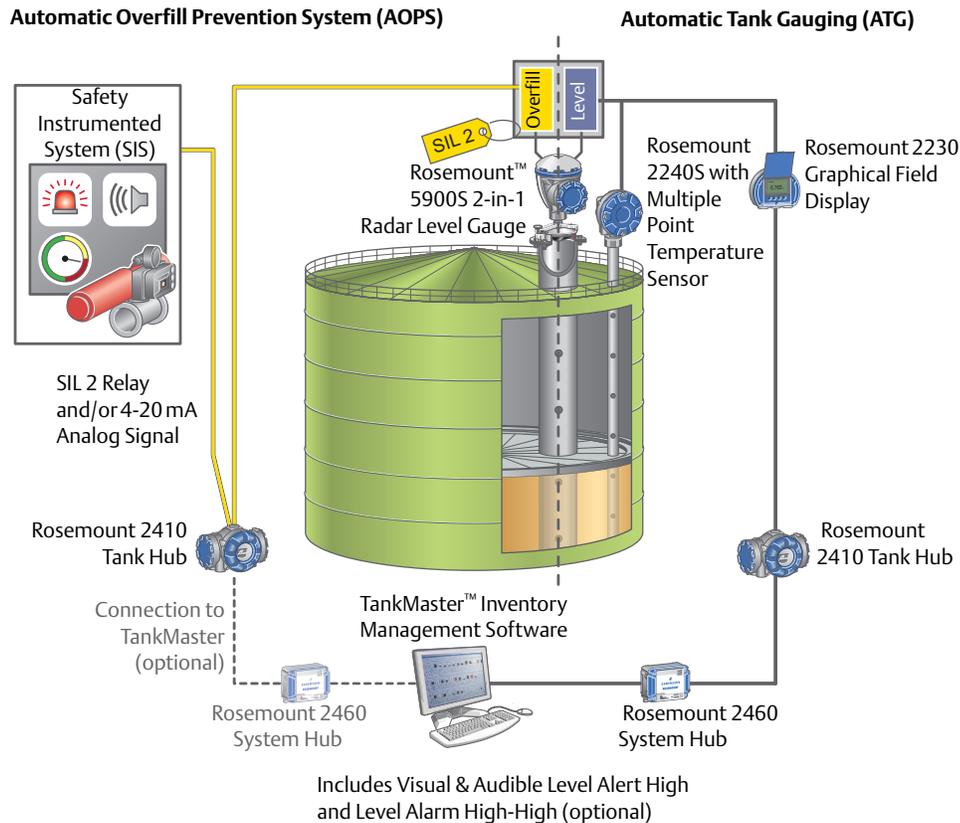
2. Inadequate safety systems

Many plants and tank farms were built before today's safety standards were widely distributed and followed. Overfill prevention might be nothing more than strategically placed mechanical switches designed to stop the flow in the nick of time. Unfortunately, few of these meet the requirements of IEC 61508 / 61511, and bringing older equipment into compliance is now more critical.

The kinds of radar level gauges available today provide a safety system with continuous surveillance of a tank's contents, whether the level is going up, down or remaining static. Radar level gauges are certified and proven in use for storage tank safety applications, and are a critical part of an IEC 61508/61511, SIL 2 or SIL 3 as well as an API 2350 compliant system. Newer safety systems using these units maintain a much closer watch on filling operations as part of the overfill prevention system, and even have the ability to detect leakage if a decrease in level has no apparent operational cause.

The 2-in-1 gauge can serve the same function as two devices: one for normal level monitoring as required by the tank gauging system, and a second safety measurement in compliance with API 2350 and IEC 61511 with a SIS/SIL certificate. Both measurements are continuous, accurate and reliable – and they function completely independent of each other. One state-of-the-art radar device, mounted in place of a single traditional float-and-tape level gauge, can thus perform both measurement and safety functions.

Figure 2. Two Independent Radar Gauges in One Tank Opening

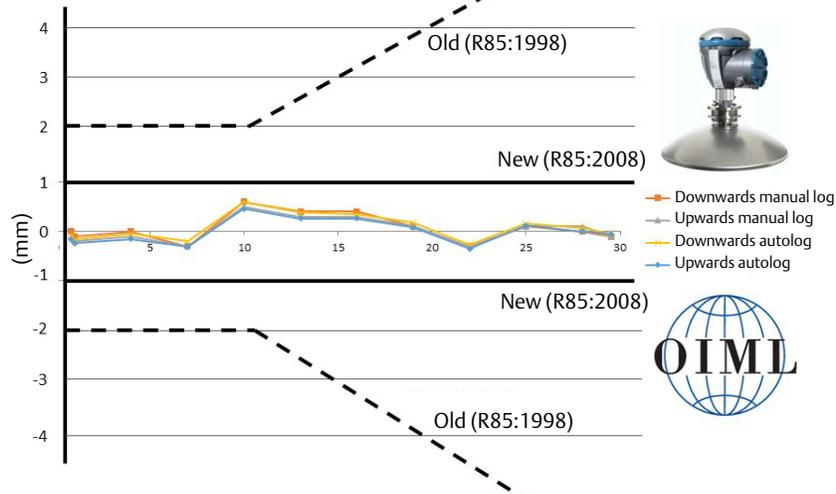


3. Inaccurate measurements

Tank gauging instruments are often the heart of custody transfer and asset management systems. They might work in conjunction with sophisticated flow meters, but in many applications, the level and temperature measurements are the sole basis for calculating how much product has changed hands. Given the size of many terminal storage tanks, a difference of a millimeter or two in level measurement can equal hundreds or even thousands of barrels. Every drop counts, because a measurement discrepancy can cause the terminal operator a significant inventory loss, or leave the customer shorted, neither desirable in the long term.

Today's radar level gauges are capable of an absolute and repeatable accuracy with an error range less than 0.5 millimeter. This exceeds the requirements of OIML (International Organization of Legal Metrology) R85:2008. Moreover, corresponding tank gauging systems are able to incorporate secondary measurements such as temperature to achieve the precise total quantity by either mass or volume. These systems can be OIML certified along with a variety of other institutes, and can easily stand up to the toughest third-party verifications and audits.

Figure 3. Strengthen Accuracy with Radar Level Gauges



Bottom line: using a precise radar gauge can deliver a 90 percent reduction in volume uncertainty when compared to a less sophisticated radar level gauge or servo gauge, and a 180 percent reduction over traditional methods such as float-and-tape. The difference can total hundreds of thousands of dollars over a year when replacing older technologies, and up into the millions of dollars when replacing malfunctioning existing systems.

4. Obsolete components

The level gauging devices mounted on many tanks date back to original construction. Some may have been updated here and there, but at many facilities, few level gauging devices have been replaced outside of situations where there have been complete failures.

Some facilities enjoy the benefits of improved technologies, replacing float-and-tape or servo devices with radar level gauges, but other users conclude there is no way for them to make such improvements. This conclusion is erroneous because radar gauges can work with the old tank gauging system using an emulation mode. The new radar device can be programmed to respond like a float-and-tape or servo unit to work seamlessly with the existing inventory management system.

Figure 4. Emulation – Migrate Legacy Systems Seamlessly

Modern radar level gauges can be installed in existing tank nozzles and interface with existing management systems.

So even if the existing system is old and can't readily handle new technologies, the new gauging devices can still deliver improved accuracy and reduced maintenance headaches. When the overall tank gauging system is upgraded, the emulation capability can be turned off, allowing the new instrument to deliver its full range of information and diagnostics.

Adding new wired instruments is the traditional method for creating a new measurement point, however wireless instruments are a convenient and practical alternative. Wireless radar gauges can send measurement information to a wireless gateway without having to install new cables. The gateway is then hardwired to the tank gauging system to deliver level and other measurement information via standard industry protocols.

If an existing level gauge has failed completely, or another measuring point needs to be added, it is a simple matter to install a wireless radar gauge interfaced with the tank gauging system. Any necessary process and diagnostic data can be transmitted and collected without the need for new cabling, making adding a new device far simpler. A cluster of new devices, including both level and temperature instruments, can send their information together using only one wireless transmitter when such a device is attached to a data concentrator able to collect the information and consolidate it into one signal.

Emulation and wireless make it practical to upgrade a system incrementally, bit by bit as the situation demands or as funds are available. It is not necessary to launch a large-scale CAPEX project to fix everything at once. Instead, gains made from initial efforts can be proven, making it easier to justify and get approval for the next stage of upgrades.

5. Complicated software

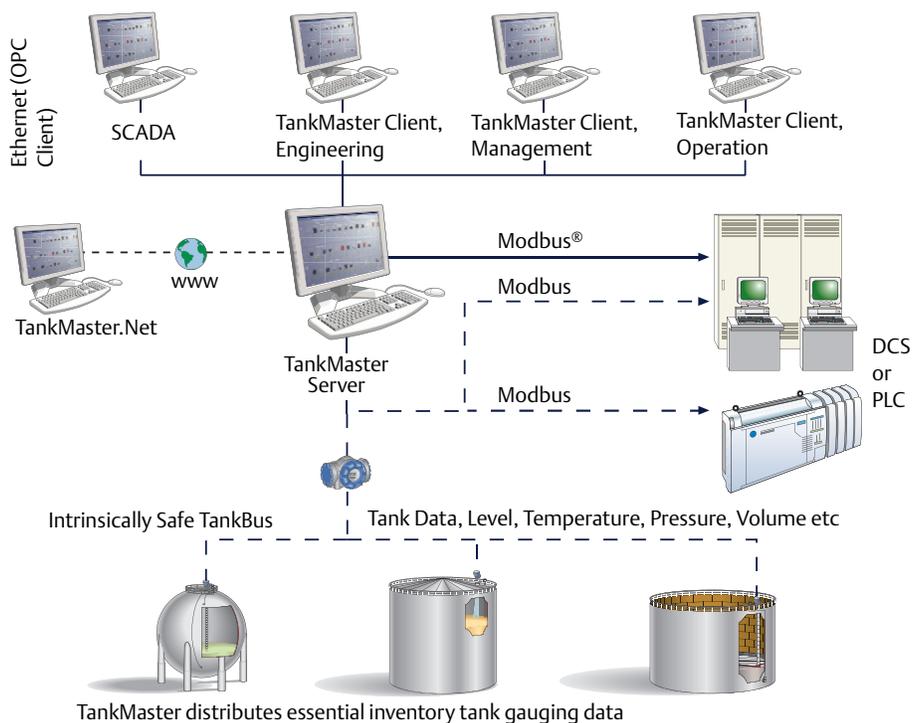
For some facilities, bolting on a new tank level instrument might be the easiest part of the process. Getting the new instrument to communicate with the tank gauging system, so it can process the signal and send it to the right place might be the harder part of making an upgrade. In some situations, it can be virtually impossible. The inventory management software should be straightforward and easy to use, providing the calculations necessary to convert a level measurement to net volume.

The inventory management system has to provide a variety of critical functions:

- Operator human-machine interface (HMI)
- Converting the level and temperature measurements into the desired units (volume, mass, available space, etc.)
- Real-time data reporting to the control room
- Alarm setpoints and handling
- Automated report handling

If adjustments to accommodate changing operational demands or new equipment installations are hard to implement, the facility remains stuck in its rut until it can be updated. Newer software platforms are far easier to use, with intuitive programming and HMIs, and they integrate seamlessly with higher level process control and enterprise level systems.

Figure 5. Access Tank Gauging Data Anywhere, Anytime through Easy-to-Use Interface



In addition to handling the mechanics of reading levels and collecting data, the right software platform can provide integrated inventory management capabilities including:

- API tables
- Net standard volumes
- Custody transfer approvals
- Batch handling
- Automated and manually generated reports

The ability to do all these things and more without the need for custom code is one of the major advantages of an up-to-date integrated platform designed specifically to work with terminals and tank farms of all sizes.

6. Mechanical systems require frequent maintenance

Traditional level measuring devices are mechanical in nature and have many moving parts. Consequently, there are always opportunities for malfunctions. If the float does not move freely up and down the guides due to dirt or debris, the reading can be thrown off even if everything else is working properly. If something within the control unit develops problems, the mechanism can jam. Eventually these units drift out of calibration, often without plant personnel realizing the change. When the situation is discovered, those units require testing and adjustment.

Newer level gauging technologies have no moving parts and nothing extending into the liquid. Non-contacting radar devices barely extend into the tank at all and have no moving parts. Many radar level instrument configurations have self-diagnosing capabilities able to determine if the antenna parts are getting coated with dirt or build-up. A loss of signal strength is an indicator of fouling, and can warn maintenance of accumulations long before they degrade the device's ability to read accurately. For many radar level gauges, the cost of spare parts is effectively \$0 because failures of any kind are exceedingly rare. MTBF for many of the critical parts is measured in decades.

Figure 6. Reduce Maintenance Spending and Improve Safety



Mechanical level instruments need regular maintenance and repair, requiring dangerous trips to the tank top.

7. Nonexistent lifecycle support

When systems contain a hodge-podge of equipment, getting one company to help with an issue can be a challenge. It is always somebody else's problem. If a malfunction is clearly connected to a single piece of equipment there might be some help, but if doubt can be cast on another element in the system, it probably will be. Buying from a variety of suppliers isn't always a planned activity and often happens on a piecemeal basis, but it comes at a price – erratic and generally poor support.

For this and other reasons, some operators want to have one supplier responsible for the entire tank measurement system, but often find this isn't practical if their chosen company can not provide the range of products and services necessary. The ideal situation is adopting a lifecycle strategy developed in partnership with the right kind of supplier. Working with a company capable of providing the right products and ongoing support creates a high degree of reliability and system performance.

Figure 7. Partner with a Trusted Advisor Knowing Your Business



Addressing the issues

Fortunately, all of these issues can be effectively addressed. The first step is connecting with the right kind of partner – a supplier able to provide an open and scalable tank gauging system, including a full range of level and temperature measuring instruments, along with all the necessary supporting networking hardware for new and installed equipment. To make it all work seamlessly from the individual device to the enterprise level, a comprehensive and flexible inventory management software platform is needed to tie everything together.

This type of a system will not only address the seven common tank gauging issues, it will also deliver additional benefits immediately and over the life of the facility. It lets you take control of your tank farm, enabled by superior accuracy, reliability and overfill prevention.

For more information, see
EmersonProcess.com/Rosemount-TankGauging.

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