

A COST-EFFICIENT TANK GAUGING SOLUTION

Tomas Hasselgren, global business development manager for tank gauging at Emerson, explains how emulation technology helps organisations replace old or malfunctioning equipment for safer operations

MANY OF the world's bulk liquid storage tanks have been in service for a long time and rely on ageing tank gauging systems to support both overflow prevention and inventory management. Many systems are based on level measurement devices using servo technology. Although widely used, these devices have numerous drawbacks, including a poor reliability record and the need for regular maintenance.

Servo gauges are mechanical devices with many moving parts, suffering constant wear and tear. Hence, regular maintenance and recalibration, and a large spare parts stock is needed. Servo gauges have a mean time between failures (MTBF) of less than five years and, because their accuracy depends on external conditions such as hysteresis, temperature and density, they are prone to measurement errors.

THE BENEFITS OF RADAR TECHNOLOGY

In stark contrast to servo gauges, the latest radar devices provide extremely accurate and reliable measurements, with the mean time between failure for critical parts measured in decades. Their design minimises maintenance requirements because they have no moving parts, and they have advanced diagnostics

to automatically monitor device health during operation.

Although many terminal operators wish to replace their servo gauges with modern radar level gauges, they are prevented from doing so due to communication compatibility issues. Historically, most manufacturers of tank gauging equipment have provided proprietary fieldbus options for the communications between their devices and the control room. Because the electrical interface and protocol software is specific to each manufacturer, this prevents devices developed by other manufacturers from communicating within the implemented tank gauging system.

So, if an organisation wanted to partially upgrade their system or replace individual devices, the only option would be to buy equipment from the original system supplier. Installing equipment from another supplier would typically require separate cabling installed for another fieldbus network, a second operator display in the control room and a second interface added to the existing distributed control system – which would be costly and time-consuming.

An alternative to upgrading individual devices is to replace a tank gauging system – including level temperature and pressure instrumentation, data communication devices and inventory management



software – in one go. This would eliminate the issue of proprietary communications. However, installing a new complete system is often regarded as cost-prohibitive, overly complex, time-consuming and requiring a significant period of downtime. With many tanks and gauges being taken out of operation while a new system is installed, the resulting reduction in capacity and throughput would impact operations and have serious financial implications for the operator.

RADAR GAUGES EMULATING SERVO GAUGES

A solution to this challenge is provided by gauge emulation. Gauge emulation makes it possible to perform easy and cost-efficient tank gauging system upgrades incrementally. Emulation refers to the ability of the latest gauges to 'speak the language' of servo devices, enabling these older gauges to be seamlessly replaced by modern radar gauges from alternative vendors. Emulation enables the legacy technology to be replaced when the budget is available – one gauge at a time if necessary – with minimal disruption.

However, before servo gauges can be replaced, operators must first make sure the emulating level gauge is electrically compatible with the existing tank gauging system cabling. And secondly, all measurement data the tank gauging system host expects to receive from the level gauges must be supported. That means if, for example, pressure, density, flow rate or some other data is measured by the existing gauge, the emulating



gauge must be able to produce the same measurement data.

Also, there may be software commands sent out from the tank gauging system host that will require a response from the gauge, even though they are irrelevant for the new emulating gauge. For example, a radar gauge emulating a servo gauge might receive the command 'raise the displacer to top'. Despite being irrelevant for a radar gauge, which has no displacer, it must still provide a proper response to prevent an alarm message occurring.

TECHNOLOGY SOLUTIONS

The large number of servo gauges still in use are from a variety of manufacturers and use different proprietary communication protocols. In general, they are all suitable for emulation because the vendors have continued to use the same fieldbus hardware and the software protocol has changed little.

When looking to upgrade the gauges, users may not want to continue to source them from the original vendor. This may be because the vendor no longer offers the right technology or cannot provide the appropriate support. It could also be because alternative manufacturers offer more advanced solutions.

Emerson has 50 years of experience in radar level measurement. Its Rosemount 5900 Series is a modern radar level gauge that can emulate a broad range of legacy gauges and different proprietary fieldbus protocols, when used in conjunction with a Rosemount 2410 Tank Hub for communicating with the host system. In addition, its ability to be installed within an existing tank opening makes the replacement of servo gauges very quick and easy. The Rosemount 5900 can also communicate with open standard protocols, such as Foundation Fieldbus or Modbus. This functionality is important as it enables connection to these different communication networks should they be deployed at a later point.

EMULATING OLDER, UNRELIABLE RADAR GAUGES

As well as emulating servo gauges, modern radar level gauges can also emulate older and/or less reliable radar devices. A good example of this was provided at a large gas separation plant in Thailand. Radar level gauges were installed to provide critical level and volume measurements in spherical liquefied petroleum gas (LPG) tanks. However, these instruments proved unreliable, with the level measurements fluctuating and then recovering again, seemingly without reason. So, feeding-in and feeding-out activities were stopped,

causing feeding pumps and valves to shut off. This led to frequent downtime.

The plant owners wanted to upgrade the radar level gauges but to communicate with the control room system, the field device communication protocol needed to be compatible with the existing communication protocol. The entire tank gauging system could have been replaced in one go but this was considered cost-prohibitive. Instead, on each of its 19 tanks, the company replaced the unreliable devices with Rosemount 5900S Radar Level Gauges with a 4-inch LPG antenna, specially designed for spherical tanks. Using emulation technology, the upgrade was performed step-by-step. Consequently, the plant now has a safe and reliable tank gauging system, with the upgrade performed at a pace and budget that suited the company. The plant owners estimate that this upgrade with emulating gauges saved them around \$45,000 (€ 41,500) in downtime, operational expenditure and man-hours.

HOST SYSTEM EMULATION

In addition to gauge emulation, Emerson also provides host system emulation, which enables the old tank management system equipment to be upgraded but still communicate with the existing legacy gauges. Using the Rosemount 2460 System Hub, measurement and status data can be collected from servo or radar gauges from a broad range of vendors using a variety of proprietary communication protocols. The hub forwards the data to the new tank management system to provide the operator with a real-time overview.

An example of host system emulation is a tank terminal owned by a leading sugar cane ethanol manufacturer in Brazil, which wanted to improve its efficiency. The site was equipped with legacy tank gauging equipment, including servo gauges and communication interface units (CIU). Data communication

between the tank gauging field devices and the host system was based on a proprietary protocol. Technical support for the CIU was lacking and spare parts were expensive or unavailable, making the terminal highly vulnerable to device faults. In addition, the CIU didn't offer the possibility of integration with modern automation equipment and host systems.

When the terminal's owners decided to replace the existing CIU, Emerson provided its Rosemount 2460 System Hub with emulation. The Rosemount 2460 could emulate the protocol communication with both the existing servo gauges and the host system. No changes in the servo gauges or in the host system were required. The system hub also enables future communication updates, redundancy capability, plus inventory management calculations.

The company now benefits from a modern, future-proof communications device which is fully supported by Emerson. There is no longer any need to risk operational disturbances from obsolete data communication equipment.

For more information:

To find out more about Emerson's emulation technology, visit stand M17 at StocExpo in Rotterdam on 14-16 March.

www.emerson.com/TankGaugingEmulation
www.stocexpo.com

- 01** The Rosemount 5900 Series radar level gauge can emulate a broad range of legacy gauges and different proprietary fieldbus protocols
- 02** A leading sugar cane ethanol manufacturer in Brazil replaced its existing communication interface units with Emerson's Rosemount 2460 System Hub
- 03** Emulating Rosemount 5900S radar level gauges from Emerson were installed on all 19 tanks at a large gas separation plant in Thailand



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