Intelligent Buoyancy Level Measurement, Part 2:

New Software-Based Tools Can Tackle Long-Time Cost and Operating Challenges

Authors: Philipp Michel, Joseph DiOrio, Oliver Niederheiser, Ab Punte

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How digital tools can simplify management and reduce the costs of instrument acquisition, commissioning, and long-term operation

Along with the design advances that led to the innovative LevelStar family of buoyancy level transmitters from Foxboro, the LevelStar product team examined how intelligent, software-based features could play a role in simplifying and reducing the costs of owning and operating a buoyancy level measurement device over its operating life. Specifically these include:

- Costs of acquisition
- Costs of commissioning
- Costs of long-term operation and maintenance, particularly the costs involved with periodic removal and recalibration of traditional buoyancy level instrument designs

Costs of acquisition. Traditionally, buoyancy level devices rely on several elements of information before they can be ordered. Two key elements are the predicted density of the liquid and the measurement length. These enable the device maker to select appropriate displacer material, to create the displacer, and to calibrate the measuring mechanism of the instrument to work optimally with the expected density of the fluid.

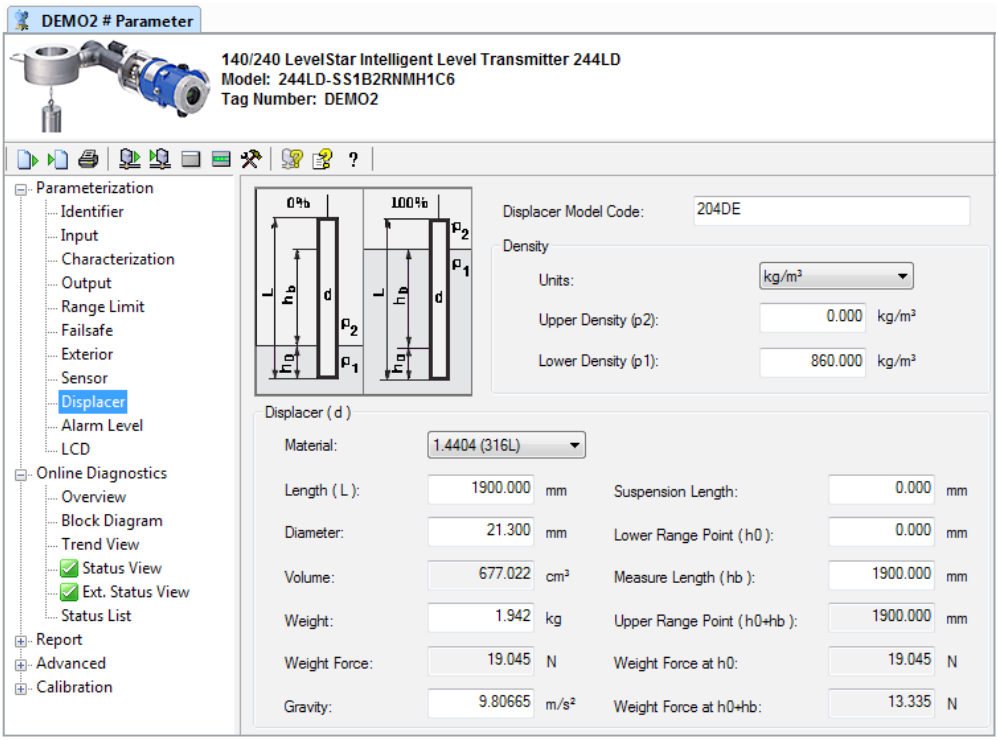
Only after installing and commissioning the device can you know whether your predictions were correct. In fact, it is quite common for fluid densities to vary considerably from original projections used for ordering. For example, the consistency and density of crude oil flowing from wells can vary based on geography and formation type, or may change rapidly during extraction and handling based on the presence of other fluids. In process applications, the actual density of a product or feedstock also can vary based on circumstances of production, variations in temperature and pressure, or other factors.

No matter the reason, coping with these unforeseen errors in fluid type or density can bring unanticipated costs, including the need to halt production, remove a recently installed instrument, and recalibrate it. While it's possible to recalibrate some instruments in a plant instrument lab, the process often requires them to be returned to the manufacturer.

This is why, together with the innovative direct-coupled force sensor, the LevelStar product also includes an easy-to-use "digital tools manager," or DTM. The DTM is a software-driven user interface that allows customers to adapt and optimize the factory-calibrated LevelStar instrument by modifying a range of operating parameters. This easy-to-use capability means that, following the original factory calibration for accuracy, a LevelStar instrument will never have to be removed for recalibration.

An example illustrates how this capability works: The customer's order predicted the density of crude oil in a wellhead storage tank to be 0.862. However, the consistency of the oil is actually 0.867, a small but still significant difference. Instead of having to remove a traditional buoyancy level measurement instrument for recalibration, all that the user of the LevelStar instrument needs to do is bring up the Digital Tools Manager and change the Upper Density and Lower Density values to correspond with the current fluid characteristics (see Illustration). Should process conditions change again in a manner that affects fluid density, all the user needs to do is to bring up the DTM and change the density values once again.

Modifying application parameters using Digital Tools Manager software



Costs of commissioning. Beyond making a quick adjustment to a key operating parameter such as a changing density value, the LevelStar DTM offers users a dramatically simpler and faster way to manage all aspects of commissioning, operation, and long-term maintenance.

Based on the customer order, many key operating parameters are already completed by the factory and displayed on the screen. To complete the startup, users must input only four key items, using the same DTM display as was shown above:

- Displacer, length in mm
- Displacer, diameter in mm
- Displacer, mass in kg (including suspension weight)
- Upper and lower process liquid density values (kg/m^3)

This intelligent configuration capability, together with the hysteresis-free design of the instrument's precise, direct-coupled force sensor, means that following the factory calibration, the LevelStar needs only periodic verification of load cell operation[1]. This simple bench test virtually eliminates the need for factory-based recalibration.

Costs of routine maintenance. Due to their more complex mechanical designs, traditional buoyancy level measurement instruments require periodic maintenance, calibration, and adjustments to ensure that they are working properly. But in operating environments the LevelStar technology offers the cost-saving potential of automating not only buoyancy level measurement, but instrument monitoring and maintenance.

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[1] Foxboro, the manufacturer of LevelStar™ devices, does not recommend any particular test intervals for our level measurement devices. Generally, plants that are certified to TÜV or SIL are obligated to follow specifications offered by these certifying organizations. We note that test intervals for measurement devices may be affected by a wide range of factors, including, but not exclusive to:

- Aggressiveness of the media
- Clumping or curing of the media
- High levels of mechanical vibration
- Process dynamics, particularly when no process damping methods are used

Conclusion

The latest generation of intelligent buoyancy level measurement devices, typified by the Foxboro LevelStar, leverages the capabilities of advanced sensor design with the power of software-driven configuration and diagnostic tools to meet the challenges of level, interface, and density measurement in a simpler, more elegant, and easier-to-manage way.

The innovative LevelStar design eliminates the variability and hysteresis associated with the mechanical linkages used in traditional buoyancy level instruments, together with the high costs of instrument removal for periodic calibration. At the same time, its powerful, software-driven features enable rapid and precise process configurations or changes, sustain greater repeatability in measurement, and boost accuracy from a typical 0.5% to 0.2% or better of full span measurement.

Thanks to intelligent calibration, diagnostic, and communication features, the guesswork and cost long associated with periodic shutdowns, troubleshooting and removal-repair-recalibration of traditional buoyancy level instruments can be virtually eliminated. Management strategies that strive for improved asset management, greater process utilization and uptime, optimum levels of automation, and minimal staffing can be realized.

Foxboro

38 Neponset Avenue
Foxboro Massachusetts 02035 USA
Toll free within the USA 1 866-746-6477
Global +1 508-549-2424

www.schneider-electric.com

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