



PROCESS INSTRUMENTATION

Siemens LR250 level transmitter provides consistent solution for tank farm monitoring

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Situation

Refining of vegetable oils is essential to ensure removal of gums, waxes, phosphatides, and free fatty acid (F.F.A.) from the oil. It is also used to provide uniform color by removing coloring pigments and to eliminate unpleasant smells by removing odorous matter. Refining is carried out either by batch operation or a continuous operation.

A vegetable oil refiner wanted to automate their raw material level measurements and was looking for a monitoring system that would provide real-time product inventory and available freeboard per tank. (Freeboard is the volume between the actual liquid level and the design full level mark). When a rail car of crude vegetable oil arrives at the plant, it is important to know that the receiving storage tank will have sufficient room to accommodate the oil shipment. At this plant, storage tank levels were previously being measured manually. This required a worker to climb to the top of a tank and take a manual level measurement. Since product shipments are by weight, the freeboard needed to be calculated in pounds of product in order to determine if sufficient room was available for the oil transfer.

Challenges

Product measurement

The oil product inventory (both crude and refined) is measured in pounds. In order to calculate weight, the volume of oil in the storage tank must be measured and the density of the oil must also be known. With large straight wall storage tanks, the volume of the tank is affected by the height of the liquid. The greater the height, the more pressure is exerted on the tank walls. Therefore, the change in volume per change in level is not a constant, and a simple volume formula is not suitable. Strapping tables are developed to simplify the calculation; they relate outage liquid level to volume. Also, each oil product has a different density with different coefficients of expansion. Since they are stored in outdoor storage tanks, the density is not necessarily constant. The monitoring system needs to continuously read the outage level and product temperature. With these measurements, the system must calculate the product inventory per storage tank and determine the available freeboard in weight.

Inventory management

This vegetable oil refiner needs the ability to change the oil type stored in each tank without the need for continuous

recalculations for varying densities. Vegetable oils come from domestic and international sources and are harvested at different times of the year. From a programming point of view, the oil type is independent of the storage tank. This means that the density calculations cannot be hard coded into the storage tank weight calculation.

Siemens solutions

Level measurement

The vegetable oil facility has over 90 storage tanks located in multiple tank farms distributed throughout the plant. The level in each storage tank is being measured with a SITRANS LR250 radar level transmitter. The LR250 instrument provides continuous monitoring of liquid levels up to 65 feet with a 0.118 inch accuracy. It is a loop-powered device available with either a 4-20 mA analog output signal, Foundation Fieldbus, or PROFIBUS PA digital communications. For this application, the 4-20 mA output with HART communications model was used and the transmitter was configured using SIMATIC PDM software via a HART modem. The output signal was configured to indicate the storage tank outage level in feet from the design full level mark, and for this non-contacting level transmitter, the density of the liquid is not a required property for an accurate level measurement.

Temperature measurement

The temperature in each tank is now being measured with a SITRANS TH300 temperature transmitter using an RTD sensor. The TH300 is a loop-powered transmitter that provides a 4-20 mA output signal and supports HART communications. The temperature transmitter was configured using SIMATIC PDM software via a HART modem and the output signal was configured to indicate the oil temperature in degrees Fahrenheit. Each storage tank is insulated and heated, and contains an agitator that ensures an even temperature distribution. SIMATIC PDM is not only a software tool for configuration and diagnostics, but it stores the initial setup or the latest saved configuration that can be used for value comparison any time in the feature.

Data acquisition

The level and temperature values are brought to a programmer logic controller (PLC). The controller reads the level and temperature signals directly as 4-20 mA analog inputs signals. In addition, the controller handles the volume, density and weight calculations, and tank graphical representation displayed on a flat monitor.

Inventory management

Instead of depending on manual level and temperature measurement, the PLC continuously reads the storage tank outage level and temperature. It calculates the volume based on the storage tank's strapping table profile and calculates the density based on the oil type. In addition to the product weight, it calculates the available freeboard and manages the high level alarming. Finally, all tank measurements, calculations, and high



Tank monitoring system using RD 500



Tank monitoring system using SITRANS LR250 radar level transmitter.

level alarm status information is made ready available for display in the control room and remote monitoring stations. graphical displays and remote monitoring stations.

Remote monitoring stations

The facility's plant manager wanted multiple employees, located throughout the plant, to have access to the tank farm monitoring system. In addition to this, he also wanted to provide access to remote clients via a web server using a standard internet browser.

Benefits

Easy to install – Small narrow beam on the LR250 radar level transmitter allows installation practically anywhere on your vessel. Infrared handheld programmer allows for local set up or use of SIMATIC PDM via HART® or PROFIBUS PA. The Start Wizard guides the user during setup.

Increased Productivity – Using the Siemens automated solution vs. a manual measurement allows decisions based on easy access to real-time data. Alarming options allows user to ensure that the correct tanks are being filled or emptied as needed and eliminating dispatching delivery trucks with partial unloaded cargo.

Remote monitoring –The SITRANS RD500 is ideally suited for remote data management including, remote web visualization of instrumentation data, data logging and alarming of critical events with countless opportunities to reduce logistics costs for inventory management and the ability to better integrate instrumentation data into corporate information systems.

Legal Manufacturer

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