Application Note

THORNTON
Leading Pure Water Analytics

Power Plant Conductivity Measurement

In Water Treatment and Cycle Chemistry

Conductivity measurement throughout a power plant treatment system from raw water to ultra-pure water has typically required a variety of sensors to span the range. With new sensor technology this is no longer necessary and, at the same time, higher accuracy can be achieved.

Makeup Water Measurements

Monitoring and controlling makeup water treatment systems using reverse osmosis requires multiple conductivity measurements of feed and product water. With seawater feed, the conductivity can run especially high, near 50 mS/cm, which normally necessitates high cell constant, 4-electrode or inductive conductivity sensors.

As water moves through the RO system, dissolved mineral concentration and conductivity are sequentially reduced, requiring many more measurement points, usually with progressively lower cell constant sensors. Finally, deionized product water can be produced at < 0.06 µS/cm where conductivity provides the final quality indication. This measurement often needs a very low cell constant. From the RO system input to the output there is a reduction in conductivity of nearly six orders of magnitude! Confirmed high measurement accuracy of the final product water is essential to prove compliance with guidelines and standards for water purity. Where water treatment is outsourced, dependable continuous measurement of product water is necessary to verify fulfillment of contract specifications.

Sensor Simplification

With the appropriate choice of sensor technology, all of the above measurements can be made using a single model of conductivity sensor. Conductivity measurement using Intelligent Sensor Management (ISM®) technology opens up a whole new range of capabilities. UniCond® conductivity sensors with ISM have their measuring circuit, calibration memory and analog-to-digital conversion built in. The on-board measuring circuit enables optimized measuring techniques. There are no limitations imposed by long leadwire resistance and capacitance. The circuit includes internal auto-ranging that is able to achieve unprecedented rangeability. Only a digital signal is output by the sensor and neither the conductivity nor the temperature measurement are affected by long cable runs.

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All UniCond sensor calibration data is stored in integral memory so it can never be lost or mixed up if sensors and transmitters are interchanged. The combination of both integral measuring circuit and memory means that the factory calibration accuracy and the installed accuracy are identical. There is no degradation of performance regardless of cable length or routing. Use of correct calibration data is assured.

Cycle Chemistry Measurements

Many cycle chemistry samples include suspended corrosion product particles released during plant startups and load changes. These particles can become trapped between the electrodes of conventional conductivity sensors used to measure pure waters. This results in a partially shorted sensor and erroneously high conductivity readings. UniCond sensors have considerably wider electrode spacing than other conductivity sensors for pure water ranges. This enables UniCond sensors to operate in the presence of corrosion products with no loss of performance.

UniCond sensors can provide particularly accurate measurements on cycle chemistry samples. Their certified ASTM- and NIST-traceable calibration of cell constant and temperature measurement provide assurance of highest accuracy factory and operating calibration. Industry-leading accuracy is achieved because calibration includes both the sensing elements and the measuring circuit and there are no changes caused by installation.

UniCond conductivity sensor technology with ISM, provides the highest performance available for makeup water and cycle chemistry measurements.

Conductivity sensors—left, conventional closely spaced electrodes; right, wider spacing available with UniCond sensors

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AN-0134 Rev A 07/12