Optical pH Sensors

Polestar’s optical pH Sensors are designed specifically to work with Polestar’s DSP Series Optical Process Monitors. A fully configured Polestar Process Monitoring system includes a DSP Series transmitter an optical cable (available in a variety of lengths), a probe housing (available in a range of traditional and single-use formats), and a sensor.

- Physiologic Range pH 6-9

Features and Benefits

- Rugged, glass-free construction suitable for use where glass electrodes are not
- Rapid response: t<sub>90</sub> < 40 seconds
- Made from USP Class VI materials
- Compatible with real-world process conditions, including CIP
- Sterilizable by gamma, autoclave, SIP
- Available in any of Polestar’s traditional or single-use probe configurations
- Pre-calibrated for plug-and-play use (or simple 1- or 2-point user calibration)
- Minimal maintenance
- Long-term dry storage

Applications

- Bioprocessing
- Food and beverage
- High-purity water
- Fuels and Biofuels
- Environmental monitoring

Basis of Detection

Polestar's optical pH sensors operate on the principle of “signal magnitude ratio” (SMR). Each sensor film incorporates a fluorescent indicator covalently attached to a robust hydrophilic polymer membrane. The DSP detector sequentially excites the indicator at two distinct wavelengths (isosbestic point and deprotonated maximum), and then ratios the two emission signals.

This ratio becomes ‘dimensionless’ and robust to variations in optical coupling efficiency, etc. Using the supplied lot-specific calibration factors, the DSP then converts SMR to pH.

While SMR varies with pH across a range somewhat wider than the specified limits for any given sensor, the narrower specified range is given, as it is the range over which the system is most responsive – at the extremes of the response range, the change in SMR per change in pH decreases sharply. Among the calibration parameters included with each lot of pH sensor are the detection limits over which the DSP will be allowed to compute pH values. Measured SMR values outside this range will return the appropriate upper or lower pH reading, along with an indication of “pHUR” (under range) or “pHOR” (over range), indicating that the computed pH for the measured SMR is outside the defined range.

Because it is inherently self-referencing, this detection approach eliminates the potential for measurement error arising from changes in sample turbidity, refractive index, viscosity, or color. This ensures stable, drift-free calibration and hence reliable measurements throughout the lifespan of a sensing element.
### Optical pH Sensor Performance Specifications

<table>
<thead>
<tr>
<th>Detection Range</th>
<th>pH 6-9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Precision</strong></td>
<td>±0.02 @ pH 7.0</td>
</tr>
<tr>
<td><strong>Accuracy (1-point cal)</strong></td>
<td>±0.29 @ pH 6.0 – 8.0</td>
</tr>
<tr>
<td><strong>Response time (t&lt;sub&gt;90&lt;/sub&gt;)</strong></td>
<td>&lt; 40 seconds</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>2 – 50 °C</td>
</tr>
<tr>
<td><strong>Calibration</strong></td>
<td>1-point user defined within range of operation</td>
</tr>
<tr>
<td><strong>Cross-sensitivity</strong></td>
<td>Low ionic strength, fluorescent molecules</td>
</tr>
<tr>
<td><strong>Sterilization</strong></td>
<td>Autoclave, Steam In Place, Clean In Place, Gamma</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>USP Class VI certified</td>
</tr>
<tr>
<td><strong>Storage conditions</strong></td>
<td>Dry or wet and in the dark</td>
</tr>
<tr>
<td><strong>Shelf life</strong></td>
<td>2 years stored dry and in the dark</td>
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1 These specifications are for the stated conditions. Performance may vary under different application conditions.

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