TELEDYNE
ANALYTICAL INSTRUMENTS
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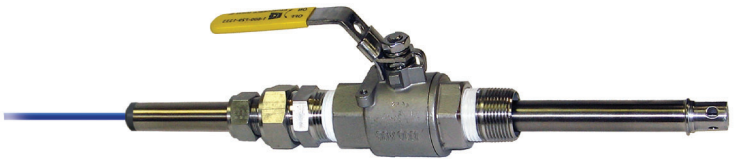
# SP3 & SP3X SERIES

## SMART SENSORS

The SP3 and SP3X Smart Sensors can be configured for many liquid measurements by selecting among many flexible type of sensors such as:

- Amperometry style sensor cartridges for pH, specific ion (pION), or ORP
- Galvanic style sensor cartridge for ppm or ppb Dissolved Oxygen analysis
- Polarographic sensor for free chlorine, total chlorine, and chlorine dioxide
- Conductive style sensor for contacting conductivity, inductive (Toroidal) conductivity, or resistivity
- Optical sensors: Optically activated Dissolved Oxygen, Turbidity & Total Suspended Solids



See detailed sensor configuration matrix on pages 5 - 7 for available sensor set up. Contact factory if selection not available.

# Electrodes for SP3 / SP3X Sensors

## Fixed Electrodes - Conductivity

Conductivity is a measurement of a solution's ability to conduct electricity. The SI unit expressed in conductivity is micro-Siemens (uS), mili-Siemens (mS) or Siemens (S). Conductivity is a non-ion specific sensor and it can be correlated to total dissolved solids (TDS) measurement, which is commonly used to gauge water purification system's performance. The electrical conductivity of a solution is determined by measuring the resistance of solution between two fixed electrode surfaces, ideal for (1uS to 50 mS). Alternatively, when solution conductivity is high (50mS to 1S), an inductive method, Toroidal type sensors, can be utilized for the measurement.

### Contacting Conductivity:

Available in both SP3 / SP3X sensor platform, range of this sensor is 1uS to 50mS. Typically used from high purity water application to industrial waste water application. Material of contacting conductivity probe is SS316, Titanium (General Purpose & FM), Hastelloy, or Poly Propylene

### Non-Contacting Toroidal Conductivity:

Toroidal conductivity is available for range of 50mS to 1S, applied for sea water or solution with high salinity. Material for Toroidal Conductivity is Kynar (PVDF) by standard, and available for SP3 sensor platform.

## Optical Sensors: Turbidity & Suspended Solids (TSS), Optical DO (ODO)

### Turbidity & Suspended Solids (TSS) Sensor:

The Turbidity & Suspended Solids (TSS) sensor comes with two optical configurations, which minimizes the error from reflecting surfaces: front mounted optics – ideal for direct immersion into basin style pool, side mounted optics – ideal for flowing processes in pipeline or flow cell. Water Proof or water resistant cable allowing the most robust use onsite, see SP3-TSS brochure for details.

### Optical Dissolved Oxygen (ODO) Sensor:

The Optical Dissolved Oxygen sensor uses fluorescence quenching to determine the oxygen concentration in water The use of the optical method minimizes maintenance, increases reliability and improves the long term accuracy of the Oxygen measurement. See SP3-ODO brochure for details.

## Replaceable Electrodes: pH, ORP, Specific Ion (pION), DO

Designed for toughness while keeping measurements versatility, the SP3 and SP3X sensor probes comes with interchangeable and replaceable electrodes that can be adapted for the most demanding applications.

- Chemical Resistant & Physically Rugged Electrode Body
- Chemical Resistant O-rings
- Long Electrode Life span
- Rugged glass bulbs
- Rugged bulb Protection against Physical Stress
- Optional sensor diagnostic for pH, ORP or pION electrodes displayed on the transmitter

Measurements done by Teledyne Electrodes for SP3 / SP3X Sensor:

| Measurement | Range | pH Range Required | Temperature Range | Sentinel Diagnostics |
|---|---|---|---|---|
| Ammonium | 0.05 to 18,000 ppm | 2 to 8 pH | 32° to 104°F (0° to 40°C) | Y |
| Bromide | 1 to 80,000 ppm | 1 to 12 pH | 32° to 176°F (0° to 80°C) | Y |
| Cadmium | 0.1 to 11,200 ppm | 3 to 9 pH | 32° to 176°F (0° to 80°C) | Y |
| Calcium | 0.1 to 40,000 ppm | 3 to 11 pH | 32° to 104°F (0° to 40°C) | Y |
| Chloride | 2 to 30,000 ppm | 1 to 12 pH | 32° to 176°F (0° to 80°C) | Y |
| Copper | 1 to 6,300 ppm | 2 to 6 pH | 32° to 176°F (0° to 80°C) | Y |
| Cyanide | 0.1 to 260 ppm | 10 to 14 pH | 32° to 176°F (0° to 80°C) | Y |
| Dissolved $O_2$ (ppb) | 0.01 to 20 ppm | No Limitation | 14° to 176°F (-10° to 80°C) | N |
| Dissolved $O_2$ (std.) | 1 to 20 ppm | No Limitation | 14° to 176°F (-10° to 80°C) | N |
| Fluoride | 0.02 to 2,000 ppm | 2 to 8 pH | 32° to 176°F (0° to 80°C) | Y |
| *High Temp. pH | 0 to 14 | No Limitation | 32° to 266°F (0° to 130°C) | Y |
| Lead | 2 to 20,700 ppm | 4 to 8 pH | 32° to 176°F (0° to 80°C) | Y |
| Nitrate | 0.1 to 14,000 ppm | 3 to 11 pH | 32° to 104°F (0° to 40°C) | Y |
| ORP | -1500mV to +1500mV | No Limitation | 14° to 176°F (-10° to 80°C) | Y |
| Potassium | 0.1 to 40,000 ppm | 2.5 to 11 pH | 32° to 104°F (0° to 40°C) | Y |
| Silver | 0.1 to 107,000 ppm | 1 to 12 pH | 32° to 176°F (0° to 80°C) | Y |
| Sodium | 0.2 to 23,000 ppm | 6 to 12 pH | 32° to 176°F (0° to 80°C) | Y |
| Standard pH | 0 to 14 | No Limitation | 14° to 194°F (-10° to 90°C) | Y |
| Sulfide | 0.01 to 32,000 ppm | 11 to 14 pH | 32° to 176°F (0° to 80°C) | Y |

* Contact factory for this application.

# Specifications

| | SP3 Smart Sensor | SP3X Smart Sensor |
|---|---|---|
| **Dimensions** | 3/4" O.D. x 10", 17", 24", 30", 36" | |
| **Body Material** | SS316, Titanium, Hastelloy (C22), Kynar (PVDF), Polypropylene (PP) | SS316, Titanium (FM Only), Hastelloy (C22), Kynar (PVDF), Polypropylene (PP) |
| **O-Ring** | Viton, Ethylene Propylene (EPR), Viton 75 (VIT75), Kalrez (KLZ), CV75 | |
| **Probe Glands** | 3/4" SS316, Ti, Hastelloy, PVDF, PP or 1" PVDF, PP | |
| **Retraction Valves** | 1" SS316, Ti, Hastelloy, PVDF | |
| **Sensor Cable Connector** | Integral (no connector), Straight (axial) detachable connector | FM B3X Barrier & Connector, ATEX/IECEx Connector |
| **Cable Length** | No Cable - if detachable connector<br>10ft, 20ft, 30ft, 40ft, 50ft, 100ft | 10ft, 20ft, 30ft, 50ft |
| **T-Handle** | No Handle, T-handle with Lanyard (std. for Valve Retraction) | |
| **Electrode: pH** | Range: 0 to 14<br>*Temperature: 14° to 194°F (-10° to 90°C)<br>Optional: 32° to 266°F (0° to 130°C)<br>Pressure Range: 0-100 psig @ 194°F (90°C)<br>Temp. Comp.: 32° to 212°F (0-100°C) (Auto), ± 0.36°F (0.2°C) | |
| **Electrode: ORP** | Range: -2000mV to +2000mV<br>*Temperature: 14° to 176°F (-10° to 80°C)<br>Pressure Range: 0-100 psig @ 194°F (90°C)<br>Temp. Comp.: 32° to 212°F (0-100°C) (Auto), ± 0.36°F (0.2°C) | |
| **Electrode: pION** | Range: See sensor data sheet, ppb, ppm & ppt<br>*Temperature: See sensor data sheet<br>Pressure Range: 0-100 psig @ 194°F (90°C)<br>Temp. Comp.: 32° to 212°F (0-100°C) (Auto), ± 0.36°F (0.2°C) | |
| **Electrode DO** | Range: 0 to 20 ppm, 0 to 150% SAT<br>*Temperature: 14° to 176°F (-10° to 80°C)<br>Pressure Range: 0-65 psig @ 194°F (90°C)<br>Temp. Comp.: 32° to 212°F (0-100°C) (Auto), ± 0.36°F (0.2°C) | |
| **Conductivity & Resistivity** | Range: 1uS to 50uS, 0-20 Mohm<br>*Temperature: 23° to 212°F (-5° to 100°C)<br>Optional: 23° to 302°F (-5° to 150°C)<br>Pressure Range: 0-100 psig @ 194°F (90°C)<br>Temp. Comp.: 32° to 212°F (0-100°C) (Auto), ± 0.36°F (0.2°C) | |
| **Inductive Conductivity (Toroidal)** | Range: 0.5mS to 1000mS<br>*Temperature: 23° to 212°F (-5° to 100°C)<br>Pressure Range: 0-100 psig @ 194°F (90°C)<br>Temp. Comp.: 32° to 212°F (0° to 100°C) (Auto), ± 0.36°F (0.2°C) | N/A |
| **Optical DO (ODO)** | Range: 0-20 mg/L (0-20 ppm), 0-200% SAT, 0-400 hPa (0-6 psi)<br>*Temperature: 41° to 122°F (5° to 50°C)<br>Response Time: T90 = 60 sec<br>Accuracy: < 2% of Range<br>Repeatability: ± 0.5% of Range<br>Resolution: 0.01 ppm or 0.01% SAT<br>Process Connection: G1 Thread or 3/4" FNPT | N/A |
| **Turbidity & Suspended Solids (TSS)** | Range: 0-1000NTU, 0-4000NTU, or <40NTU (Flow Cell/Debubbler ONLY)<br>*Temperature: 41° to 122°F (5° to 50°C)<br>Pressure: 50 psi / 3.5 bar max. in flow cell<br>Sensor Body: CPVC or Polypropylene (opt.)<br>Process Connection: 1" NPT | N/A |

*Although some electrode temperature ratings may be higher than that of the sensor probe (SP3/SP3X) the lower rating is the official temperature rating of the complete sensor apparatus.

# Model Codes

| | Code | SP3 | SP3X |
|---|---|---|---|
| A-Measurement | 0 | SP3 Digital Sensor: pH, ORP, pION | |
| | 1 | SP3 Digital Sensor: Dissolved Oxygen | |
| | 2 | SP3 Digital Sensor: Conductivity - 1uS to 50mS | |
| | 3 | SP3 Digital Sensor: Inductive Cond. - 1mS to 1S | N/A |
| | 4 | SGTC Sensor: No Digital Preamp | N/A |
| | 5 | Diagnostic SP3 Digital Sensor pH, ORP, pION | |
| | 6 | SP3 Digital Sensor: ppb Dissolved Oxygen | |
| | 7 | SP3 Digital Sensor: Resistivity - 0.00-50Mohm | |
| B-Sensor Style | 0 | Insertion | |
| | 1 | Valve retractable style with blow out protector | |
| C-Housing | 00 | 316SST - 10", 3/4" OD (Std - Insertion) | |
| | 01 | 316SST - 17", 3/4"OD (Std - Valve Retractable) | |
| | 02 | 316SST - 24", 3/4" OD | |
| | 03 | 316SST - 30", 3/4" OD | |
| | 04 | 316SST - 36", 3/4" OD | |
| | 10 | Titanium - 10", 3/4" OD | |
| | 11 | Titanium - 17", 3/4"OD | |
| | 12 | Titanium - 24", 3/4" OD | |
| | 13 | Titanium - 30", 3/4" OD | |
| | 14 | Titanium - 36", 3/4" OD | |
| | 20 | HASTELLOY - 10", 3/4" OD | |
| | 21 | HASTELLOY - 17", 3/4"OD | |
| | 22 | HASTELLOY - 24", 3/4" OD | |
| | 23 | HASTELLOY - 30", 3/4" OD | |
| | 24 | HASTELLOY - 36", 3/4" OD | |
| | 40 | KYNAR (PVDF) - 10", 3/4" OD - Inductive Cond. | N/A |
| | 41 | KYNAR (PVDF) - 17", 3/4" OD - Inductive Cond. | N/A |
| | 50 | Polypropylene - 10", 3/4" OD | |
| | 51 | Polypropylene - 17", 3/4"OD | |
| | 52 | Polypropylene - 24", 3/4" OD | |
| | 53 | Polypropylene - 30", 3/4" OD | |
| | 54 | Polypropylene - 36", 3/4" OD | |
| | XX | Other Materials/Length (Custom) | |
| D-Process Connection | 00 | No Fitting or Valve Assembly | |
| | 01 | 3/4" MNPT 316SS Gland, Nylon Ferrule | |
| | 02 | 3/4" MNPT 316SS Gland, TFE Ferrule | |
| | 03 | 3/4" MNPT 316SS Gland, SST Ferrule | |
| | 04 | 3/4" MNPT Hastelloy Gland, TFE Ferrule | |
| | 05 | 3/4" MNPT Titanium Gland, TFE Ferrule | |
| | 06 | 3/4" MNPT, All Polypropylene Fitting | |
| | 07 | 3/4" MNPT, All Kynar Fitting | |

| | Code | SP3 | SP3X |
|---|---|---|---|
| D-Process Connection | 08 | 3/4" MNPT, All TFE Fitting | |
| | 09 | 3/4" MNPT, Fitting Set For 1" Ball Valve | |
| | 10 | 1" MNPT All Nylon Fitting | |
| | 11 | 1" MNPT All Polypropylene Fitting | |
| | 12 | 1" MNPT All Kynar Fitting | |
| | 29 | Other Materials/Lengths (Custom) | |
| | 30 | 1" NPT SS316 Valve, Nylon Ferrule | |
| | 31 | 1" NPT SS316 Valve, TFE Ferrule | |
| | 32 | 1" NPT SS316 Valve for 3/4" Inductive Cond. | |
| | 33 | 1" NPT Hastelloy Valve | |
| | 34 | 1" NPT Titanium Valve | |
| | 40 | 1" NPT Kynar Valve | |
| | 41 | 1" NPT Kynar Valve for 3/4" Inductive Cond. | N/A |
| | 42 | 1" NPT Polypropylene Valve | |
| | 43 | 1" NPT Polypropylene Valve for 3/4" Inductive Cond. | N/A |
| | | Reserved for Future Use | |
| E-Sensor Connectors | 0 | None, Integral Sensor Cable | N/A |
| | 1 | Detachable Sensor Connector, Straight (Axial) | N/A |
| | 3 | N/A | FM Approved Sensor Assembly w/ B3X Barrier & Connector |
| | 4 | N/A | FM Approved Connector Only (use as spare sensor) |
| | 5 | N/A | ATEX/IECEx Approved Connector |
| F-Cable Length | 0 | No Cable | N/A |
| | 1 | 10 ft. | 10 ft. |
| | 2 | 20 ft. | 20 ft. |
| | 3 | 30 ft. | 30 ft. |
| | 4 | 40 ft. | N/A |
| | 5 | 50 ft. | 50 ft. |
| | A | 100 ft. | N/A |
| | X | Other Length (Contact Factory) | |
| G-Handle | 0 | No "T" Handle | |
| | 1 | "T" Style Handle with Lanyards for Valve | |
| | 5 | 3/4" T Handle with Detachable Connector - Insertion | N/A |
| | 6 | 3/4" T Handle with Detachable Connector - Valve | N/A |
| | 7 | 1" T Handle with Detachable Connector - Insertion | N/A |
| | 8 | 1" T Handle with Detachable Connector - Valve | N/A |
| H-O-Rings for Electrode and Process Connection | 0 | VITON | |
| | 2 | EPR | |
| | 3 | KALREZ | |
| | 7 | EPR Valve and Fitting O-Ring | |
| | 8 | KALREZ Valve and Fitting O-Ring | |
| I-Electrodes | 000 | Select for No Electrode, Conductivity and Resistivity | |

| | Code | SP3 | SP3X |
|---|---|---|---|
| I-Electrodes | 001 | General Purpose, Radel Body, TFE REF, Flat pH Glass 14° to 194°F (-10° to 90°C) | |
| | 003 | High Purity Water, Radel Body, TFE REF, Full pH Glass 14° to 194°F (-10° to 90°C) | |
| | 030 | Platinum ORP, PT CAP, Peek Body, TFE REF, 14° to 176°F (-10° to 80°C) | |
| | 031 | Platinum ORP, PT WIRE, PES Body, TFE REF, 14° to 176°F (-10° to 80°C) | |
| | 040 | DO, 0 - 20 ppm, Peek Body, Glavanic, Lead/Silver, 14° to 176°F (-10º to 80°C), 2 MIL | |
| | 042 | DO, 0 - 20 ppm, Peek Body, Glavanic, Lead/Silver, 14° to 176°F (-10º to 80°C), 5 MIL | |
| | 043 | DO, ppb, Peek Body, Glavanic, 14° to 176°F (-10º to 80°C) | |
| | 070 | Ammonia, Radel Body, TFE REF, 0.05 - 18,000 ppm 32° to 104°F (0° to 40°C) | |
| | 071 | Ammonium, Radel Body, TFE REF, 0.05 - 18,000 ppm 32° to 104°F (0° to 40°C) | |
| | 072 | Bromide, Radel Body, TFE REF, 1 - 80,000 ppm 32° to 176°F (0° to 80°C) | |
| | 073 | Cadmium, Radel Body, TFE REF, 0.1 - 11,200 ppm, 32° to 176°F (0° to 80°C) | |
| | 074 | Calcium, Radel Body, TFE REF, 0.1 - 40,000 ppm, 32° to 104°F (0° to 40°C) | |
| | 075 | Chloride, Radel Body, TFE REF, 2 - 30,000 ppm, 32° to 176°F (0° to 80°C) | |
| | 076 | Copper, Radel Body, TFE REF, 1 ppb - 6,300 ppm, 32° to 176°F (0° to 80°C) | |
| | 077 | Cyanide, Radel Body, TFE REF, 0.1 - 260 ppm, 32° to 176°F (0° to 80°C) | |
| | 078 | Fluoride, Peek Body, TFE REF, 0.02 - 2,000 ppm, 32° to 176°F (0° to 80°C) | |
| | 079 | Lead, Radel Body, TFE REF, 0.02 - 20,700 ppm, 32° to 176°F (0° to 80°C) | |
| | 080 | Nitrate, Radel Body, TFE REF, 0.1 - 14,000 ppm, 32° to 104°F (0° to 40°C) | |
| | 081 | Nitrite, Radel Body, TFRE REF, 0.5 - 460 ppm, 32° to 104°F (0° to 40°C) | |
| | 082 | Potassium, Radel Body, TFE REF, 0.1 - 40,000 ppm, 32° to 104°F (0° to 40°C) | |
| | 083 | Silver, Radel Body, TFE REF, 0.1 - 107,000 ppm, 32° to 104°F (0° to 40°C) | |
| | 084 | Sodium, Radel Body, TFE REF, 0.2 - 23,000 ppm, 32° to 176°F (0° to 80°C) | |
| | 085 | Sulfide, Radel Body, TFE REF, 0.01 - 32,000 ppm, 32° to 176°F (0° to 80°C) | |
| | 301 | General Purpose, Radel Body, TFE REF, Full pH Glass 14° to 194°F (-10° to 90°C) (w/ Diagnostic) | |
| | 303 | High Purity Water, Radel Body, TFE REF, Full pH Glass 14° to 194°F (-10° to 90°C) (w/ Diagnostic) | |
| | 330 | Platinum ORP, PT CAP, Peek Body, TFE REF, 14° to 176°F (-10° to 80°C) (w/ Diagnostic) | |
| | 370 | Ammonia, Radel Body, TFE REF, 0.05 - 18,000 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 371 | Ammonium, Radel Body, TFE REF, 0.05 - 18,000 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 372 | Bromide, Radel Body, TFE REF, 1 - 80,000 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 373 | Cadmium, Radel Body, TFE REF, 0.1 - 11,200 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 374 | Calcium, Radel Body, TFE REF, 0.1 - 40,000 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 375 | Chloride, Radel Body, TFE REF, 2 - 30,000 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 376 | Copper, Radel Body, TFE REF, 1 ppb - 6,300 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 377 | Cyanide, Radel Body, TFE REF, 0.1 - 260 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 378 | Fluoride, Peek Body, TFE REF, 0.02 - 2,000 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 379 | Lead, Radel Body, TFE REF, 0.02 - 20,700 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 380 | Nitrate, Radel Body, TFE REF, 0.1 - 14,000 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 381 | Nitrite, Radel Body, TFRE REF, 0.5 - 460 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 382 | Potassium, Radel Body, TFE REF, 0.1 - 40,000 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 383 | Silver, Radel Body, TFE REF, 0.1 - 107,000 ppm, 32° to 104°F (0° to 40°C) (w/ Diagnostic) | |
| | 384 | Sodium, Radel Body, TFE REF, 0.2 - 23,000 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |
| | 385 | Sulfide, Radel Body, TFE REF, 0.01 - 32,000 ppm, 32° to 176°F (0° to 80°C) (w/ Diagnostic) | |

# TELEDYNE
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