Conductivity sensors measure the specific conductance of liquid processes. The specific conductance is directly related to the presence of ionic species and their concentration. Barben Analytical offers a full range of two electrode and four electrode contacting conductivity sensors for a variety of industrial measurement applications.

**Two Electrode Conductivity Sensors**
- Designed for pure water and other low to medium conductivity applications.
- Threaded in-line, submersible, and “Hot Tap” retractable product options
- Large range of cell constants to ensure the sensor range properly matches the application.

**Four Electrode Conductivity Sensors**
- Ideal for medium to high conductivity applications
- A great low cost alternative to toroidal sensor technology
- Additional electrode pair compensates for particulate and scale build-up.
- Threaded in-line, submersible, and “Hot Tap” retractable product options
- Sensor diagnostics (analyzer dependent)

**Compatibility with All Major Vendor’s Electronics**
- Proven with major vendors of conductivity analyzers (Rosemount, ABB, E&H, Mettler Toledo, Knick)
- Improve your measurement by replacing only the sensor
- Wiring information available

**Industrial Mounting Options**
- Mounting fittings for sample line installations
- Submersible cleaners and scrubbers
- Ball Valve “Hot Tap” retraction solutions
- Variety of materials for corrosive applications
Liquid Conductivity
Two & Four Electrode Sensors

Well known for industrial pH sensor technology; Barben Analytical also provides a full range of two and four electrode industrial conductivity sensors to support your applications.

Two Electrode Sensor Technology

Two electrode sensors provide a simple, time-proven method for conductivity measurement. Precision machined electrodes of various sizes (cell constants) are matched to the process based on their measurement range. Two electrode sensors are recommended for use in clean (non-coating) applications such as the following:

- Ultrapure Water
- Demineralized / Deionized Water
- Reverse Osmosis
- Water for Injection
- Boiler Water

Four Electrode Sensor Technology

As the name suggests, four electrode sensors add an additional pair of electrodes to the two electrode sensor design. This second pair of electrodes provides sensor diagnostics which can then be used to compensate the measurement if scale or particulate build-up occur on electrodes. Four electrode conductivity sensors can withstand coating and scale which might otherwise foul a traditional two electrode sensor. Typical applications include the following:

- Leak Detection
- Condensate Return
- Salinity
- Chemical Concentration
- Clean-In-Place

Sensor Technology
(How it works)

Two electrode conductivity measurement is based on the ability to conduct a current between two electrodes. The concentration of ions in the liquid are directly proportional to the conductance of the liquid.

Pros
- Simple, time-proven electrode design
- Industry standard cell constants determine measurement range.
- Works best for clean applications where electrodes do not get fouled.
- High accuracy and repeatability.

Cons
- Susceptible to coating and scale (no compensation)
- Susceptible to corrosion
- No diagnostics

Four electrode sensor designs keep a constant current through two of the electrodes and let the drive voltage change. If fouling occurs then the drive voltage can be increased to compensate the measurement.

Pros
- Compensation for coating and build-up
- Wide measurement range
- Sensor diagnostics if fouling is too great (analyzer dependent)
- No polarization effect

Cons
- Not as accurate as two electrode sensors at low conductivity
- Susceptible to corrosion
- Limited availability of analyzers (ABB, Rosemount, Mettler Toledo, Knick)
- Conductive field can be distorted by pipe walls and flow cells
Liquid Conductivity
Two & Four Electrode Sensors

Typical Measurement Ranges for Two & Four Electrode Sensors

Conductivity (MicroSiemen/CM²)

Sensor Selection: Mounting

Mounting should be considered as part of sensor selection. Examples of various process mounting configurations are provided below.

In-line Sensor Mounting: In-line installations are common on sample streams from the main process. The sensor may be mounted in a piping tee or a flow cell. The electrodes should be fully exposed to the process flow. Four Electrode Sensors require at least 1 inch of clearance from pipe walls to avoid any distortion of reading. Isolation valves should be upstream / downstream of sensor for removal.

Hot Tap Sensor Mounting: Hot Tap refers to the ability to remove the sensor from the process while under pressure. A ball valve is used to isolate the sensor for removal.

Submersible Mounting: This mounting style is used when the sensor is installed in a tank, or open channel. The sensor must be mounted on a “dip tube” which is the hardware to submerge the sensor in the application.
Liquid Conductivity
Two & Four Electrode Sensors

Model CS10 / CS51
Two Electrode Threaded In-line, Submersible

The threaded CS10 / CS51 products are ideal for clean water sample stream applications using the NPT process connection. The same NPT adapter fitting can be reversed to mount the sensor in submersible installations.

Wetted Material
- Electrodes: 316 Stainless Steel
- Insulator: Teflon
- Seals: EPR
- Mounting: Polypropylene or 316 Stainless

Pressure / Temperature Ratings

<table>
<thead>
<tr>
<th>Sensor Design</th>
<th>Max. Pressure / Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polypropylene Adapter</td>
<td>100 PSIG (690 kPa) @ 212°F (100°C)</td>
</tr>
<tr>
<td>316 Stainless Adapter</td>
<td>200 PSIG (1380 kPa) @ 248°F (120°C)</td>
</tr>
</tbody>
</table>

Temperature Compensation
- PT100 RTD
- PT1000 RTD
- 8550 Ohm (Honeywell)

CS10 / CS51 Dimensions

Adapter Fitting
Polypropylene - 1/2" or 3/4" NPT Thread
316 Stainless - 1/2" NPT Thread
(reverse adapter direction for submersible installations)
## Liquid Conductivity

### Two & Four Electrode Sensors

**CS10 / CS51 Two Electrode In-line / Submersible Conductivity Sensors**

<table>
<thead>
<tr>
<th>Body</th>
<th>Cell Constant</th>
<th>TC</th>
<th>Cable</th>
<th>Terminations</th>
<th>Mounting Hardware</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS10</td>
<td>SS316/Teflon/EPDM Inline or Submersible for Pure Waters (0.01 / 0.02 / 0.05 Cell Constant)</td>
<td>1</td>
<td>1.0 CS51 Only (0-20,000 MicroSiemens)</td>
<td>1 - 10 ft (whole #')s</td>
<td>All tinned leads</td>
<td>Long</td>
</tr>
<tr>
<td>CS51</td>
<td>SS316/Teflon/EPDM General Purpose (0.1 /1.0 Cell Constant)</td>
<td>0.1</td>
<td>0.1 CS51 Only (0-1000 MicroSiemens)</td>
<td>11 - 20 ft</td>
<td>All spade leads</td>
<td>Long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05</td>
<td>0.05 CS10 Only (0-500 MicroSiemens)</td>
<td>21 - 30 ft</td>
<td>Other</td>
<td>Long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.02</td>
<td>0.02 CS10 Only (0-250 Microsiemens)</td>
<td>31 - 40 ft</td>
<td>Other</td>
<td>Long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.01</td>
<td>0.01 CS10 Only (0-100 MicroSiemens)</td>
<td>41 - 50 ft</td>
<td>Other</td>
<td>Long</td>
</tr>
</tbody>
</table>

#### Cell Constant (True range is analyzer/electrode size dependant)

- **Integral Temperature Compensation**
  - PT100 100 Ohm RTD
  - PT1000 1000 Ohm RTD
  - HW 8550 Ohm

#### Lead Terminations

- TL All tinned leads
- SL All spade leads
- (Blank) Other

#### Hardware Options for Non-Sanitary Flange

<table>
<thead>
<tr>
<th>Body</th>
<th>Cell</th>
<th>TC</th>
<th>Cable</th>
<th>Terminations</th>
<th>Hardware</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS10</td>
<td>0.1</td>
<td>PT1000</td>
<td>10</td>
<td>TL</td>
<td>SS.5</td>
<td>Long Typical Sensor Configuration</td>
</tr>
</tbody>
</table>

#### Nominal Length (reduced by sanitary flange thickness if ordered)

- Long 5.2” (recommended)
- Short 2.75”
Liquid Conductivity
Two & Four Electrode Sensors

Model CS41
Two Electrode High Pressure Threaded In-line

The CS41 Two Electrode Conductivity Sensor is specifically designed to handle the high pressure requirements found in boiler water measurement. It uses a rugged, explosionproof junction box with a high temp terminal strip for internal wiring.

Wetted Material
- Electrodes 316 Stainless Steel
- Insulator PEEK
- Seals EPR (dual o-ring)
- Mounting 316 Stainless

Pressure / Temperature Ratings

<table>
<thead>
<tr>
<th>Sensor Design</th>
<th>Max. Pressure / Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>316 Stainless</td>
<td>400 PSIG (2758 kPa) @ 212°F (100°C)</td>
</tr>
<tr>
<td></td>
<td>250 PSIG (1724 kPa) @ 401°F (205°C)</td>
</tr>
</tbody>
</table>

Temperature Compensation
- PT100 RTD
- PT1000 RTD
- 8550 Ohm (Honeywell)

CS51 Dimensions

- 6.5” (165mm)
- 3.8” (96mm)
- 0.75” (19mm)
- 1.0” (25.4mm)
- 3/4” Female NPT Conduit Port

Figure 7
Liquid Conductivity
Two & Four Electrode Sensors

CS41 Two Electrode High Temperature In-line Conductivity Sensors

<table>
<thead>
<tr>
<th>Body</th>
<th>Cell Constant</th>
<th>Pressure / Temp</th>
<th>TC</th>
<th>Length</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS41</td>
<td>SS 316 / PCTFE (Kel-F)</td>
<td>¾” MNPT Inline Sensor</td>
<td>Cell Constant (True range is analyzer/electrode size dependant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.00 (0-30,000 MicroSiemens)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.00 (0-20,000 MicroSiemens)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1</td>
<td>0.10 (0-1000 MicroSiemens)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.05</td>
<td>0.05 (0-500 Microsiemens)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure / Temperature Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT High Temp. 0°C to 205°C, PEEK Insulator</td>
</tr>
<tr>
<td>HV High Temp. Press, 6.5&quot; OAL for use in 546 Hi-pressure insertion system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integral Temperature Compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW 8550 Ohm @ 25°C (Honeywell)</td>
</tr>
<tr>
<td>Pt100 100 Ohm @ 0°C, PTC (BAT and Others)</td>
</tr>
<tr>
<td>Pt1000 1000 Ohm @ 0°C, PTC (BAT and Others)</td>
</tr>
<tr>
<td>Other (Blank)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insertion Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1.0&quot; Insertion depth (standard)</td>
</tr>
<tr>
<td>2.6 2.6&quot; Insertion depth for (HV) only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>JB Junc Bx, Expl Proof, Inc 8” Ids &amp; Term Strip</td>
</tr>
<tr>
<td>PT 8” Pig Tail, for Cust Supp Junc Bx Inc Term Strip</td>
</tr>
<tr>
<td>Coup 3/4” coupling on rear of sensor</td>
</tr>
<tr>
<td>Other, (Call Factory For Price &amp; Availability)</td>
</tr>
</tbody>
</table>

Typical Sensor Configuration
Liquid Conductivity
Two & Four Electrode Sensors

Model CS40
Two Electrode Hot Tap Retractable

For applications where a sample line is not present the CS40 Two Electrode Sensor provides an easy method to remove and isolate the sensor for cleaning and calibration.

Wetted Material
- Electrodes: 316 Stainless Steel
- Insulator: Kel-F PCTEF (std), PEEK (high temp)
- Seals: EPDM / Viton / Buna-N
- Hardware: 316 Stainless

Pressure / Temperature Ratings

<table>
<thead>
<tr>
<th>Sensor Design</th>
<th>Max. Pressure / Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Temp</td>
<td>100 PSIG (689 kPa) @ 302°F (150°C)</td>
</tr>
<tr>
<td>High Temp</td>
<td>250 PSIG (1724 kPa) @ 401°F (205°C)</td>
</tr>
</tbody>
</table>

Temperature Compensation
- PT100 RTD
- PT1000 RTD
- 8550 Ohm (Honeywell)

CS40 Dimensions

1" Male NPT Process Connection
Variable Insertion: 3" - 9" (76 - 229mm)
3/4" Female NPT Conduit Port
## CS40 Two Electrode Hot Tap Retractable Conductivity Sensors

<table>
<thead>
<tr>
<th>Body</th>
<th>Orings</th>
<th>Cell Constant</th>
<th>Temp Range</th>
<th>TC</th>
<th>Cable</th>
<th>Terminations</th>
<th>Hdw</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS40</td>
<td>S</td>
<td>3/4&quot; Diameter sensor for 1&quot; valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Orings
- S: Standard - EPDM
- V: Viton
- B: Buna-N

### Cell Constants (True range is analyzer/electrode size dependant)
- 2.00: 2.00 (0-30,000 MicroSiemens)
- 1.00: 1.00 (0-20,000 MicroSiemens)
- 0.20: 0.20 (0-2000 MicroSiemens)
- 0.10: 0.10 (0-1000 MicroSiemens)
- 0.02: 0.02 (0-250 MicroSiemens)
- 0.01: 0.01 (0-100 MicroSiemens)

### High Range Cell Constants
- 20.00: 20.0 (0-200 MilliSiemens)
- 10.00: 10.0 (0-100 MilliSiemens)
- 5.00: 5.0 (0-50 MilliSiemens)

### Operational Temperature Range
- Standard up to 150°C, PCTFE Insulator
- Hi-Temp. 205°C Max, PEEK Insulator (Not Avail for High Range Constants)

### Integral Temperature Compensation
- HW: 8550 Ohm @25°C, (Honeywell)
- Pt100: 100 Ohm @0°C, PTC (BAT and Others)
- Pt1000: 1000 Ohm @0°C, PTC (BAT and Others)
- Other

### Cable
- JB: Junc Box, Exp Proof, Inc 8" Leads & Term
- PT: 8" Pig Tail, Inc Term Strip
- Footage: 1-10Ft (Whole Numbers Only)
- 10: Footage 11-20Ft
- 20: Footage 21-30Ft
- 30: Footage 31-40Ft
- 40: Footage 41-50Ft
- 50: Footage 51-60Ft
- (Blank): Other

### Lead Terminations
- TL: All Tinned Leads
- SL: All Spade Lugs
- (Blank): Other

### Hardware
- SSV: 1" SS Ball Vlv, Cmp Flg & Nip
- N: None
- (Blank): Other

### Typical Sensor Configuration

---

**Liquid Conductivity**

**Two & Four Electrode Sensors**
Liquid Conductivity
Two & Four Electrode Sensors

Model 551 / 546 / 547
Four Electrode In-line, Hot Tap, and Submersible

Barben’s four electrode conductivity sensors use the same housing and accessories as our pH products.

Wetted Material
- Electrodes: 316 Stainless, Titanium Gr2, Hastelloy C
- Insulator: PEEK
- Seals: EPDM / Viton
- Hardware: (see accessories guide for hardware options)

Pressure / Temperature Ratings

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Installation Type</th>
<th>Pressure / Temperature Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>551</td>
<td>Threaded Nut Lock (metal body with hand nut only)</td>
<td>100 PSIG @ 158°F (70°C) 40 PSIG @ 212°F (100°C)</td>
</tr>
<tr>
<td></td>
<td>Threaded Nut Lock (metal body &amp; metal hex nut only)</td>
<td>300 PSIG @ 176°F (80°C) 40 PSIG @ 266°F (130°C)</td>
</tr>
<tr>
<td></td>
<td>Flanged / Threaded Nut Lock (plastic body &amp; metal hex nut only)</td>
<td>150 PSIG @ 73°F (25°C) 25 PSIG @ 266°F (130°C)</td>
</tr>
<tr>
<td>546</td>
<td>3/4” In-line or Submersible*</td>
<td>150 PSIG @ 158°F (70°C) 40 PSIG @ 266°F (130°C)</td>
</tr>
<tr>
<td></td>
<td>High Pressure Hot Tap</td>
<td>300 PSIG @ 176°F (80°C) 40 PSIG @ 266°F (130°C)</td>
</tr>
<tr>
<td>547</td>
<td>Threaded In-line High Pressure</td>
<td>2500 PSIG @ 122°F (50°C) 50 PSIG @ 266°F (130°C)</td>
</tr>
<tr>
<td></td>
<td>Retractable</td>
<td>150 PSIG @ 158°F (70°C) 40 PSIG @ 266°F (130°C)</td>
</tr>
</tbody>
</table>

Four Electrode Tip Options

**HIGH RANGE ELECTRODES**
(0 - 2 SIEMENS)
SM, TH, HH SERIES

- Current Electrodes
- Sensing Electrodes
- Metal Electrodes: 316SS, Hastelloy C
- Dual EPDM or Viton O-ring Seals

**LOW RANGE ELECTRODES**
(0 - 1400 MICROSIEMENS)
SM, HM SERIES

- Current Electrodes
- Sensing Electrodes
- Metal Electrodes: 316SS, Hastelloy C
- Dual EPDM or Viton O-ring Seals

Flush High Range Electrodes

- 0.3” (7.6mm)

Extended Low Range Current Electrodes
551 Four Electrode Conductivity Sensor

Example - 551 Sensor
Submersible installation

The full offering of mounting adapters and flowcells used with the 551 sensor can be found in the Barben Accessories Guide (Consult technical support for more information)

546 Four Electrode Conductivity Sensor

Example - 546 Sensor
Submersible installation

Flow cells and other accessories used with the 546 sensor can be found in the Barben Accessories Guide (Consult Barben technical support for more information)

547 Four Electrode Conductivity Sensor

Bottom image show 547 sensor with hot tap retractable hardware
Barben offers an extensive offering of compression fittings, valve assemblies and sheath kits. These can be found in the Barben Accessories Guide (Consult Barben technical support for more information)
# Liquid Conductivity
## Two & Four Electrode Sensors

### 551 / 546 / 547 Four Electrode Conductivity Sensors

<table>
<thead>
<tr>
<th>Material</th>
<th>Orings</th>
<th>Body Style</th>
<th>Electrodes</th>
<th>TC</th>
<th>Insertion Depth</th>
<th>Cable</th>
<th>Terminations</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Kynar body PEEK insulator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Seals
- E: EPDM
- V: Viton

#### Configuration
- 551: Quick-Change Inline (Drawing 2P0076)
- 546: Threaded In-line / Submersible 3/4" NPT (Drawing 2P0078)
- 547: Cartridge for Valve Insertion (Drawing 2P0079)

#### Electrode Range and Material (True range is analyzer dependant)
- SM: 0 - 1,400 MicroSiemens - SS 316, 0.0275 cell constant
- SH: 0 - 2 Siemens - SS 316, 0.3727 cell constant
- TH: 0 - 2 Siemens - Titanium Gr2, cell constant 0.3727
- HM: 0 - 1,400 MicroSiemens - Hastelloy C, 0.0275 cell constant
- HH: 0 - 2 Siemens - Hastelloy C, 0.3727 cell constant

#### Integral Temperature Compensation
- K: PT1000
- C: PT100
- B: 3K Ohm Balco (120°C Max)
- Blank: Other

#### Insertion Depth
- S: 551 / 547 Standard
- 0.5: 546, 1/2"
- 1: 546, 1"
- 1.5: 546, 1-1/2"
- Blank: Other 546 special order, (0.5" Increments), 5.0" Max

#### Cable
- T: 8" Pigtail for (Junction Box 546/551)
- T1: 8" Pigtail for (8" assy 547 or High Pressure 547)
- T2: 8" Pigtail for (16" 547 assy)
- T3: 8" Pigtail for (20" 547 assy or 546 Hot Tap)
- T4: 8" Pigtail for (24" 547 assy)
- T5: 8" Pigtail for (30" 547 assy)
- T6: 8" Pigtail for (36" 547 assy)
- T7: 8" Pigtail for (60" 547 assy)
- 1 to 5: Footage 1 - 5'
- 6 to 20: Footage 6 - 20'
- 21 to 30: Footage 21 - 30'
- 31 to 40: Footage 31 - 40'
- 41 to 75: Footage 41 - 75'
- 76 to 100: Footage 76 - 100'

#### Lead Terminations
- T: All Tinned
- S: All Spades #6

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