

CROSS SMART SENSOR

CS7 Conductivity Sensor

ELECTRO-CHEMICAL, DIGITAL and ANALOG TECHNOLOGY, OPTIMIZED MEASURES



FEATURES & BENEFITS

- ☐ Robust Conductivity/TDS/Salinity & Temp. Sensors.
- ☐ Digital sensor with reliable RS485 communication.
- ☐ Plug and play with GDC series terminals or computers with Delta-Phase View™ software.
- ☐ Calibration history data stored in sensor, Easy to recalibrate.
- ☐ Lightning and surge protection for worry-free power.
- ☐ Optional Self-Diagnosis function.
- ☐ Contacting sensors of 2-electrodes or 4-electrodes, different cell constants are available to cover wide measuring range.
- ☐ Non-contacting Toroidal (Inductive) sensors for high range applications.
- ☐ Optional Analog sensors to work with GDC-LP (Two-wire loop-powered) transmitter.

APPLICATIONS

- ☐ **Water Treatment**
 - Monitoring Source/Process/Dispensing Networks
 - Reverse osmosis - TDS testing
 - Desalination - Salinity testing
- ☐ **Waste Water Treatment**
 - Monitoring Influent/Process/Effluent, etc.
- ☐ **Typical Industrial Applications**
 - Boiler blowdown
 - Cooling Tower
 - Rinse baths
 - Concentration of Acid or Alkali solution
 - Level Detection

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INTRODUCTION

Delta-Phase incorporates various electrodes into CS7 sensors to widely cover conductivity measurements including most water & wastewater and chemical solutions in municipal and industrial processes. These conductivity electrodes are popular for many applications due to their convenience, affordability, and accuracy. The CS7 sensors are ideal for both portable handheld and stationary in-situ applications, offering quick time response, minimal flow dependence and low power consumption. The CS7 sensors come with different mounting types such as immersion, flow-cell and insertion /retractive ball-valve assembly installations.

PRINCIPLE OF ELECTROCHEMICAL

Conductivity is the ability of a medium to conduct electric current. The principle by which instruments measures solution conductivity is simple - two plates are placed into the sample; a potential is applied across the plates and the current is measured. Generally, the potential is in the form of a sine wave. Conductivity is determined from the voltage and current values according to Ohm's Law

$$G=1/R=I \text{ (amps)}/E \text{ (volts)}$$

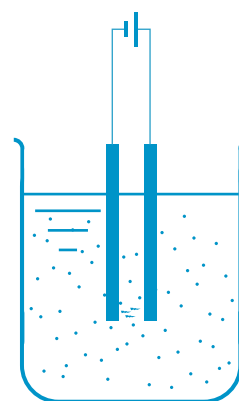
Since the charge on the ions in solution facilitates the conductance of electrical current, the conductivity of a solution is proportional to its ion concentration. The basic unit of measurement for conductivity is the siemens (S). Since cell geometry affects conductivity values, standardized measurements are expressed in specific conductivity units (S/cm) and compensates for variations in electrode dimensions. Conductivity measurements are temperature dependent. The degree to which temperature affects conductivity varies from solution to solution and can be calculated.

Choosing the correct Conductivity Sensor Design is critical to accuracy. The conductive plates or sensing elements in the simple conductivity electrode serve as sensing elements and are placed at a fixed distance apart in contact with the water sample to be measured. The distance between the sensing elements, as well as their surface area determine the electrode "cell constant", defined as length/area. The cell constant is a critical parameter affecting the conductivity value produced by the conductivity cell and utilized by the meter/controller circuitry.

A cell constant of 1.0 will produce a conductance reading approximately equal to the solution conductivity. For solutions of low conductivity, the sensing electrodes can be larger, and/or placed closer together, reducing the distance between them and producing cell constants of 0.1 or even 0.01 in extreme cases. This will raise the conductivity reading by a factor of 10 to 100 to make low conductivity solutions easier to measure and give a better signal. At the other extreme, the sensing electrodes may be smaller, and/or placed farther apart to create cell constants of 10 more suitable for use in highly conductive solutions. Conductivity sensors should be calibrated using a standard solution before use. When selecting a standard, choose one that has the approximate conductivity of the solution to be measured. The following shows optimum conductivity ranges for different cell constants of two electrode/pole sensors:

CS7-4 four electrode/pole sensor uses a reference voltage to compensate for any polarization or fouling of the electrode plates. The reference voltage ensures that measurements indicate actual conductivity independent of electrode condition, resulting in higher accuracy, covering a wider range from 0.1 to 200 mS/cm. This is very helpful to measure liquids with varying range, such as Conductivity, TDS and Salinity measurements of surface water including sea water .

Electromotive Force



CELL CONSTANT	OPTIMUM CONDUCTIVITY RANGE
0.01	0.055~20μS
0.1	0.5~200μS
1.0	0.01~2mS
10.0	1~200mS

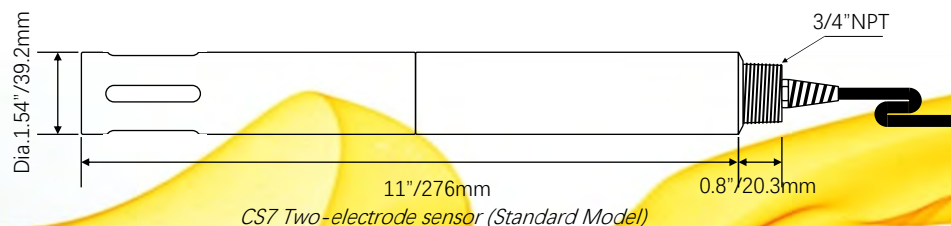
Unlike contacting sensors, there are no wetted metal parts for Toroidal/Inductive sensors. The CS7-T toroidal/inductive sensor determines the conductivity by using the induction between two toroidal shaped magnets embedded in the probe. These are often better suited for higher conductivity process fluids (up to 1000 mS or even 2000 mS), especially harsh applications, for instance, to measure the concentration of Acid or Alkali solution.

[illegible]

SPECIFICATIONS

Conductivity Range	Two-pole sensors: 0.055 to 20 μS, 0.5 to 200 μS, 0.01 to 2 mS, 1 to 200 mS; Four-pole sensors: 0.1 to 200 mS; Toroidal sensors: 0.5 to 2000 mS (Consult factory for other range)
TDS Range	0 to 70 ppt (part per thousand)/0-70,000 ppm
Salinity Range	5 to 60g/kg
Accuracy/Resolution	Depends on parameter and application (Consult factory for detail)
Temp. Compensation	Pt1000, 0 to 100°C Automatic.
Response Time	T90< 5 s
Operate Pressure	0 to 100 psig (6.9Bar) standard. Optional HP sensor up to 300 psig (21Bar) (Consult factory)
Operate Temp.	32 to 149°F (0 to 80°C), Depends on parameter and application (Consult factory for details)
Power Supply	12 to 30VDC, the maximum consumption 0.5W
Interface	RS485 Modbus RTU standard, mV signal for analog sensors.
Material	Two-pole sensors: 316L and PVC standard; Optional Titanium/PP Four-pole sensors: Graphite/PVC; Toroidal sensors: PP, Optional PFA (Consult factory for detail)
IP Rating	>IP68, submersible
Weight	Two-pole sensors: 1.9 pound (0.85 kg), Consult factory for optional sensor configurations. Four-pole sensors: 2.2 pound (1 kg); Toroidal sensors: 1.1 pound (0.5 kg),
Dimension (Standard)	Two-electrodes sensors: Dia. 1.54" × 11" (OD. 39.2 × 276 mm) standard. Four-electrodes sensors: Dia. 1.8" × 10" (OD. 45 × 254 mm) Toroidal sensors: Dia. 1.3" × 3.1" (OD. 33 × 78 mm) (Consult factory for other size)
Mounting	Immersion/Insertion, Optional Insertion with Retractive ball-valve Assembly and "T" handle.

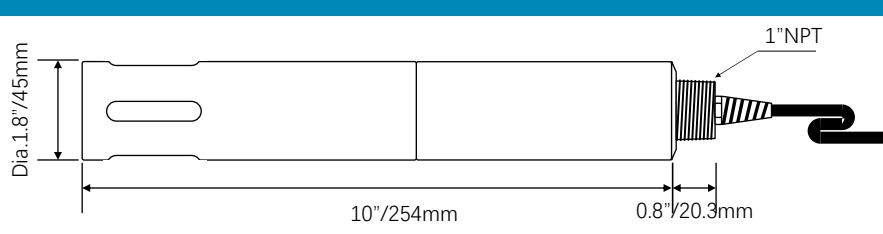
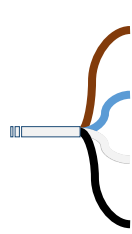
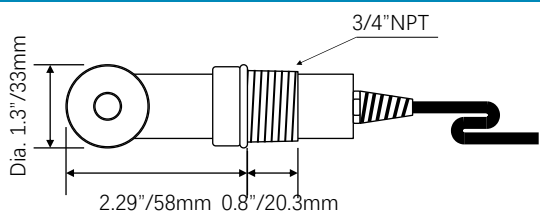
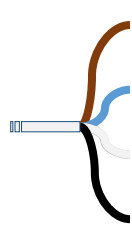
DIMENSION



WIRES

	Brown	V+
	Blue	V-
	White	RS485 A
	Black	RS485 B

CROSS SMART SENSOR

DIMENSION	WIRES								
 CS7-4 Four-electrode sensor	 <table border="1"> <tr><td>Brown</td><td>V+</td></tr> <tr><td>Blue</td><td>V-</td></tr> <tr><td>White</td><td>RS485 A</td></tr> <tr><td>Black</td><td>RS485 B</td></tr> </table>	Brown	V+	Blue	V-	White	RS485 A	Black	RS485 B
Brown	V+								
Blue	V-								
White	RS485 A								
Black	RS485 B								
 CS7-T Toroidal sensor	 <table border="1"> <tr><td>Brown</td><td>V+</td></tr> <tr><td>Blue</td><td>V-</td></tr> <tr><td>White</td><td>RS485 A</td></tr> <tr><td>Black</td><td>RS485 B</td></tr> </table>	Brown	V+	Blue	V-	White	RS485 A	Black	RS485 B
Brown	V+								
Blue	V-								
White	RS485 A								
Black	RS485 B								

ORDER CODE

CS7 Smart Conductivity Sensor

CS7A Analog Conductivity Sensor (*versions of 10 cell constant sensor, 4 pole sensor and toroidal sensor are not for two-wire transmitter*)

Measuring Range & Parameters

-	Conductivity 0 to 2mS, (Cell Constant 1)	-S	Conductivity 0.055 to 20μS (Cell Constant 0.01)
-L	Conductivity 0.5 to 200μS Cell Constant 0.1)	-H	Conductivity 1 to 200mS Cell Constant 10)
-4	Four pole sensor, 0.1 to 200mS, Including TDS & SLT measurements		
-TDS	Total Dissolved Solid 0 to 70ppt	-SLT	Salinity 5 to 60g/kg
-T	Toroidal Sensor 0.5mS to 2000mS		

Mounting (Not suitable for Toroidal sensor)

-	3/4" or 1" NPT Back Thread for standard style sensors
-NO	1.5" NPT Compress Fitting for flow-cell mounting
-N1	1" NPT compress Fitting for 2 pole sensor (SS or PP housing only)
-R0	1.25" NPT Retractive Ball-valve Assembly for Insertion 2 pole sensor (SS or PP housing only)

Other installation options contact factory

Material of Housing

-	Standard PVC
-SS	316L Stainless Steel
-PP	PP

Other housing material contact factory

Length of Housing

-	Standard
X17	17" (Min. length for Retractive Ball-valve Assembly Mounting)
X21	21"

Other Length of housing contact factory

Length of Cable

-C10	10 ft, approx. 3m
-C30	30' ft, approx. 9m
-C50	50' ft, approx. 15m

Other Length of cable contact factory

CS7 -L -R0 -SS X17 -C30



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Represented by: