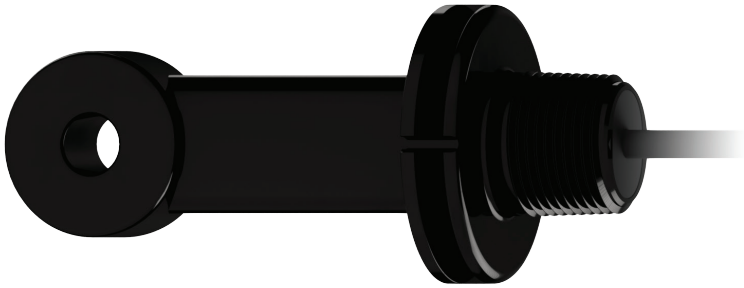
TCS3020 General Purpose Noryl Toroidal Contacting Conductivity Sensor

Product Manual



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Introduction

Thank you for choosing the Sensorex TCS3020 General Purpose Noryl Toroidal Conductivity Sensor. See below for ordering configurations and product specifications.

Model # TCS3020 Ordering Matrix

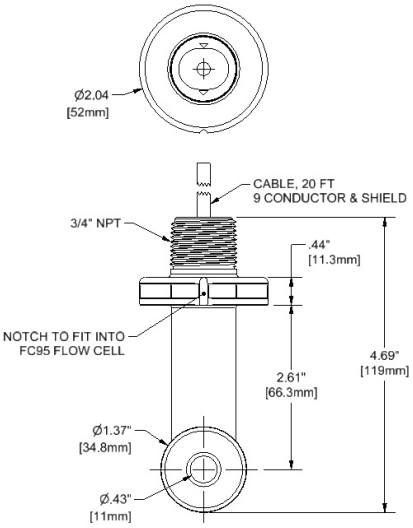
Description	Code	X	X	X	X	X
TEMPERATURE COMPENSATION						
• PT1000RTD	1					
• Custom Modification *(customer-specified)*	M					
CABLE LENGTH						
• 10 ft. (3m) •	CC					
• 20 ft. (6m) • • Process 6 Conductor Cable	CD					
• 30 ft. (10m) •	CE					
• Custom Modification *(customer-specified)*	M					
CABLE TERMINATION CONNECTOR						
• Tinned Leads	3					
• Custom Modification *(customer-specified)*	M					
BRANDING						
• Sensorex-Branded	A					
• No Branding	B					
• Custom Modification *(customer-specified)*	C					
INSTALLATION / FITTING TYPE						
• ¾" MNPT and 2" Flange for FC95C *(sold separately)*	1					
• Custom Modification *(customer-specified)*	M					

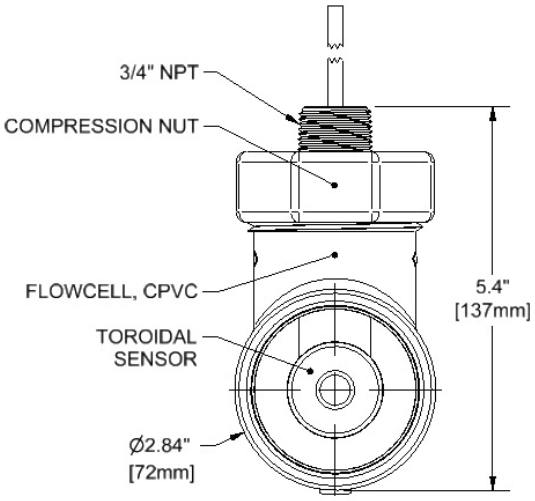
For example, choosing "PT1000" for Temperature Compensation would be **1**, *"10 feet (3m)" for Cable Length would be* **CC**, *"Tinned Leads" under Cable Termination Connector would be* **3**, *"Sensorex-Branded" under Branding would be* **A**, *and "3/4" MNPT and 2" Slip Fitting" under Installation/Fitting Type would be* **1**. *The order code would then be* **TCS3020 – 1 – CC – 3 – A – 1**.

Specifications

Measuring Range	0 – 2,000,000 uS
Body Material	Noryl
Max Temperature	105° C (if used with FC95C Flow Cell, maximum temperature is 80° C)
Max Pressure	150 psig

Temperature Compensation	See ordering matrix.
Cable Length	See ordering matrix.
Process Connection	**Submersion:** ¾" MNPT **In-line:** 2" Slip Fitting for FC95C Flow Cell *(sold separately)*





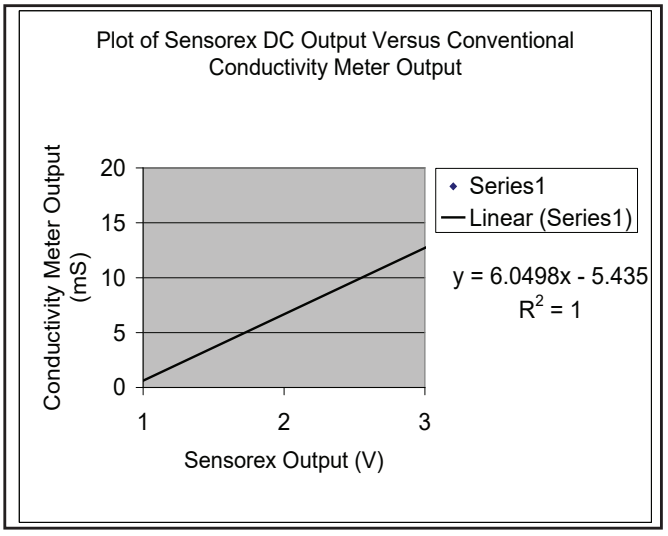
Calibration

Calibration of the sensor must be done after installation and wiring. Use a "low" and a "high" known calibration standard solution. The "low" solution is often DI water or air, and is used to calibrate the zero point of the controller. Plotting these two points will create a straight line, which can be used to find the conductivity value of any solution in the range.

Make sure probe is immersed in the calibration fluid with the toroids totally submerged. A sample plot is provided in **FIG 1** to show the approximate values that will be encountered during calibration. **Note:** The values in the plot are arbitrary; each probe will require unique linear equation values.

If the sensor is to be used in a submersion application, calibrate the sensor in a large glass or plastic beaker with all sides of the sensor at least one inch away from the wall. See **FIG 2**. If the production installation is a pipe (plastic or metal), calibration

FIG 1



should be performed in a similar pipe arrangement. All electrodeless (toroidal) sensors have a wall effect that must be taken into account during calibration.

If the non-conductive (plastic) wall is within one (1) inch of the sensor, the sensor's reading will be reduced due to the insulator interaction with the current path. If the sensor is within one (1) inch of a conductive (metal) wall, the sensor's reading will be increased due to the shorting effect of the conducting wall. These wall effects can be calibrated out of the system by simulating the application's mounting configuration. A plot showing the effects of insulating and conducting walls on the output can be seen in **FIG 3**.

During calibration and production installation (especially in a submersion environment), it is important to dislodge any air bubbles and pay special attention to the center hole of the toroids. Ensure that toroids are totally covered with fluid when calibrating. See **FIG 2**.

Please refer to your controller's manual for specific calibration instructions.

Sensor Installation

Mechanical

Your toroidal sensor can be installed in two ways:

1. Submersion Mount: Mount sensor into rigid or flexible conduit, using a 3/4" NPT coupling and attaching to the 3/4" NPT threads near the sensor's cable. Be sure to seal conduit to avoid fluid build-up in conduit.

2. In-Line Mount:

a. Plumb Flow Cell FC95C into line. Flow Cell FC95C is provided with 2" Slip Fittings. For threaded connection, install a 2" Slip x NPT female adapter (CPVC SCH 80).

b. Install O-ring into FC95C. See **FIG 4**.

c. Install TCS-3020 toroidal sensor into FC95C. Match notch

FIG 2

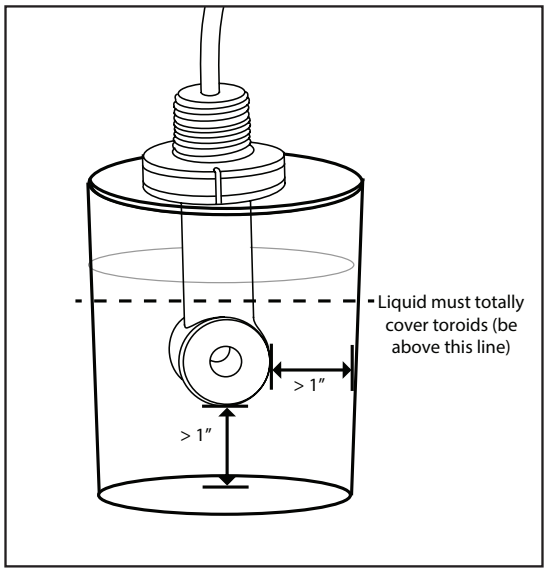


FIG 3

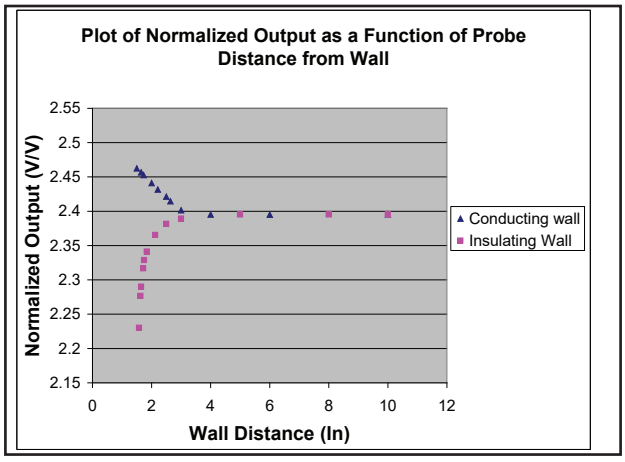
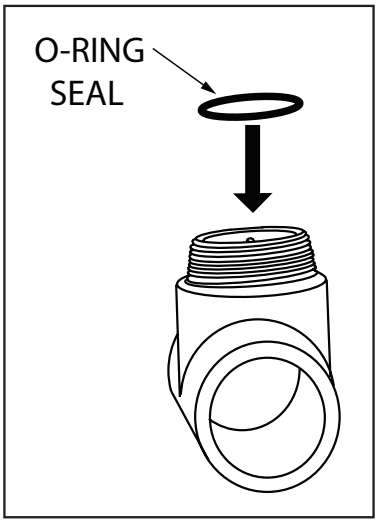


FIG 4



on flange of sensor with tab of flow cell. See **FIG 5**.

d. Install nut onto threads of flow cell and turn clockwise.

CAUTION **DO NOT USE TEFLON TAPE OR SEALANT ON THREADS!**

Electrical

The probe has nine total leads. See **FIG 6**. The driver toroid is connected to the red and black leads, with the red shrink tubing around them. When using the probe with various controllers, it is important that the red lead be connected to an **AC DRIVER** or **VOLTAGE IN** position while the black lead is connected to a **GROUND** or **DRIVER RETURN** line.

The detector toroid is connected to the white and black leads, with the white shrink tubing around them. The white lead is typically connected to the **SIGNAL IN** location, and the black lead is connected to a **GROUND** or **SIGNAL RETURN** line. The temperature element is connected to the green and black leads, with the green shrink tubing around them.

Connect these to the **TEMPERATURE INPUT** locations. The polarity is not important. The three bare leads - which supply individual pair shielding throughout the cable - should typically be connected to a ground or drain line. **Note:** The shield leads are not connected to one another; they are all individual shields for the three bundles of wires.

Refer to your controller manual for specific wiring details.

Cable Considerations

The cable uses PVC to protect the wires during use. If the cable comes into contact with the working fluid, the temperature and pressure ratings must be adjusted to allow for the lower temperature limits of the cable. The cable can withstand 105° C (dry), but should only be subjected to 70° C when immersed in a fluid. The jacket becomes significantly weakened by liquid, which raises the possibility of shorting. Pay close attention to the following cautions.

FIG 5

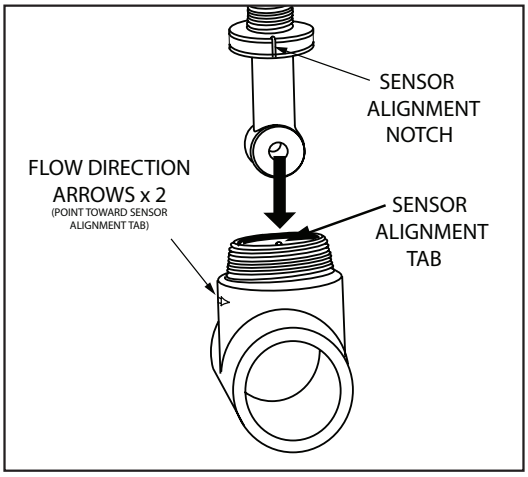
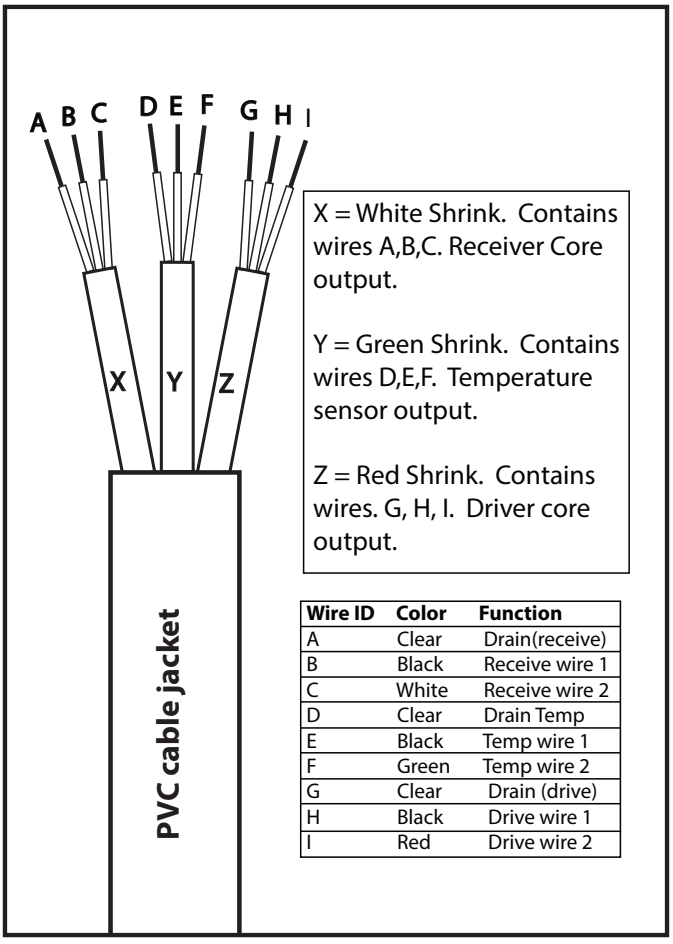


FIG 6



Wire ID	Color	Function
A	Clear	Drain(receive)
B	Black	Receive wire 1
C	White	Receive wire 2
D	Clear	Drain Temp
E	Black	Temp wire 1
F	Green	Temp wire 2
G	Clear	Drain (drive)
H	Black	Drive wire 1
I	Red	Drive wire 2

CAUTION **ALL ATTEMPTS SHOULD BE MADE TO KEEP THE CABLE OUT OF THE FLUID ENVIRONMENT.**

Do not run cable in the same conduit with any other A.C. power wiring.

Do not route the cable close to any high-current-demanding equipment. Seal conduit to avoid build-up of moisture.

Do not cut the cable.

If needed, shorter or longer cables can be provided.

Sensor Maintenance

The major advantage of the Electrodeless (Toroidal) Sensor is its ability to operate with minimal maintenance. The only maintenance actions required during the normal operational life of the sensor are those aimed at preventing the toroidal opening from being plugged with debris. Use a soft brush or rag to remove any debris in the core opening. If that does not work, try a mild detergent or weak acid (5 - 10% HCl).

Sensor Troubleshooting

If your sensor is not reading as expected, check resistance of lead. See **FIG 7**. Check temperature leads. See **FIG 8**. Only Pt100 RTD and Pt1000 RTD are shown.

FIG 7

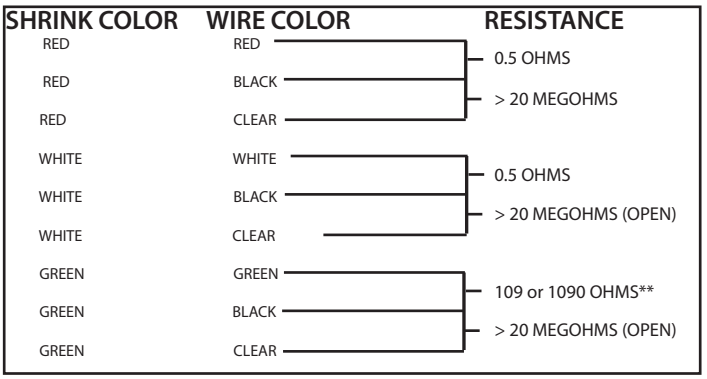


FIG 8

RTD TYPE	TEMP. (deg C/deg F)	RESISTANCE(Ohms)
100 Ohm RTD	18/64.4	106.9
100 Ohm RTD	19/66.2	107.3
100 Ohm RTD	20/68	107.7
100 Ohm RTD	21/69.8	108.1
100 Ohm RTD	22/71.6	108.4
100 Ohm RTD	23/73.4	108.9
100 Ohm RTD	24/75.2	109.2
100 Ohm RTD	25/77.0	109.6
100 Ohm RTD	26/78.8	110.0
100 Ohm RTD	27/80.6	110.4
*	*	*

Note: There is approximately 0.4 Ohm change /Deg C for Pt100 RTD and approximately 3.9Ohm/ Deg C for Pt1000RTD.