

# 8000 Series pH/ORP Electrode Platform

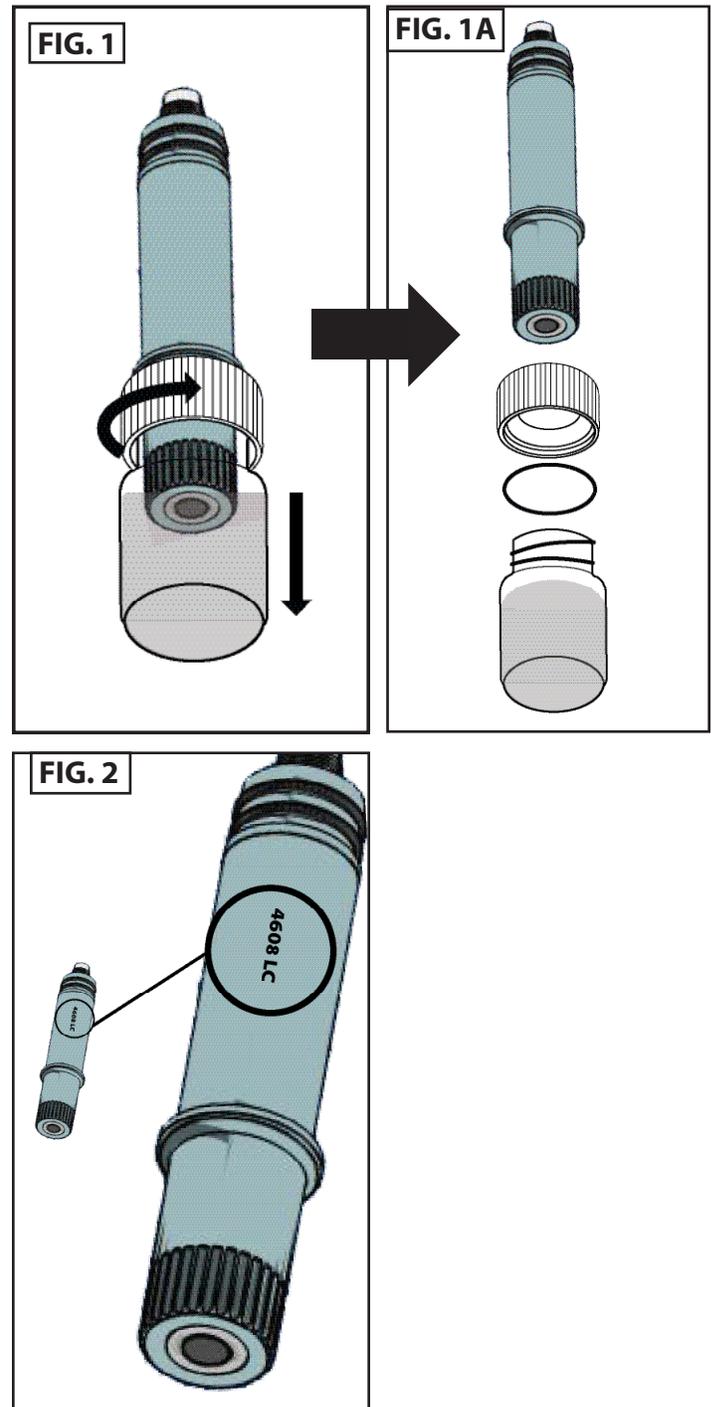
## Product Instructions

### Introduction

Congratulations on your purchase of your Sensorex S8000 series electrode platform. The platform is designed in a modular fashion with the flexibility to use only the parts needed, or to add or modify installation and interface requirements with little or minimal cost impact. All mounting adapters and cables are designed to be reusable. Replace only the electrode cartridge as needed.

### Electrode Care and Use Tips

1. The S8000 pH and ORP electrodes are shipped with a cap containing a solution of pH 4 buffer and potassium chloride. The cap should remain on the electrode until it is used. If the electrode is used infrequently the cap and its solution should be saved and the electrode stored in it. Store pH and ORP electrodes in pH 4 buffer if soaking solution is discarded. Before using the pH electrode remove the tape around the top of the black cap then slide the black cap off of the electrode. Next, *remove small o-ring under black cap* and keep with black cap or discard (SEE FIG 1A).
2. Electrodes are a form of battery and have limited shelf lives. Electrodes in inventory should be rotated so that the older electrodes are used first. The date code is stamped on each electrode by fiscal week and year (Example: 4608 = week 2 of November 2008). See FIG 2.
3. After exposure to a sample, buffer or rinse solution, carryover can be minimized by blotting—never by wiping—the electrode with a clean non-abrasive paper or a clean cloth towel. *Do not use a brush on pH glass.*
4. As a rinse solution, measure and use a portion of the next sample or buffer. This action will minimize carryover contamination.
5. When calibrating pH electrodes, use a buffer close in value to that expected from the sample for one-point calibrations or as the second buffer for two-point calibrations (See below). This action will minimize span errors. ORP electrodes are typically not calibrated. However, a solution to verify electrode performance should be used periodically. 225mV solution, Zobell's solution (Part no. B225), is a good choice for single point verification.



Parts covered by this product data sheet include:  
 S8000CD, S8000CD-ORP, S8000-HF, S8000CD-LC, S8000CD-ORP-LC,  
 EA890, EA891, EA899, EA899TC, EM800, EM801, EM802, EM805,  
 S853, S855, S856, FC800, FC801, FC804, FC805, FC806, FC875

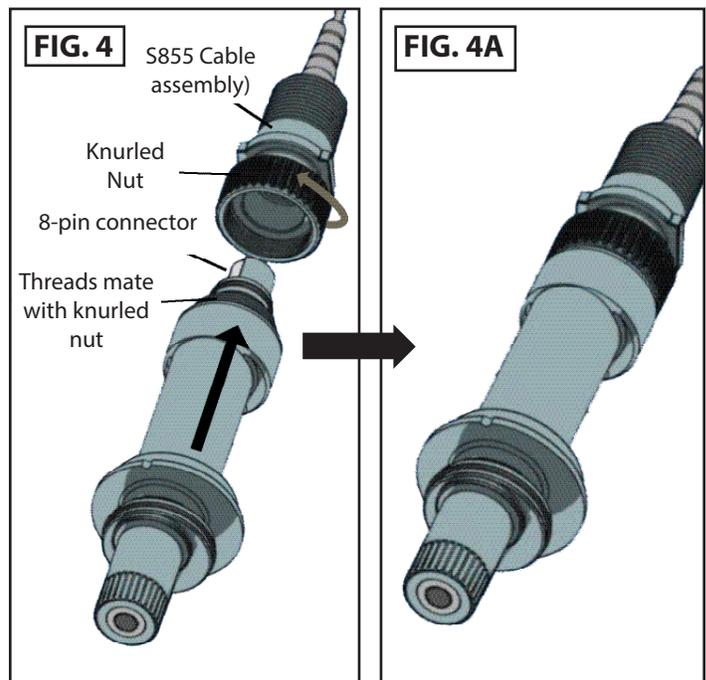
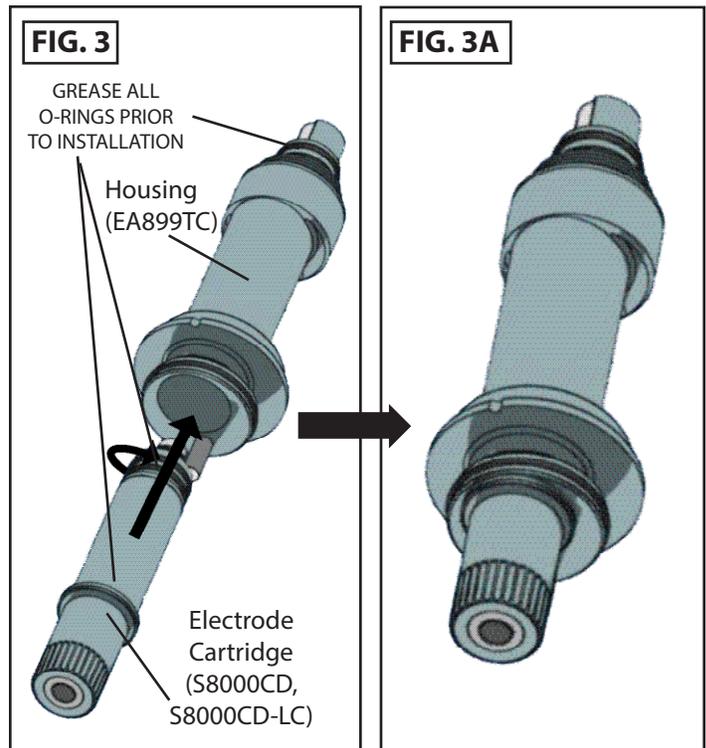
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6. Readings stabilize faster in some solutions than in others; allow time for the readings to stabilize. In general, new pH electrodes stable readings in buffer are obtained in 10-15 seconds. ORP stability in samples can take much longer.
7. All pH electrodes age with time. Aging is characterized by shortened span and slower speed of response. Aging is best detected by the two-point calibration method. If the pH meter has manual or microprocessor slope (span) controls, the controls can be adjusted to compensate for electrode span errors (but will not affect the speed of response).
8. Electrodes should be replaced when their readings cannot be corrected by the meter's controls and/or when their speed of response is too slow for the application for which they are being used. The frequency of electrode replacement is a function of the application; electrodes operating in hot liquids at very high or very low pH values will have shorter lives than those operating at neutral pH and ambient temperature.
9. Coatings on an electrode's surface prevent new liquids from contacting an electrode's measuring surface and can mimic the effects of electrode aging. Before concluding that an electrode needs replacing, check its surface for coatings by removing the pH electrode cartridge and looking at the pH glass.
10. Temperature affects electrode readings in two ways. First, the output of an electrode varies with temperature. For pH electrodes this effect can be corrected by manual or automatic temperature compensation (ORP/Redox readings are not corrected for temperature effects). Secondly, the real pH or ORP value, independent of the electrode measuring the value or use of the temperature compensation, is temperature dependent.

## Mechanical Installation

### Submersion Installation With ATC

- A) Apply silicone or other waterproof o-ring grease to all three o-rings of the electrode cartridge (S8000CD, S8000CD-LC). Install electrode cartridge into housing (EA899TC) by pushing it up into the housing until you feel resistance at the connector. Next, rotate the cartridge clockwise until it stops turning. The electrode should only be installed hand-tight. FIG 3 and FIG 3A show before and after images of this operation.
- B) Grease EA899TC o-rings then install the cable assembly (S855/10 or S855/25) onto the top of the pH sensor and housing assembly from step A, by aligning the eight-pin connector receptacle in the cable assembly with the eight-pin mating connector on the housing. Hand-tighten knurled nut onto threads of sensor housing until it stops turning. Before and after images are shown in FIG 4 and FIG 4A.

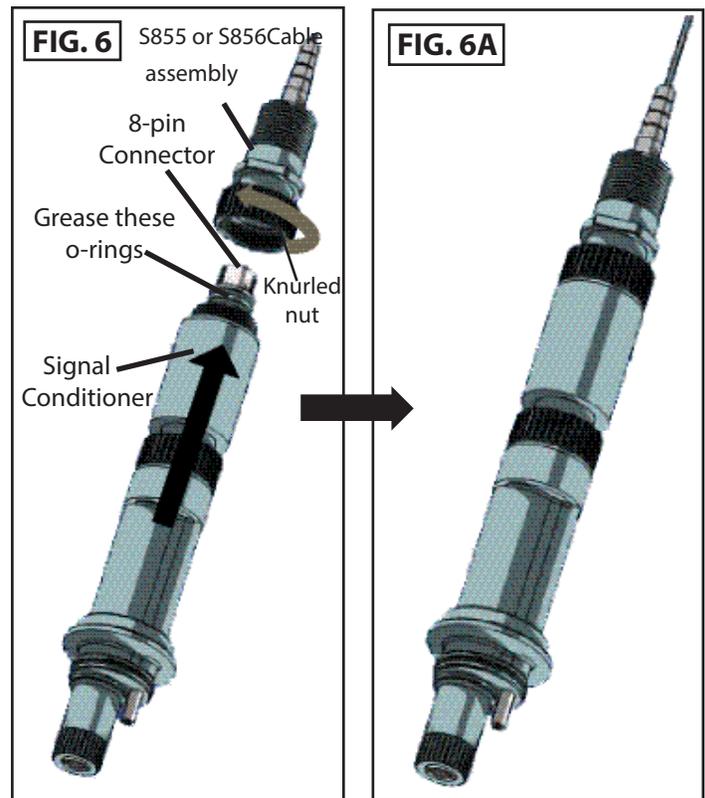
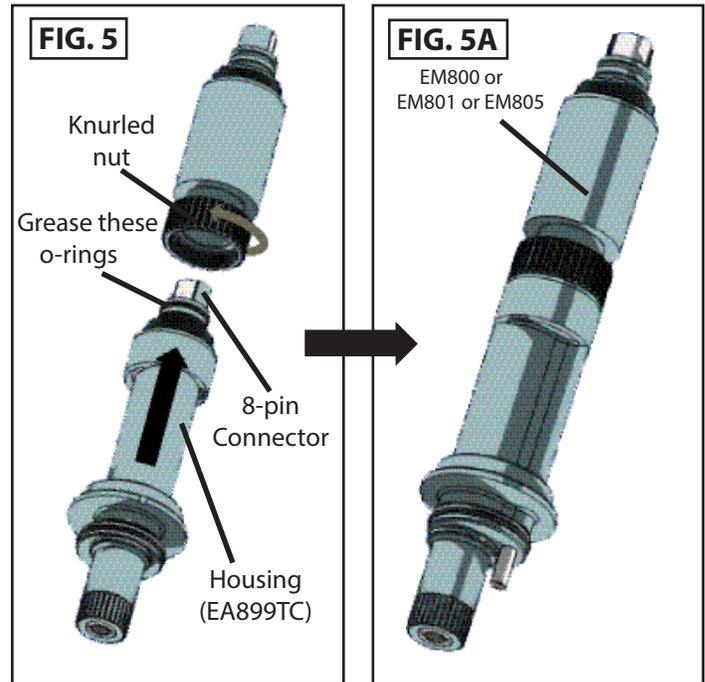


### Submersion Installation With ATC and Signal Conditioner

A) Follow steps in FIG 3.

B) Install the signal conditioner assembly onto the top of the pH sensor and housing assembly by aligning the eight-pin connector receptacle in the cable assembly with the eight-pin mating connector on the housing. Hand-tighten knurled nut onto threads of sensor housing until it stops turning. See FIG 5 and FIG 5A.

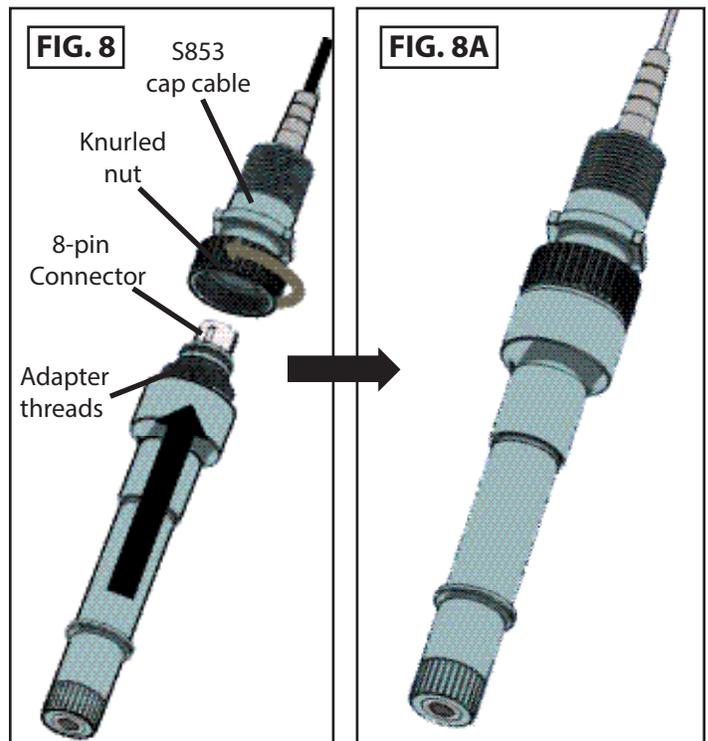
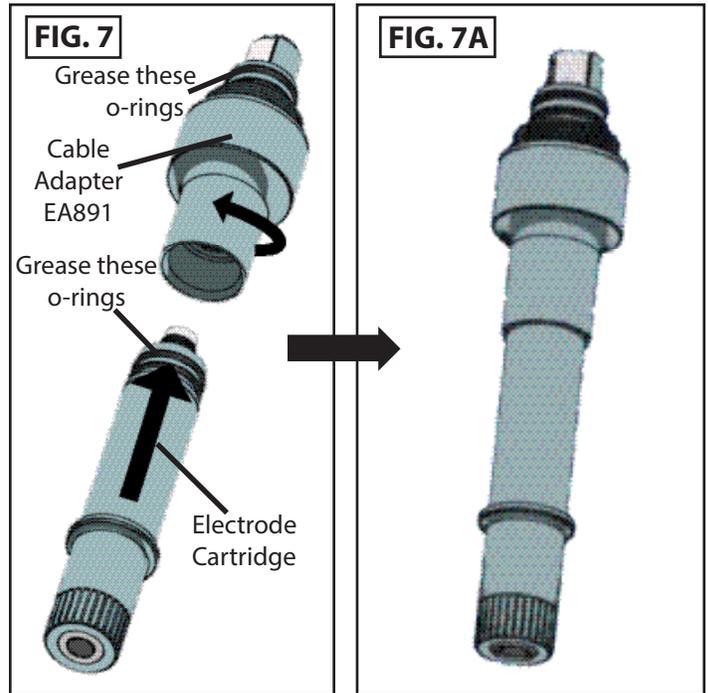
C) Install the S855 cable assembly onto the top of the pH sensor and housing assembly by aligning the eight-pin connector receptacle in the cable assembly with the eight-pin mating connector on the housing (use S855 Cable for EM800, EM801 only) . Use S856 cable for EM805 modules. Hand-tighten knurled nut onto threads of the sensor housing until it stops turning. Before and after images are shown in FIG 6 and FIG 6A.



**Submersion Installation Without ATC**

A) Apply o-ring grease to the two o-rings of the electrode cartridge closest to its electrical connector. Install electrode into cable adapter by pushing up and rotating cartridge clockwise until it stops. The electrode should only be installed hand-tight. FIG 7 and FIG 7A show before and after images of this operation.

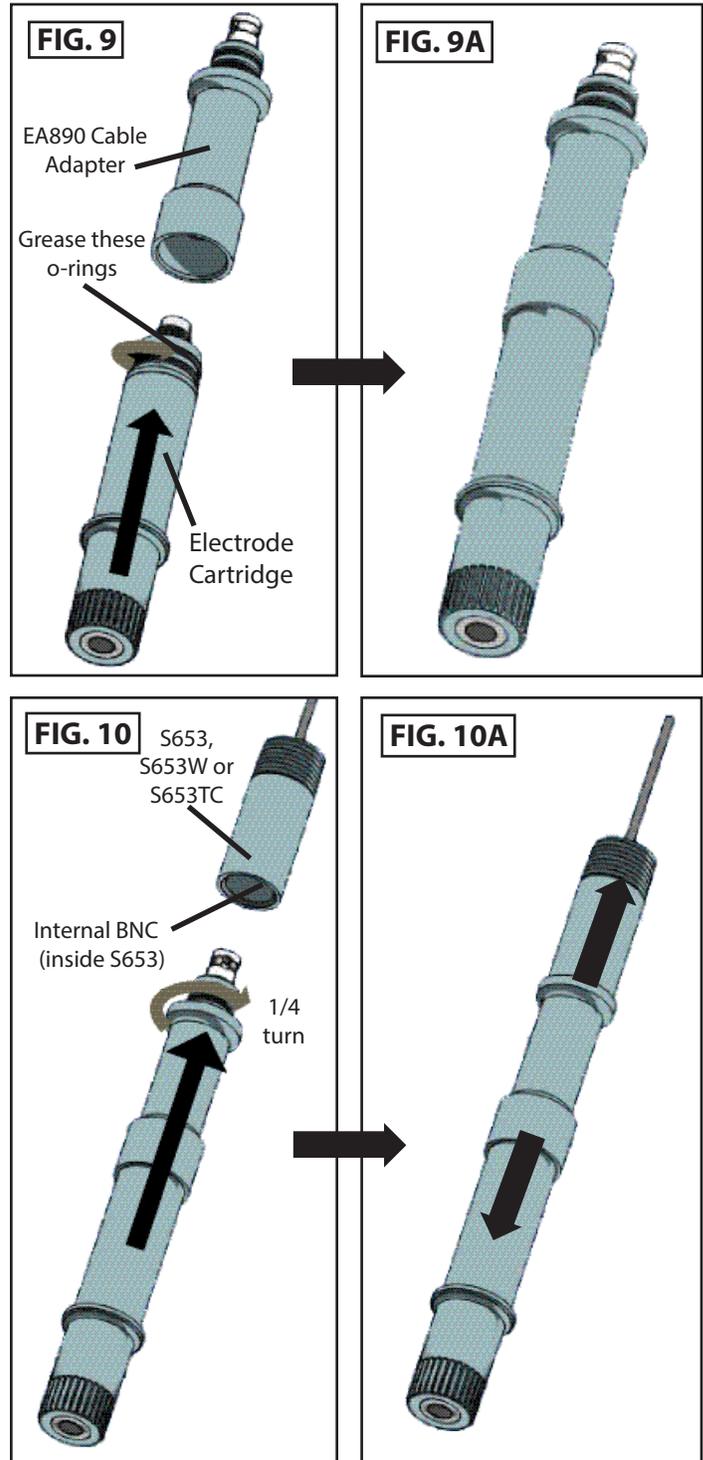
B) Install the S853 cable assembly onto the top of the pH sensor and housing assembly by aligning the eight-pin connector receptacle in the cable assembly with the eight-pin mating connector on the housing. Hand-tighten knurled nut onto threads of sensor housing until it stops turning. Before and after images are shown in FIG 8 and FIG 8A.



### Submersion Installation Adapting to Old Sensorex Cap Cable model S653 or S653W

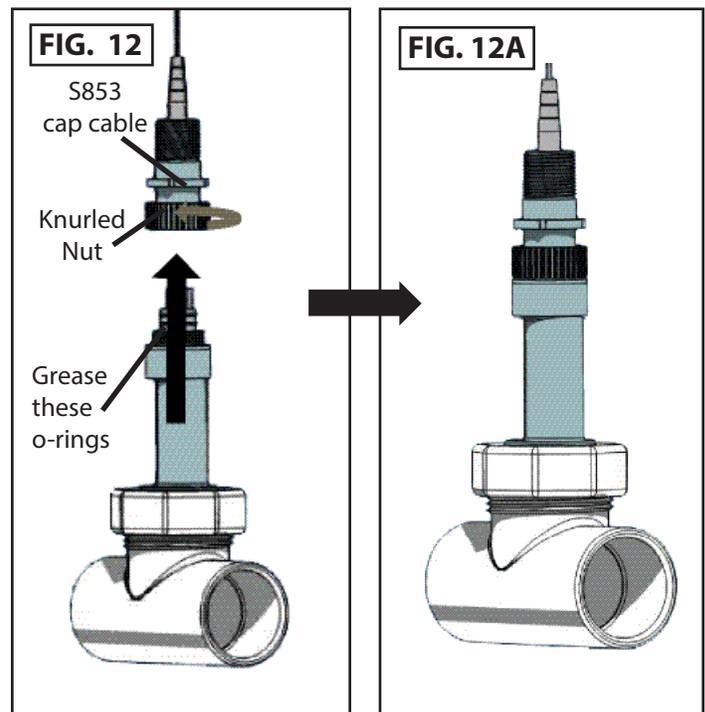
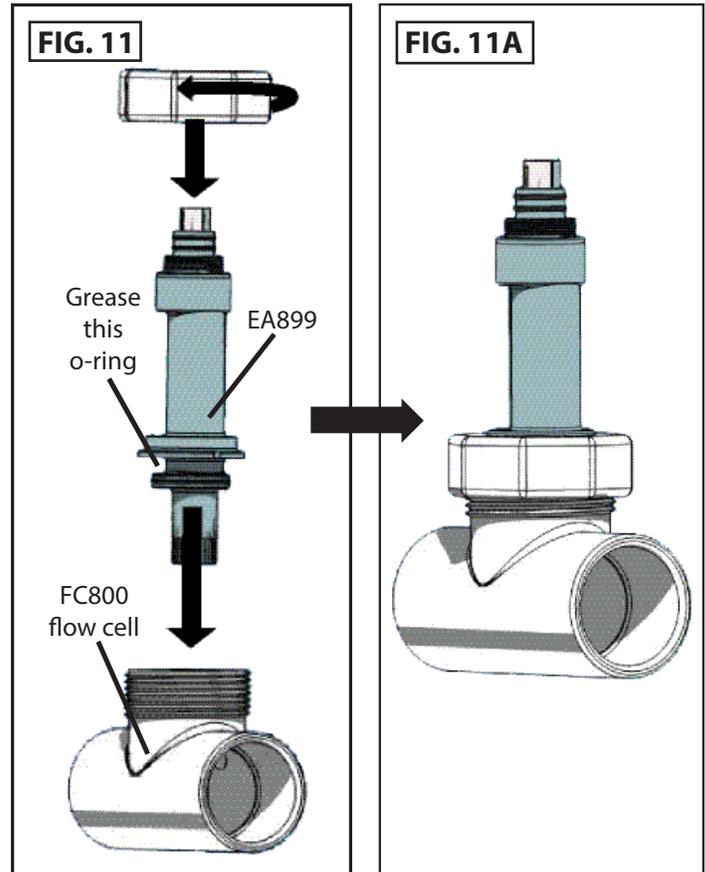
Customers using Sensorex 600 Series electrodes and cap cable assemblies may *easily upgrade* to the new and improved S8000 Series pH and ORP electrodes. Use your existing cap cable. Order the electrode adapter EA890 and the S8000 Series electrode of your choice.

- A) Apply o-ring grease to the two o-rings of the electrode cartridge closest to its electrical connector. Install electrode into cable adapter (EA890) by pushing up and rotating cartridge clockwise until it stops. The electrode should only be installed hand-tight. FIG 9 and FIG 9A show before and after images of this operation.
- B) Install the electrode and adapter assembly into the S653, S653W or S653TC cable assembly by pushing assembly into S653, S653W or S653TC and rotating until the connectors align. When aligned, press a little more then rotate 1/4 turn clockwise to engage BNC connectors (SEE FIG 10). Be sure to check that electrode is properly installed by pulling S653, S653W or S653TC cable assembly away from electrode and adapter as shown in FIG 10A. The electrode and adapter assembly cannot be separated from the cable if connectors are mated properly.



### In-line Installation Without ATC

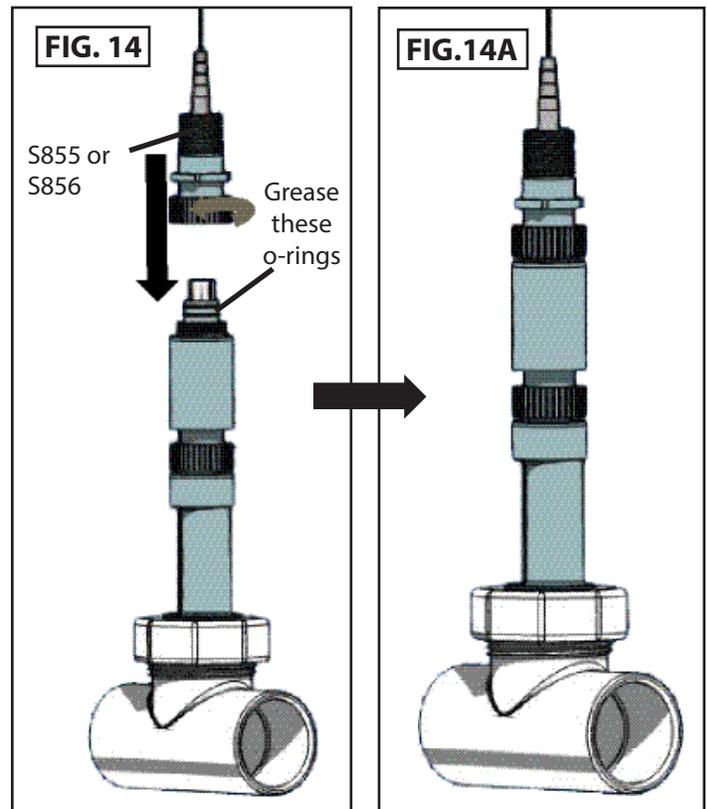
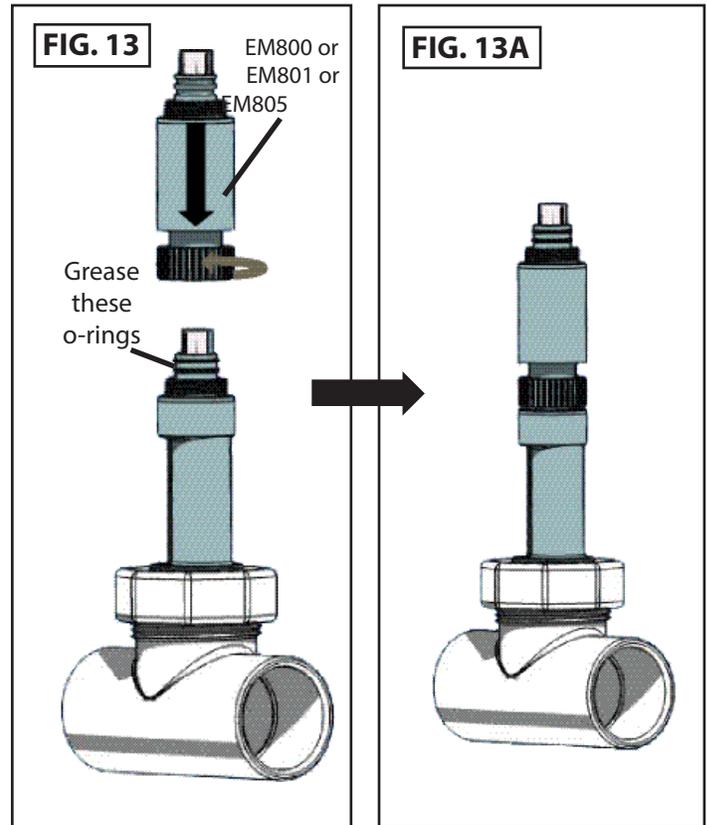
- A) Apply o-ring grease to all three o-rings of the electrode cartridge. Install electrode cartridge into housing by pushing it up into the housing until you feel resistance at the connector. Next rotate the cartridge clockwise until it stops turning. The electrode should only be installed hand-tight. FIG 3 shows before and after images of this operation.
- B) Install electrode and housing assembly into flow cell. *Flow cell choices include: FC800 (1.5" slip inlet and outlet), FC801 glued into FC800 (see pag 15), FC804 (preinstalled 3/4" NPT inlet and outlet), FC805 (preinstalled 1" NPT inlet and outlet) or FC806 (preinstalled 1" slip fitting).* Use alignment tabs on housing and slots on top of tee to ensure parts mate together. Grease o-rings on housing before installing into tee to ensure proper sealing and ease of installation. Next, slide hex nut over top of housing and down until it mates with threads of tee. Hand-tighten nut only (SEE FIG 11 and 11A).
- C) Install the S853 cable assembly onto the top of the pH sensor and housing assembly by aligning the eight-pin connector receptacle in the cable assembly with the eight-pin mating connector on the housing. Thread knurled nut onto threads of sensor housing until it stops turning. Before and after images are shown in FIG 12 and FIG 12A.



**In-line Installation With ATC and Signal Converter**

- A) Apply o-ring grease to all three o-rings of the electrode cartridge. Install electrode cartridge into housing by pushing it up into the housing until you feel resistance at the connector. Next rotate the cartridge clockwise until it stops turning. The electrode should only be installed hand-tight. FIG 3 shows before and after images of this operation.
- B) Install electrode and housing assembly from step A into tee. Use alignment tabs on housing and slots on top of tee to ensure parts mate together. Grease o-rings on housing before installing into tee to ensure proper sealing and ease of installaion. Next, slide hex nut over top of housing and down until it mates with threads of tee. Hand-tighten nut only (SEE FIG 11 & 11A).
- C) Take housing and tee assembly from FIG 11A and install signal converter as shown in FIG 13 and FIG 13A.
- D) Install the cable assembly onto the top of the signal converter by aligning the eight-pin connector receptacle in the cable assembly with the eight-pin mating connector on the housing. Hand-tighten knurled nut onto threads of sensor housing until it stops turning. Before and after images are shown in FIG 14 and FIG 14A.

**In-line Installation Notes:** Make sure to install tee at least 45 degrees above horizontal position. *Do not install horizontally.* See FIG 15.



### Installation of FC801 Pipe Adapter

A) Find adapter size marking on part prior to gluing into FC800 tee (SEE FIG 16).

B) Insert and glue opposite side of adapter into FC800 tee as shown in FIG 17 and 17A. Use standard recommended pipe gluing practices. Use CPVC primer and adhesive *only*.

### Product Specifications

#### Electrode Specifications:

##### S8000CD

pH Range: 0-14 (sodium ion error above pH 12.3)  
 Temp Range: 0-100C (derated based on pressure)  
 0-80C (in FC800)  
 0-70C with EM modules  
 Pressure Range: 0-100psig (derated based on temp)  
 Speed of Response: 95% in 5 seconds  
 Wetted Materials: PPS (Body), HDPE(junction), pH glass, Viton o-rings

##### S8000CD-HF

pH Range: 0-12  
 Temp Range: 0-50C (derated based on pressure)  
 Pressure Range: 0-100psig (derated based on temp)  
 Speed of Response: 95% in 5 seconds  
 Wetted Materials: PPS (Body), HDPE(junction), HF-resistant pH glass, Viton o-rings

##### S8000CD-ORP

Range: +/- 1000mV  
 Temp Range: 0-100C (de-rated based on pressure)  
 0-80C (in FC800 or with EM modules)  
 Pressure Range: 0-100psig (derated based on temp)  
 Wetted Materials: PPS (Body), HDPE(junction), Platinum, Viton o-rings

#### Cable Connections:

##### S853\*

Coaxial: Center = pH or ORP \*  
 Braid = Reference \*\*

##### S855\*

Coaxial: Center = pH or ORP \*  
 Braid = Reference \*\*  
 Red: Temperature  
 Black: Temperature  
 Green: Solution Ground

##### S856 \*\*

Red: V+  
 Black: GND or signal for 4-20mA  
 White: Modbus A (+)  
 Green: Modbus B(-)

#### Mounting Hardware Specifications:

##### FC800, FC801, FC875/S, FC875/T

Temp Range: 0-80C  
 (derated based on pressure)  
 Pressure Range: 0-100psig (derated based on temp)

#### Electronics Modules Specifications:

##### EM800, EM801, EM805

Temp Range: 0- 70C  
 (derated based on pressure)  
 Pressure Range: 0-100psig (derated based on temp)

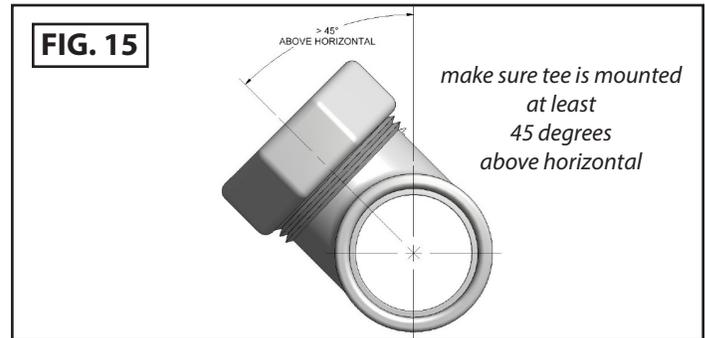
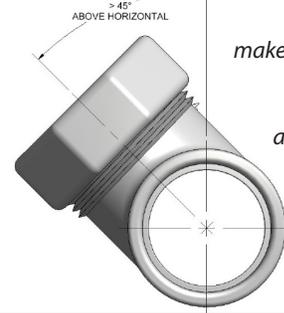


FIG. 15



make sure tee is mounted  
 at least  
 45 degrees  
 above horizontal

#### Notes:

\* extending cable is not recommended due to noise sensitivity of measurements for pH

\*\* cable can be extended. Recommend 24AWG shielded wire

### Electrode Calibration Guidelines:

As a rule, follow the procedures shown in the pH Meter's Instruction Manual. These procedures will vary depending on whether the meter is a simple type with manual adjustments, a micro-processor type or a pH transmitter.

The frequency of calibration is a function of many factors. These factors include:

- 1) The accuracy required by the application.
- 2) The value of the off-specification product versus the cost of calibration.
- 3) The coating or abrasive nature of the application.
- 4) The stability of the pH Electrode and pH Meter as a system.

The frequency of calibration is really determined by experience. At a new installation, calibration might initially be checked every few hours or shift with the calibration changes noted in a log. As a pattern of longer stability is found, the time between calibration checks can be increased to once a day or once a week.

### System Calibration Concepts

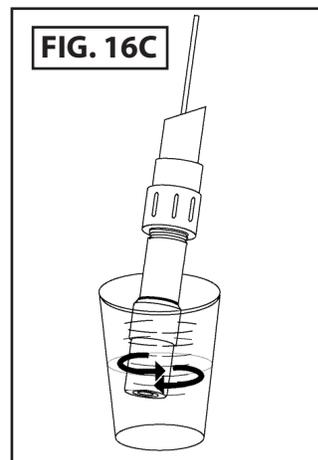
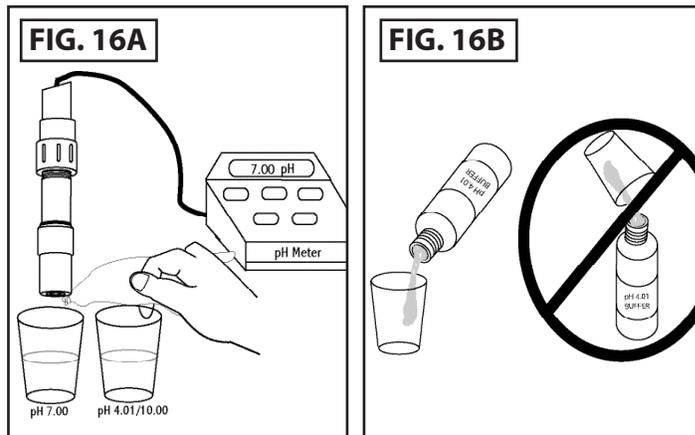
The pH Electrode and the pH Meter should always be calibrated as a system. Electronic calibration of a pH Meter with a pH signal simulator checks the meter only and does not correct for imperfections of the pH electrode. Even if perfect when new, the performance of pH electrodes varies with time, usually in an unpredictable way. When changing electrodes or connecting an electrode to a different pH meter re-calibration must be performed.

### Two-Point Calibrations

Two-point calibrations correct for both the pH electrode's offset and span errors. Since both the offset and span vary with time the two-point method is the one preferred. Choose buffer pH 7 for zero-point and a second buffer close to your normal operating range (usually pH4.01 or pH 10.00). See FIG 16 A-C.

### Grab Sample Calibrations

The Grab Sample Calibration method is used when it is difficult or undesirable to remove an electrode from a system. This method involves obtaining a sample of the liquid being measured and noting the meter's reading at that time. The sample's reading is obtained by use of a calibrated lab or portable meter and that reading is compared to that of the on-line meter. The on-line meter is adjusted by the difference between the readings. It is important to use the difference between the readings because the system's reading may have changed in the intervening time. It is important that the sample being measured by the lab meter be at the process temperature or erroneous results may occur.



<b>FIG. 17</b>			
<b>PLATINUM ORP ELECTRODE IN 7 BUFFER/QUINHYDRONE MIXTURE</b>			
Temperature	20C (68F)	25C (77F)	30C (86F)
Readings (mV)	89-107	83-101	76-94
Readings (pH)	5.20-5.50	5.30-5.60	5.42-5.72
<b>PLATINUM ORP ELECTRODE IN 4 BUFFER/QUINHYDRONE MIXTURE</b>			
Temperature	20C (68F)	25C (77F)	30C (86F)
Readings (mV)	260-287	254-281	247-274
Readings (pH)	2.15-2.60	2.25-2.70	2.37-2.82

### Intermittent Operation

Some facilities are only operated part of the time. When out of operation, electrodes must not be allowed to be exposed to air and become dry. Electrodes should be removed from such systems and stored in their bottles or caps or in a beaker filled, preferably, with pH 4.0 Buffer (SEE FIG 10). In some instances, power to the meter is shut off; this condition can be harmful to electrodes. Electrodes should be disconnected from un-powered meters.

ORP Calibration - Some instruments permit ORP calibration while others do not. Please refer to your meter's instruction manual for details. There are many types of ORP/mV standards available. See FIG 19 for quinhydrone + pH buffer standards. For all other standards, please refer to label on standard solution for acceptable measurement range.

### Electrode Cleaning Tips:

Coating of an electrode's measuring surface can lead to erroneous readings including shortened span and slow response times. The type of coating determines the type of cleaning technique.

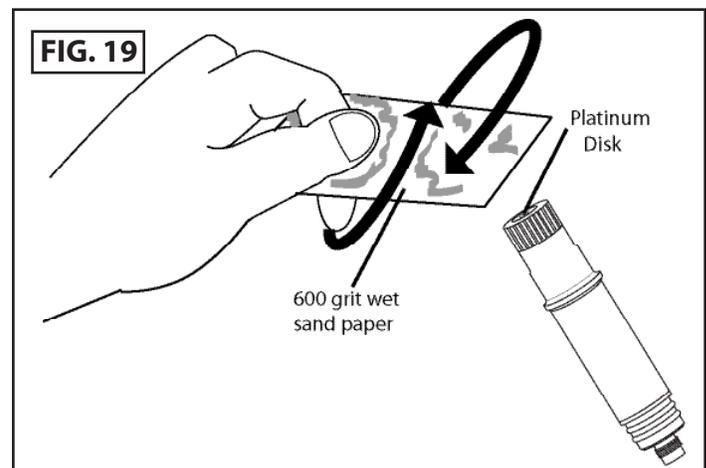
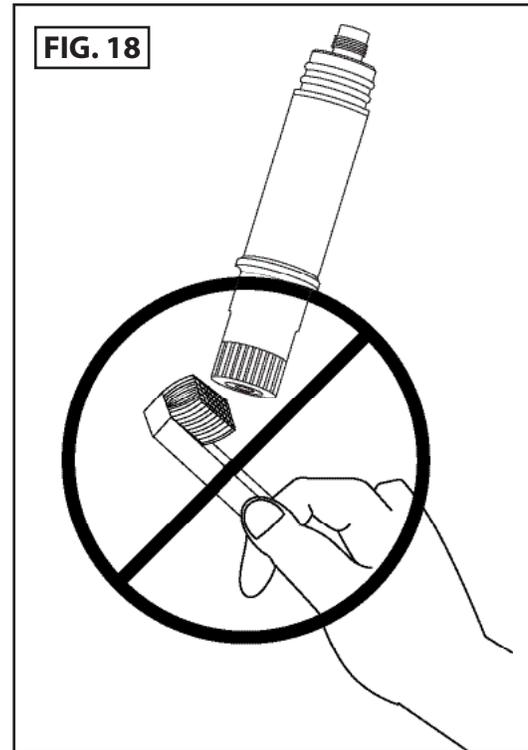
Soft Coatings can be removed by vigorous stirring, by use of a squirt bottle or very carefully, by gently wiping with a soft, clean non-abrasive paper or cloth. *Do not use any brush or abrasive cleaner on pH glass* (SEE FIG 18).

Hard Coatings should be chemically removed. The chemical used to remove the coating should be the least harsh chemical that dissolves the coating in one or two minutes and does not attack the electrode's materials of construction. For example, a calcium carbonate coating might be removed with 5% HCl (muriatic acid).

Oily or Organic Coatings are best removed with detergents or an appropriate solvent that does not attack the electrode's materials of construction. For example, isopropyl alcohol might be used but acetone should be avoided if the electrode's body is made of CPVC.

**NOTE:** When using chemicals or solvents, care should be taken and appropriate eye, face, hand, body and/or respiratory protection should be used.

Protein-based coatings are best removed with an enzyme-based cleaner such as TERG-A-ZYME ([www.alconox.com](http://www.alconox.com)). Abrading or sanding a pH electrode's surface should never be done. However, the measuring surface of an ORP/REDOX electrode may be gently abraded by use of 600 grade wet silicon carbide paper (SEE FIG 19), jeweler's rouge or very fine steel wool, but try to clean chemically before abrading with 600 paper.



### Electronic Modules

Three types of electronic modules are offered within the S8000 Series product line. See FIG 20 for choices. Model EM800, a unity gain amplifier module, allows users to send a signal up to 1000 feet remotely from the electrode to the transmitter or controller.

You can choose cable S853 or S855 to use with EM800. The S853 cable will transmit the electrode output only (no temperature compensation). Cap cable model S855 will send the signal via the coaxial cable and will also transmit the temperature signal. Model EM801 is a differential amplifier that requires the use of electrode adapter EA899TC, which incorporates a stainless steel solution ground that feeds into the EM801. This module (EM801) is useful for application in which the ground potential of the liquid is elevated (ground loop). Like the EM800, you can use either S853 or S855 cap cable with the EM801. Model EM805pH is a blind 4-20mA or Modbus 485 transmitter module that is factory calibrated and is not adjustable. An external power supply is required (user supplied). The EM805pH module should be used with electrode adapter EA899TC. The 4-20mA output from the EM805pH will already be temperature compensated via the Pt1000 RTD that will be in the EA899TC-P1k module. Module EM805ORP can be used with electrode adapter EA891 (submersion without temperature sensor) or EA899 (in-line without temperature sensor).

**NOTE:** When using EA899TC with either EM800 or EM801, please note that the temperature sensor passes by the electronic module's circuit board (is not conditioned) and is then directly connected to the temperature input connections of the pH transmitter or controller.

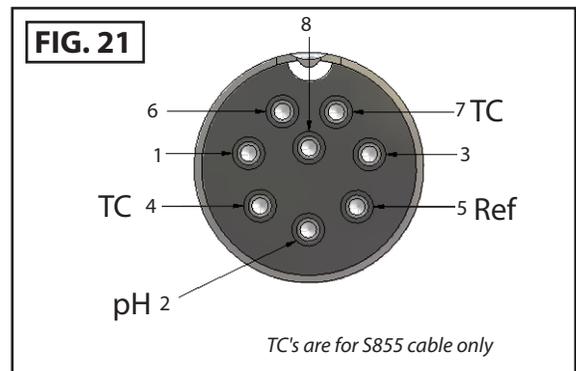
### Cap Cable Assemblies

See page 8 "Cable Connections" for wire designations.

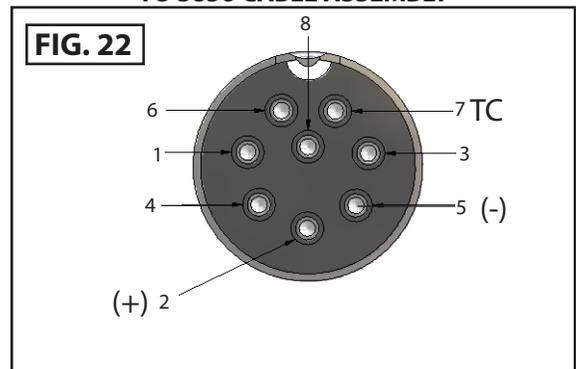
MODULE, ADAPTER AND CABLE CHOICES		
Electronic Module	Electrode Adapter	Cable Assembly
EM800	EA891, EA899 EA899TC	S853 S855
EM801	EA899 EA899TC	S853 S855
EM805pH	EA899TC-P1k	S856
EM805ORP	EA891 or EA899	S856

**FIG. 20**

**EM800 & EM801 CONNECTOR DIAGRAM TO S853 AND S855 CABLE ASSEMBLIES**



**EM805 CONNECTOR DIAGRAM TO S856 CABLE ASSEMBLY**



### EM805pH and EM805ORP Wiring

See FIG 23 for wiring. Please note that EM805's 4-20mA output is not adjustable. You can also read the output as Modbus 485 with a PLC or you computer and Sensorex's free software.

### Troubleshooting Your S8000 System

#### General Troubleshooting

Always check all electrical connections. Make sure all parts are assembled correctly and o-rings are well greased.

#### Electrode Module Troubleshooting

**EM800** - This module is battery-powered and sealed. The battery cannot be replaced. If the module fails (reads 7pH always or 0mV for ORP), then replace with a new one. Typical life is about three years from the date stamped on the module (MMYY).

**EM801** - This module is battery-powered and sealed. The battery cannot be replaced. This module must be paired with electrode adapter EA899TC (has solution ground input, necessary for correct function of the differential amplifier circuit). If the module fails (reads 7pH always or 0mV for ORP), then replace with a new one. Typical life is about three years from the date stamped on the module (MMYY).

**EM805** - This module is line-powered and does not have a limited service life. Wire the EM805 + S856 cable as shown in FIG 23 A 12-24V DC power supply is suggested

#### Electrode Adapter Troubleshooting

To verify that the electrode adapter is functioning properly you can:

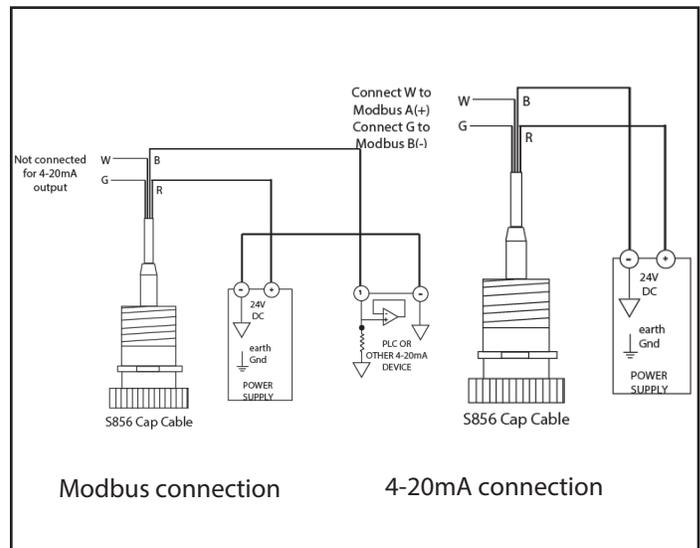
- 1) Remove the electrode from the adapter and use a paperclip to short out the internal internal connector. For pH, the value should read pH7. For ORP it should read 0mV.
- 2) Use C110 simulator + CX2/EA899 adapter (from Sensorex) to simulate pH4, 7 & 10 inputs or +700 & -700mV for ORP.

If the adapter fails the tests, please contact the factory. Check electrode to make sure o-rings are installed. *Make sure electrode is installed in adapter before installation.* If the adapter passes the test, then the electrode is the source of the problem.

#### Electrode Troubleshooting

See FIG 24 table for typical electrode symptoms, causes and corrective actions.

### EM805 LOOP-POWERED pH AND ORP TRANSMITTER WIRING



**FIG. 23**

### pH ELECTRODE TROUBLESHOOTING

Buffer reading	Possible Cause	Corrective Action
6.2-6.8 in all buffers	a) Cracked pH glass b) Stress crack	a) Replace electrode b) Contact Sensorex for Return Authorization
7.00 in all buffers	a) Bad connection b) Internal short circuit	a) Check/fix connection b) Contact Sensorex for Return Authorization
Buffers read close to expected value but speed of response* is slow (>30 seconds)	a) Dirty electrode pH glass and/or reference junction b) Temperature too low	a) Clean electrode b) Flat pH glass pH electrodes should be used at Temp >10C/50F
Large offset in buffers	a) Ground loop****	a) Ground solution for tank or line to known earth ground or buy EM899TC
Short span*** (Less than 70%)	a) Dirty pH glass or reference junction b) Aged electrode	a) Clean electrode b) Replace electrode (too old)
Unstable or drifting reading	Reference dirty or plugged	Clean electrode

**FIG. 24**