YSI ProDSS assembly & maintenance -- *rev 11/21/18*

These procedures are to be performed by program staff or people who have been trained by staff.

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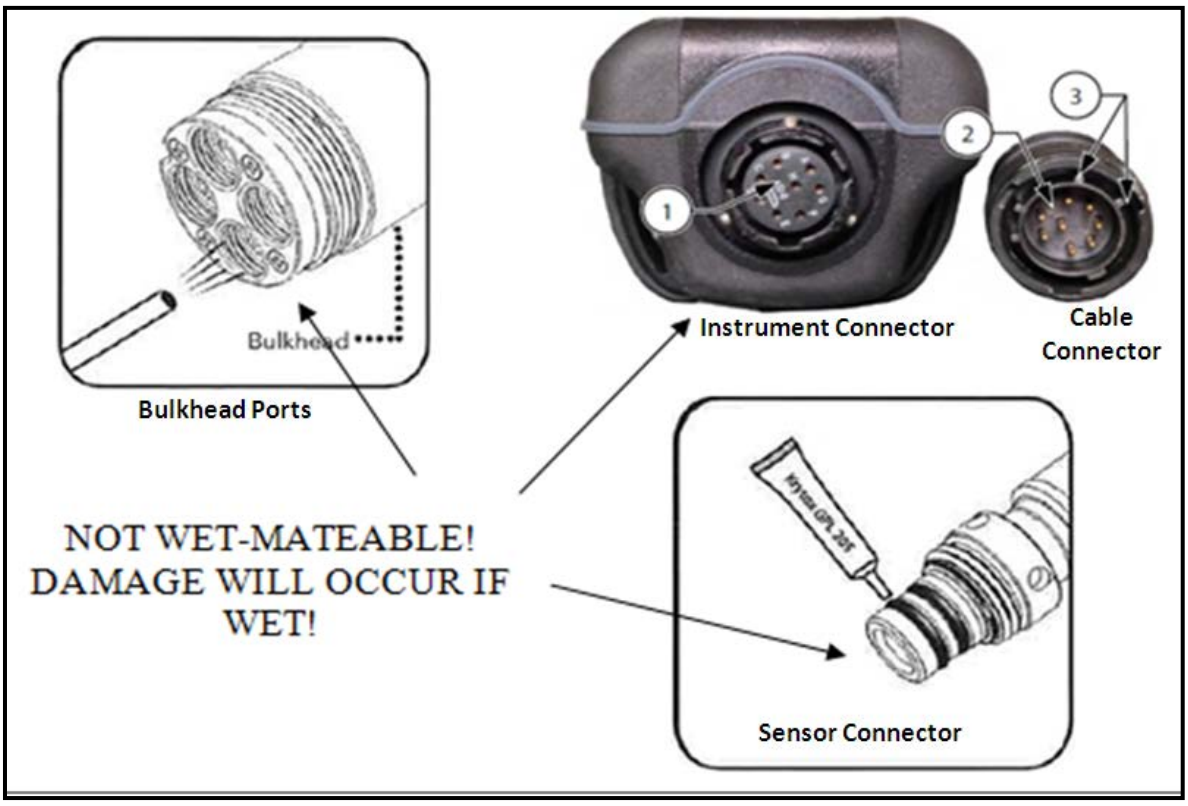


A FEW NOTES BEFORE GETTING STARTED

The instrument/cable connectors, bulkhead ports, and sensor connector ends are not wet-mateable and can become damaged if they come into contact with moisture. ***Never connect the cable connector to the handheld unit, or install a sensor if they are wet!*** Carefully follow sensor tightening instructions during installation. If any resistance is felt during any tightening (sensor, sensor guard, port plug), stop tightening, loosen nut or guard, and start again.

PUTTING THE UNIT TOGETHER

Cable Connection

Make sure the connectors are clean and dry before connecting! If connecters are clean and dry, align the keys on the male cable connector with the female slots on the instrument connector. Push together firmly, and then twist the outer ring clockwise until it locks into place. The metal pin should "snap" into place and be visible through the small hole in the outer ring (see image below).

Metal pin showing through outer ring of connector piece.

Sensor Installation

NOTE: *There are two different storage procedures for the sensors and unit:* ***short term*** *(sensors are still attached to the unit), and* ***long term*** *(sensors have been removed and individually stored). If the unit has been stored under the short term procedures, continue to the Calibration section below.*

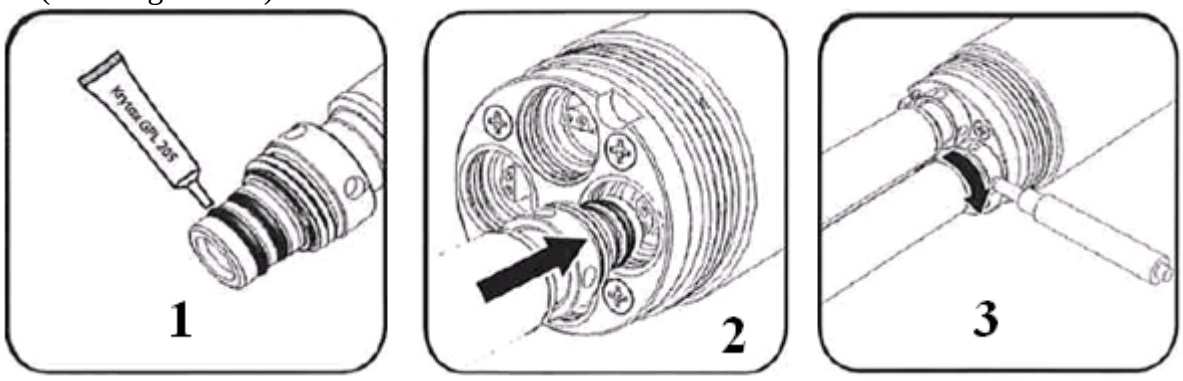
The ports on the ProDSS bulkhead are universal; therefore, you can install any sensor into any port. For highest accuracy, always install a conductivity/temperature sensor to compensate all measurement data for temperature and dissolved oxygen data for conductivity. Similar to the cable connection, the sensor and bulkhead ports are not waterproof, therefore **always make sure the ports are clean and completely dry before installation.** Any moisture in the ports will result in damage to the unit not covered under its warranty. **Avoid sensor installation in the field at all costs.**

Dissolved Oxygen

1. Remove the DO sensor from the container. Slide the plastic protective cover off of the end of the sensor; you may need to "wiggle" it back and forth to get it off.
   NOTE: *Do not remove the black DO cap (this cap will twist off in a counter clockwise direction)!*
2. Inside the plastic protective cover is a yellow sponge, inspect the sponge and take note if it appears dry. Also inspect the tip of the sensor for fouling or other debris, if dirty clean with a **moist** non-abrasive lint-free cloth.
   NOTE: *Clean the tip carefully to prevent scratches. Do not use organic solvents to clean the ODO sensor or sensor cap.*
3. Inspect the bulkhead ports for moisture or debris, clean with a **dry** lint-free cloth if need be. If moisture can't be reached with a cloth, ask staff to assist with an air compressor. Remove the red connector cap and apply a **thin** coat of Krytox o-ring lubricant to the sensor o-rings (maintenance kit). Wipe off any extra lubricant with a lint-free cloth (see image below).
4. Carefully align the sensor into the bulkhead port rotate the sensor gently until you can feel it align with the bulkhead. Once aligned, push the sensor into the bulkhead until it is firmly seated in the port (see image below).
5. Carefully tighten the retaining nut, if any resistance is felt loosen the nut and try again. Finger tighten as much as you can, then use the sensor installation tool to tighten until snug (see image below). DO NOT OVER TIGHTEN!
6. Submerge probe in water for 24 hours prior to calibrating.

Conductivity (NOTE: *Use care when handling this sensor to prevent damage to the exposed thermistor (at tip of sensor).*

1. Remove the conductivity sensor from the container. Slide the clear plastic cap from the tip of the sensor and store in container. Inspect the tip of the sensor for debris or fouling, look into the two holes for debris or fouling. If the tip is dirty, refer to the *Maintenance* section below for cleaning techniques.
2. Inspect the bulkhead ports for moisture or debris, clean with a **dry** lint-free cloth if need be. If moisture can't be reached with a cloth, ask staff to assist with an air compressor. Remove the red connector cap and apply a **thin** coat of Krytox o-ring lubricant to the sensor o-rings (maintenance kit). Wipe off any extra lubricant with a lint-free cloth (see image below).
3. Carefully align the sensor into the bulkhead port rotate the sensor gently until you can feel it align with the bulkhead. Once aligned, push the sensor into the bulkhead until it is firmly seated in the port (see image below).
4. Carefully tighten the retaining nut, if any resistance is felt loosen the nut and try again. Finger tighten as much as you can, then use the sensor installation tool to tighten until snug (see image below). DO NOT OVER TIGHTEN!



If not all ports on the bulkhead will be filled, a port plug must be installed to prevent damage to

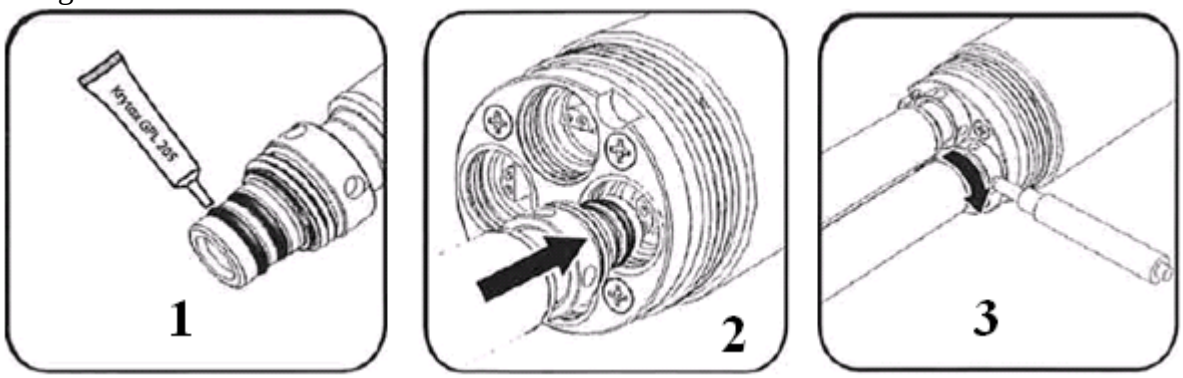
the unit.

pH

1. Remove the pH sensor from the container. Holding the bottle upright, remove the bottle covering the tip of the sensor and replace the "open" cap and o-ring with the storage cap and store in container. If the tip of the pH sensor appears dirty, refer to the *Maintenance* section below for cleaning techniques.
2. Carefully rinse the sensor tip with clean tap or distilled water, TAKE EXTREME CARE to not get the sensor connector end of the sensor wet. If you do get moisture in the connector end, completely dry the sensor with a lint-free cloth, or ask staff for assistance with an air compressor.
3. Inspect the bulkhead ports for moisture or debris, clean with a **dry** lint-free cloth if need be. If moisture can't be reached with a cloth, ask staff to assist with an air compressor. Remove the red connector cap and apply a **thin** coat of Krytox o-ring lubricant to the sensor o-rings (maintenance kit). Wipe off any extra lubricant with a lint-free cloth (see image below).
4. Carefully align the sensor into the bulkhead port rotate the sensor gently until you can feel it align with the bulkhead. Once aligned, push the sensor into the bulkhead until it is firmly seated in the port (see image below).
5. Carefully tighten the retaining nut, if any resistance is felt loosen the nut and try again. Finger tighten as much as you can, then use the sensor installation tool to tighten until snug (see image below). DO NOT OVER TIGHTEN!

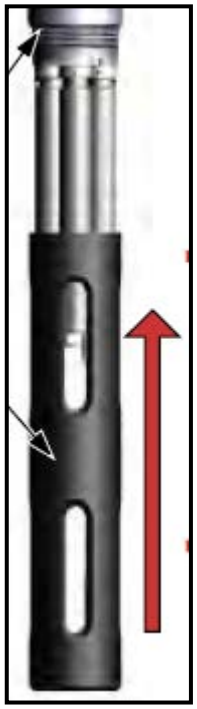
Turbidity

1. Remove the turbidity sensor from the container. Slide the clear plastic cap from the tip of the sensor and store in container (you may need to wiggle it off).
2. If the tip is dirty, refer to the *Maintenance* section below for cleaning techniques.
3. Inspect the bulkhead ports for moisture or debris, clean with a **dry** lint-free cloth if need be. Remove the red connector cap and apply a **thin** coat of Krytox o-ring lubricant to the sensor o-rings. Wipe off any extra lubricant with a lint-free cloth
4. Carefully align the sensor into the bulkhead port, rotate the sensor gently until you can feel it align with the bulkhead. Once aligned, push the sensor into the bulkhead until it is firmly seated in the port.
5. Carefully tighten the retaining nut, if any resistance is felt loosen the nut and try again. Finger tighten as much as you can, then use the sensor installation tool to finish tightening. You will not need to tighten the retaining nut much more, only a ¼ to ½ turn, DO NOT over tighten.



If not all ports on the bulkhead will be filled, a port plug must be installed to prevent damage to the unit.

Installing the Sensor Guard



1. Carefully slide the sensor guard over the bulkhead and attached sensors/port plugs. Push the sensor guard toward the bulkhead until the sensor guard threads align with the bulkhead threads (see image right).
2. Carefully finger-tighten the sensor guard clockwise.

NOTICE: If any resistance is felt, loosen the sensor guard completely to prevent cross-threading. Incorrect installation may cause damage to the sensor guard or bulkhead that is not covered by the warranty.

Battery Life

Use YSI designated charging equipment only!
If the battery is not charged, the meter must be charged from the AC power adapter (strongest charge source), directly from a computer USB connection or from an external, portable USB battery pack. For the instrument to recognize that it is using AC power, you must start charging the ProDSS while on. After the instrument recognizes it is being charged, it can be turned off to finish charging. When using the AC adapter, it takes approximately 14 hours to charge the ProDSS battery when the instrument is turned off during the charge. The amount of time required to completely charge the battery pack when the ProDSS is initially turned on during the charge is approximately 9 hours. Expected battery life:

- ProDSS instrument only - 48 hours
- ProDSS with fully loaded cable assembly and 25% (Default) LCD brightness - 20 hours
- ProDSS with fully loaded cable assembly and 100% LCD brightness - 14 hours

For maximum battery life, keep the battery 40% to 80% charged. Also, a larger discharge (e.g. to 50%) is better than a small discharge (e.g. to 90%) between recharges.

Check Sensor Readings

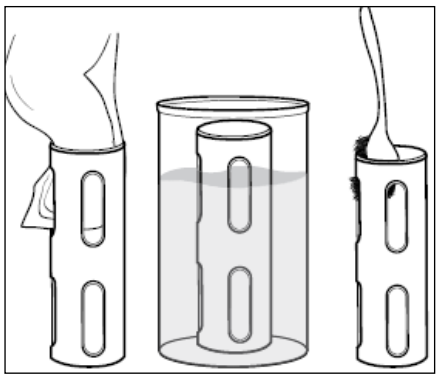
After installing all the sensors turn the unit on. In the "Run" screen (main display screen, image right) make sure all parameters are being displayed and are displaying the proper units:
temperature – °C
barometer – inHg
dissolved oxygen – DO mg/L
conductivity – SPC-µS/cm
salinity – SAL-ppt
pH – pH units
turbidity – FNU
If any of these are not right, do the following:

Select the *probe button*  and scroll down to Display submenu and hit enter. Scroll down and select the desired parameter. A submenu will appear with multiple unit options, select the proper unit and return to the Run Screen.

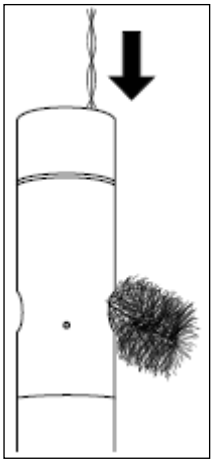
MAINTENANCE

When performing maintenance on the ProDSS and its sensors, follow the specified procedures in this section, which have been taken directly out of the manual, or it could void the warranty. For more information on the warranty, consult the manual.

Cleaning the Handheld Unit, Cable, and Bulkhead
The handheld unit, consisting of the screen, keypad, and the unit itself, can be cleaned with a wash cloth dampened with a mild solution of clean water and dish soap.
DO NOT clean handheld unit, cable, or bulkhead if they are detached or the sensor ports are exposed (on bulkhead). If these connectors are exposed to any moisture, the unit can be damaged and would not be covered under warranty.



Cleaning the Sensor Guard
For a quick cleaning of the sensor guard, use a cloth dampened with clean water and dish soap. To remove resistant dirt or heavy bio-fouling, soak the guard in a solution of clean water and dish soap and then scrub with a plastic scrub brush. For a stronger soak, use vinegar.
DO NOT use a brush that could scratch the finish on the guard, **DO NOT** sand or polish the guard. Removal of the guard coating can affect turbidity data.



Cleaning the Bulkhead & Probes—general instructions
The bulkhead, probe guard, and calibration cup can all be cleaned with a mild detergent. A bottle brush works well for cleaning the calibration cup; remove the locking ring and gasket and scrub the inside of the chamber well. Remove the bottom of the cup to clean it as well, particularly the threads which can get full of grit. Use a bottle brush to clean the probe guard, removing it from the bulkhead and unscrewing the bottom of the guard to clean it. Clean any dirt off of the bulkhead and sides of the probes using a toothbrush. ***Don't scrub the faces of the probes with a brush, as this could cause damage.*** Be sure to rinse everything well with tap water after you've cleaned it.

Cleaning the Insides of the Sensor Ports
First clean and dry around the bases of the sensors, preferably with forced air. Use the sensor ring wrench to detach the sensors from their ports. There are two o-rings on every probe that keep water out of the ports. Look for damage or sediment on these o-rings, in which case the seal could have been compromised—report this to YSI. If you see any sediment or contamination, wipe the o-rings with a Kimwipe and apply a thin layer of Krytox grease. You can also flush it out with isopropyl alcohol to dry it completely (can use forced air) and remove any contamination that might be present. Tiny drops of water inside the port probably will not do any damage to the cable assembly.

Cleaning the Cable Connector to the Handheld
This connector is water-tight, but it's a good idea to periodically open it and clean any grit out with a toothbrush and soapy water.

Conductivity Sensor

NOTE: Be careful when handling this sensor, the tip has a temperature sensor that is fragile.

1. Dip the cleaning brush from the maintenance kit in distilled or clean tap water, insert the brush at the top of the channels and sweep the brush back and forth 15-20 times.
2. If heavy build up has occurred on the electrodes, use a mild solution of dish soap and clean water. If build up is still present, soak the sensor in white vinegar and then clean with the brush and a mild soap and water solution.
3. Rinse the sensor after cleaning.
4. Gently pat dry with Kimwipes and proceed to the *Storage* section below.

pH Sensor

NOTE: pH and pH/ORP sensors require periodic maintenance to clear contamination from the sensing elements. These contaminants can slow sensor response time. Clean the sensors when deposits, bio-fouling or other contamination appears on the glass or when the sensor response time is noticeably slow. Avoid using deionized water when cleaning or storing (short term) the pH sensor, because it tends to leach electrolytes from inside the sensor--clean tap water is preferable. DO NOT physically scrub or swab the glass bulb: it's fragile and can break with a small amount of force.

<u>To clean a sensor whose glass bulb looks fouled:</u>

1. Remove the sensor from the bulkhead and soak the end of the sensor in a mild solution of clean tap water and dish soap in a glass beaker. Soak for ~10 to 15 minutes.
2. After soaking, rinse with clean tap water and inspect the glass probe, if the probe is visibly clean then proceed to storage.
3. If the glass bulb appears to still be dirty, soak the sensor in 1 molar HCl for 30 to 60 minutes, if HCl is not available, use white vinegar. After soaking in HCl rinse with clean tap water, then soak the sensor in clean tap water for 60 minutes, stir occasionally.
4. If dirt or bio-fouling is still present, soak the sensor in a 1:1 dilution of clean tap water and chlorine bleach for 60 minutes. Rinse the sensor with clean tap water; soak the sensor in clean tap water for 60 minutes.
5. Gently pat dry with Kimwipes and proceed to the *Storage* section below.

<u>If a sensor looks fine but has slow response time or, when calibrating (see protocol), is outside proper mV ranges or shows a GLP warning in Kor after calibration</u>: Perform the bleach soak. This might remove biofouling which might be impeding the signal across the sensor interface.

Turbidity Sensor

Clean the sensing window with a non-abrasive, lint-free cloth. Clean the window carefully to avoid scratches. If necessary, use a mild solution of dish soap and water. Gently pat dry with Kimwipes and proceed to the *Storage* section below.

Dissolved Oxygen Sensor Cap

ODO sensor caps are **warranted for 1 year** but have a typical working life of 18 to 24 months. As the ODO sensor cap ages, large scratches in the paint/dye layer and changes in the dye layer can reduce measurement stability and response time. Periodically inspect the sensor cap for damage and large scratches in the paint/dye layer. Replace the cap when readings become unstable and cleaning the cap and DO recalibration do not remedy the symptoms.

The sensor cap should be kept clean since some types of fouling may consume oxygen which could affect the dissolved oxygen measurements. To clean the sensor cap, gently wipe away any fouling with a lens cleaning tissue that has been moistened with water.

NOTICE: Do not use organic solvents to clean the sensor cap. Using an organic solvent to clean the sensor cap may cause permanent damage to the cap. For example, alcohol will dissolve the outer paint layer and other organic solvents will likely dissolve the dye in the cap.

IF THE CAP EVER GETS DRIED OUT (left dry for longer than 8 hours), rehydrate it by soaking in room-temperature tap water for 24 hours. After the soak, recalibrate the sensor.

Sensor Cap Replacement

1. It is VERY important to keep the instruction sheet that is shipped with a new sensor and cap, or a new replacement cap. Calibration coefficients are on the instruction sheet and must be programmed into the sensor they're on. If you're getting a whole new sensor, a new cap will come with it and the coefficients will already be programmed into the sensor. If you're just getting a replacement cap, you'll have to program the coefficients into the sensor you're installing it on—see below. Keep the instruction sheet with the coefficients in case you need to reload them.
2. It is also important to keep the sensor cap in a 100% humid environment—see storage sections below. Do not remove a new cap from its shipping chamber until ready for installation.
3. Use extreme care not to damage the threads at the end of the sensor. Turn the old cap on the sensor counterclockwise and remove; avoid hand tools, but if the cap cannot be removed by hand, use a small pair of pliers gently on the cap until it "breaks loose". Never use the pliers on the sensor itself. Remove and discard the old o-ring without using any tools and clean the threads with a clean, lint-free cloth.
4. Inspect the new o-ring for any nicks, tears, or particles/contaminants. If the o-ring is compromised, discard and get a new one from the maintenance kit.
5. Install the new o-ring over the threads and into the o-ring groove. DO NOT twist the o-ring.
6. Carefully apply a thin coat of Krytox to the o-ring only; if excess lubricant is applied to the threads or sensor body, gently wipe it off with a lint-free cloth.
7. Make sure the new sensor cap cavity is completely dry, then carefully finger-tighten the cap clockwise onto the sensor. The o-ring should be compressed between the sensor cap and body and not pinched. If the o-ring is pinched, discard and repeat the above steps with a new o-ring. Do not over-tighten the cap.
8. Attach the sensor to the bulkhead; refer to the Sensor Installation section above for proper sensor installation techniques.
9. After the new sensor cap has been installed, the sensor cap coefficients must be programmed into the sensor. You can do this via either the handheld or KorDSS, following the instruction sheet shipped with the new cap.
10. Calibrate the sensor after cap replacement and coefficient update; refer to the DO Calibration protocol for the ProDSS.

Installing a Port Plug

1. Apply a thin coat of Krytox o-ring lubricant to the o-rings on the plug port.
2. Remove any excess lubricant from the o-rings and port plug with a lint-free cloth.
3. Insert the port plug into the empty port and press until firmly seated.
4. Finger-tighten the port plug clockwise to install. If necessary, use the sensor installation tool to make sure that the plug is fully seated into the port.

NOTICE: The o-rings will not be visible if a port plug is correctly installed. Do not over-tighten the port plug; over-tightening can cause damage.

SENSOR STORAGE

There are two ways to store the YSI ProDSS: short term and long term. Only use the Short Term Storage procedures if the unit and its sensors will be stored for 4 weeks or less. If the unit will be stored for over a month, use the Long Term Storage procedures described below.

Short Term Storage – Storage time ≤ 4 weeks

When in regular field use or for the duration of the monitoring quarter, all sensors should remain installed on the bulkhead. All sensors should remain in a water-saturated air environment (this especially applies to the DO sensor cap) except for turbidity, which can be stored in a dry environment if stored separately. However, for ease of use and to reduce damage to sensors during removal, keep all sensors on the bulkhead and in a water-saturated air environment during short term storage.

- Place approximately 0.5 in (1 cm) of any water (deionized, distilled or environmental) in calibration cup. Install the calibration cup on the bulkhead and firmly tighten to prevent evaporation.
- If storing for longer than a week but < 4 weeks, use expired pH 4 buffer as a storage solution to improve the life of the pH probe. Pour enough pH 4 buffer in the calibration cup so the ends of the sensor modules are all submerged when the sensor assembly is oriented with the sensor ends down. Store the unit in this orientation.

Long Term Storage – Storage time > 4 weeks

If the ProDSS will be stored for >4 weeks, it should be broken down so that the individual sensors can be stored more securely and under their own optimal storing conditions. Storage caps can be found in the individual storage boxes of each sensor; do not lose these. The following are guidelines to removing and storing the sensors:

1. Confirm that all parameters on the ProDSS have undergone their post check procedures before removing sensors. If a parameter has not undergone a post check, inform the staff.
2. Disconnect the cable from the handheld unit and clean any grit out of the connector ring with a toothbrush and soapy water.
3. Remove and store each sensor one by one; removing them all at once prior to storage can cause unsecure situations where the sensors could be dropped and damaged.
4. Make sure each sensor is clean and dry before long term storage. Se the *Maintenance* section above for proper cleaning/drying techniques.
5. Always be aware of the sensor connector ends and the bulkhead ports. DO NOT get water into these connectors; if you do, be sure to dry them before connecting or turning on the instrument. Get help from staff if you get a connector end wet.

Conductivity

1. Loosen the retaining nut on the sensor using the removal tool, use fingers to finish removing the retaining nut from the bulkhead.
2. Remove the sensor from the bulkhead. Inspect the tip for dirt or debris, if it warrants cleaning, see the *Maintenance* section above for proper cleaning techniques. Take care to not get the exposed sensor connector end wet.
3. Pat the sensor dry with Kimwipes or a lint-free, non-abrasive cloth.
4. Place the red cap onto the sensor connector end.
5. Place the sensor into its designated long term storage container.

Turbidity

1. Loosen the retaining nut on the sensor using the removal tool, use fingers to finish removing the retaining nut from the bulkhead.
2. Remove the sensor from the bulkhead. Inspect the tip for dirt or debris, if it warrants cleaning, see the *Maintenance* section above for proper cleaning techniques. Take care to not get the exposed sensor connector end wet.
3. Pat the sensor dry with Kimwipes or a lint-free, non-abrasive cloth.
4. Place the red cap onto the sensor connector end.
5. Place the clear plastic cap onto the end of the sensor.
6. Place the sensor into its designated long term storage container.

pH

1. Loosen the retaining nut on the sensor using the removal tool, use fingers to finish removing the retaining nut from the bulkhead.
2. Remove the sensor from the bulkhead. Inspect the tip for dirt or debris, if it warrants cleaning, see the *Maintenance* section above for proper cleaning techniques. Take care to not get the exposed sensor connector end wet.
3. Pat the sensor dry with Kimwipes **only**.
4. Place the red cap onto the sensor connector end.
5. Take out the storage bottle, "open" lid and o-ring from the storage box.
6. Carefully slide the "open" lid with the o-ring placed inside the lid onto the sensor until it is about 1" up the sensor.

7. Remove the storage cap on the storage bottle. Place the tip of the sensor into the bottle and screw the "open" lid onto the bottle so that the sensor tip is submerged in the buffer 4 solution. Do not let the sensor tip touch the bottom of the bottle.
8. Place the sensor and the storage cap into its designated long term storage container.

Dissolved Oxygen

1. Loosen the retaining nut on the sensor using the removal tool, use fingers to finish removing the retaining nut from the bulkhead.
2. Remove the sensor from the bulkhead. Inspect the tip for dirt or debris, if it warrants cleaning, see the *Maintenance* section above for proper cleaning techniques. Take care to not get the exposed sensor connector end wet.
3. Pat the sensor dry with Kimwipes or a lint-free, non-abrasive cloth.
4. Place the red cap onto the sensor connector end.
5. Wet the yellow sponge located in the plastic cap, do not soak the sponge, just wet it until it becomes moist but is not dripping water.
6. Place the plastic cap with the sponge in it over the sensor tip.
7. Place the sensor into its designated long term storage container.