APPENDIX F

QUICK START GUIDE TO DRINKING WATER MONITORING

Introduction: This Quick Start guide is designed to allow users who are already familiar with the basic use of YSI 6-series sondes for surface or groundwater applications to get up and running quickly in drinking water applications. Users who have not previously used 6-series sondes should carefully read the 6-series sonde manual supplied with the drinking water sondes prior to beginning any studies and only use this Quick Start guide after a thorough understanding of the use of the YSI multiparameter instruments has been gained.

Description of YSI Drinking Water (DW) Sondes: The 6920DW and 600DW-B drinking water sondes have many identical features to other YSI 6-series instruments as detailed below:

- They interface to computers, the YSI 650 display/logger, the YSI 6500 process monitor, and data collection platforms.
- They utilize the same cables.
- The calibration of all sensors other than free chlorine is carried out in the same way.
- Discrete Sampling and Unattended Sampling studies are set up in the same way.

However, there are some key differences from the standard YSI 6-series sondes:

- The sonde contains a new circuit board which will allow the measurement of free chlorine instead of dissolved oxygen. At the present time, dissolved oxygen cannot be measured with DW sondes.
- The new free chlorine probe is very similar in appearance to the Rapid Pulse dissolved oxygen probe and is designed to fit in the "DO" port of the sonde. The free chlorine sensor will probably be ordered as an accessory with each DW sonde.
- The DW systems are designed for use in flow cell applications and the appropriate flow cell should have been ordered with your DW sonde. The sonde can be used in drinking water tanks without the flow cell, but the flow dependence of the free chlorine sensor may result in a significant compromise in accuracy under these conditions.
- The free chlorine probe must be calibrated in situ versus a known chlorine value – usually determined from a DPD analysis.
- The membrane of the free chlorine sensor is a different material (polyvinylidene fluoride) from that used with YSI dissolved oxygen sensors (Teflon or polyethylene) and must be installed using special tools.
- The electrolyte used with the free chlorine sensor is different from that used with YSI dissolved oxygen sensors. Dissolved oxygen electrolyte should not be used with the free chlorine sensor.

Setting up DW Sondes For Drinking Water Studies:

- After unpacking the instrument and the flow cell, install all sensors EXCEPT free chlorine as described in Section 2.3 of the 6-series drinking water manual. Leave the port plug installed in the "DO" port of the sonde. The chlorine probe will be installed in this port at a later time.

- Access the **Advanced|Setup** menu of the sonde and make certain that the "Sample and Hold" feature is INACTIVE.

- Calibrate all sensors EXCEPT free chlorine according to standard procedures described in Section 2.5 of the 6-series drinking water sonde manual. Use the calibration vessel supplied with the sonde to hold the calibration reagents.

  CAUTION: Make certain that the free chlorine sensor is not present in the sonde bulkhead when calibrating other sensors.

- Install the membrane for the free chlorine probe as described in Attachment 1 of this document and in Section 2.3 of the DW sonde manual. Proceed IMMEDIATELY to the next step to avoid the drying out of the free chlorine membrane and electrodes or store the probe in a beaker of tap water (not distilled or deionized) until proceeding to the next step.

- Now you MUST activate the sensor according to the following instructions:

  - Prepare a solution of free chlorine by diluting commercial bleach by a factor of 200. For example, add 1 mL of commercial bleach to 200 mL of water (purified or tap).

  - Place the sensor end of the probe in the bleach solution and leave for approximately 60 seconds.

  - After 60 seconds in the bleach solution, remove the sensor and rinse with purified water.

    CAUTION: Use of more concentrated bleach solutions and/or exposure times longer than <u>60 seconds</u> will cause a significant increase in the sensor break-in period and, in extreme cases, may cause damage to the sensor.

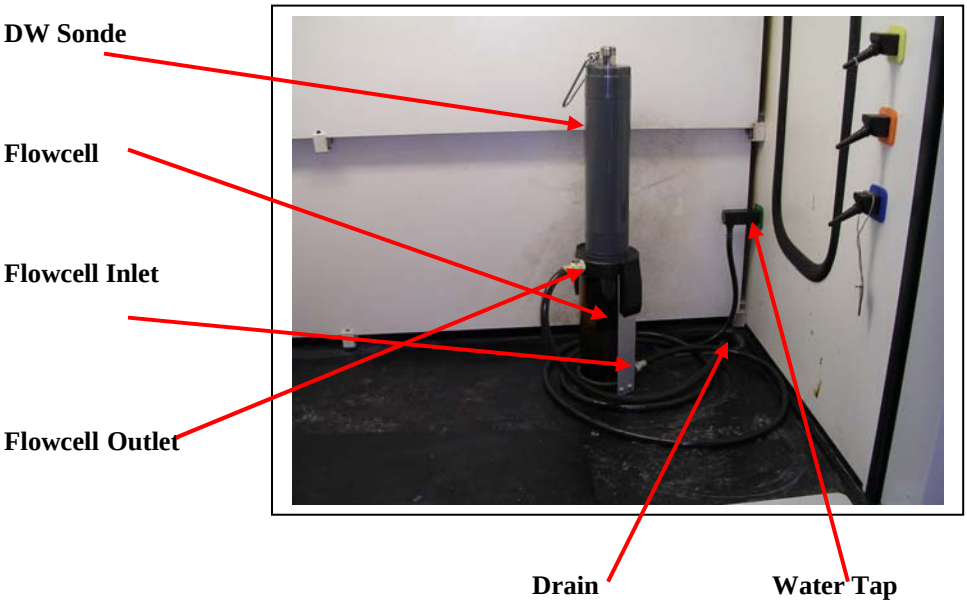
- Remove the port plug from the "DO" port in the sonde bulkhead and install the free chlorine probe according to the instructions in Section 2.3 of the manual. Be careful not to touch or damage the membrane.

  CAUTION: The sensor should either be installed in the sonde bulkhead and immersed in water in the flow cell (see below) within 5 minutes after the activation process or the probe itself should be placed in a beaker of tap water. It is important that the probe does not dry out after activation

- Following the instructions in the flow cell kit supplied with your DW sonde, install the flow cell on to the sonde. Be sure the proper O-ring is in place on the sonde above the threads of the probe compartment.

- Attach a piece of tubing between your drinking water source and the bottom connector of the flow cell and another piece of tubing between the top connector of the flow cell and your drain. Open the water valve to allow a flow of 500-1000 mL per minute(minimum 500 mL/min). See picture below for a typical laboratory setup.

CAUTION: Make certain that both inlet and outlet holes are held securely in place at the flow cell fittings and at the inlet tap and drain. Failure to take these precautions can result in flooding and subsequent damage to your facility.



- Break in the free chlorine sensor by following the instructions below.
    - Interface to the sonde with a PC, YSI 650 Display/Logger, or 6500 Process Monitor as described in the manual.
    - For PC interface, select Run|Discrete Sample from the main menu and begin a study at a 4 second sample interval with data displayed on the PC monitor.
    - For 650 interface, select Sonde Run from the main menu and readings will automatically appear on the 650 display. Be sure that the "Shut off time" in the 650 System Setup menu is set to a value of zero so that the 650 maintains interface for the break-in period.
    - For a 6500 interface, plug in the 6500 and readings will automatically appear of the 6500 display.
    - Observe the displayed readings for at least 2 hours and make sure that they are relatively stable for a period of 1 hour. If possible, it is prudent to simply leave the sensor running continuously overnight to assure stability prior to calibration.

- Calibrate the sensor according to the instructions below depending on your sonde interface device.
    - Collect an effluent sample from the drain line of the flow cell.
    - Immediately determine the free chlorine content of the sample in mg/L using a DPD-based test kit such as the YSI 9100 or the Hach Pocket Colorimeter™ II.

- Immediately calibrate the free chlorine sensor in the sonde to the value just determined via DPD analysis. Interface to the sonde for calibration can be via PC, YSI 650 Display/Logger, or YSI 6500 Process Monitor.

- Start a Continuous Monitoring Study

  - For stand-alone applications, make sure that you have new batteries in your sonde and use a PC or 650 interface to set up an Unattended Sampling Study from the Run|Unattended menu at your desired sample interval and start the study. Under these conditions, data will be logged to the internal memory of the sonde for later upload using a computer or a 650 display/logger. The **Sample and Hold** feature found in the **Advanced|Setup** menu of the sonde should be INACTIVE for this type of application.

  - For applications involving the YSI 6500 Process Monitor applications, follow the procedure below. Consult **Appendix G, Using Your DW Sonde with the 6500 Process Monitor** or the manual supplied with the 6500 for more details:

    1. Make sure that the sonde is attached to the 6500 via a suitable YSI field cable.
    2. Make sure that the 6500 is attached to line power.
    3. Make sure that readings of all appropriate parameters are displayed on the screen.
    4. Connect the 4-20 mA current loop or modbus outputs of the 6500 to your SCADA system and assure proper data capture by the SCADA system.
    5. Determine whether you would like the readings output to your SCADA system to be continuous (NOT RECOMMENDED because higher frequency of free chlorine probe maintenance and potential compromise of pH/ORP sensor life) or frozen between longer sample intervals (RECOMMENDED because of lower frequency of free chlorine probe maintenance and longer pH/ORP probe life).
    6. If you choose continuous output to the SCADA, no further action is required.
    7. If you choose to use the recommended longer sample intervals, then enter the secondary menu of the 6500 by pressing the **Esc** and **Enter** keys simultaneously. Select **Setup sonde** from the menu and (a) activate the **Data Freeze and Release** function by pressing **Enter** to show a check mark in the box and (b) choose the sample interval between readings, pressing **Enter** after selecting the interval.
    8. Data should now be acquired by your SCADA system for processing according to user software.

Maintenance of the Chlorine Sensor During a Continuous Monitoring Study

- Inspect the flow cell, inlet and drain fittings and hose attachment points as often as possible and make certain no leaks are present. If leaks are observed, turn off the water at the inlet valve and make the necessary repairs to the fittings and/or tubing.

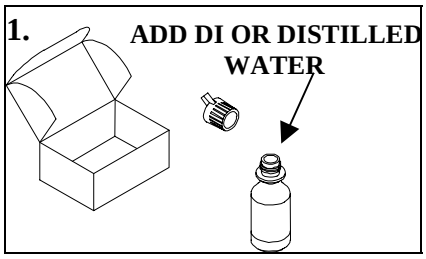
- Check the accuracy of the free chlorine sensor after approximately 2 days of deployment in flowing tap water and recalibrate the sensor to remove any drift due to long-term break-in. The accuracy check should be done by carrying out a colorimetric DPD analysis of a sample of the flow cell effluent and comparing it with the latest logged reading or the reading displayed in a real-time or 6500 study. Note that the sonde should not be taken off-line to calibrate the sensor. Calibration of any parameters during a study will not interrupt the continuity of the Unattended logging file.

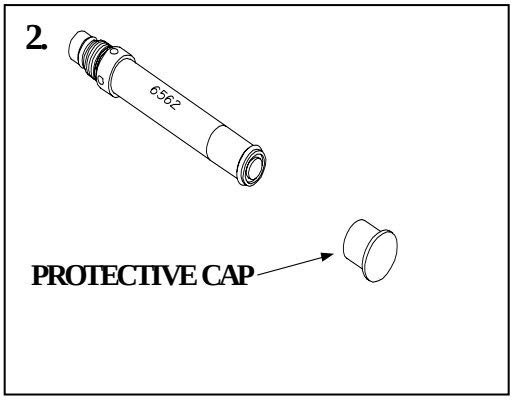
- Check the accuracy of the free chlorine sensor every two weeks if possible and recalibrate if necessary.

ATTACHMENT 1. FREE CHLORINE MEMBRANE INSTALLATION INSTRUCTIONS

FREE CHLORINE SENSOR ELECTROLYTE PREPARATION

Open the 6573 membrane kit which was shipped with your 6572 chlorine probe and prepare the electrolyte solution. Dissolve the KCl in the dropper bottle by filling it to the neck with deionized or distilled water and shaking until the solids are fully dissolved. After the KCl is dissolved, wait a few minutes until the solution is free of bubbles.





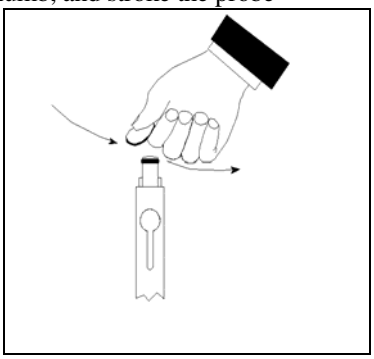
FREE CHLORINE SENSOR MEMBRANE INSTALLATION

Remove the protective Teflon membrane and O-ring from the sensor end of the YSI 6572 Free Chlorine probe**. CAUTION: The Teflon membrane MUST be removed for proper sensor function.**

Remove the protective cap is installed on the connector end of the probe.

Locate the 6035 Reconditioning Kit which was supplied with your 6572 Free Chlorine Probe. Use one of circular sanding disks the 6035 Reconditioning Kit to sand the face of the 6572 Probe according to the following instructions.

- Hold the probe in a vertical position, place a sanding disk under your thumb, and stroke the probe face in a direction parallel to the platinum electrode (located between the two silver electrodes). The motion is similar to that used in striking a match. Usually 10-15 strokes of the sanding disk are sufficient to remove black deposits on the silver electrodes. However, in extreme cases, more sanding may be required to regenerate the original silver surface.



- Rinse the probe tip well with purified water to remove any dust from sanding.

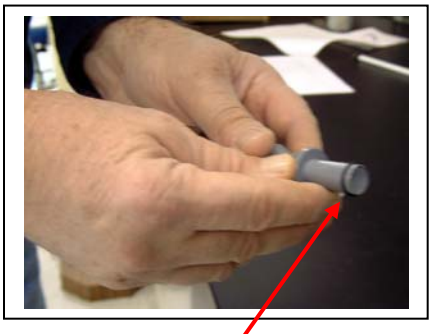
CAUTION: You must sand your free chlorine sensor as described above prior to installing a membrane to insure the surface tension for probe surface/membrane interface.

Locate the YSI 6574 O-ring Installation Kit which was shipped with your sonde. Note that the kit contains two items – a circular plate with a threaded hole and a cylindrical tool with a screwdriver-style handle as shown in the picture below.

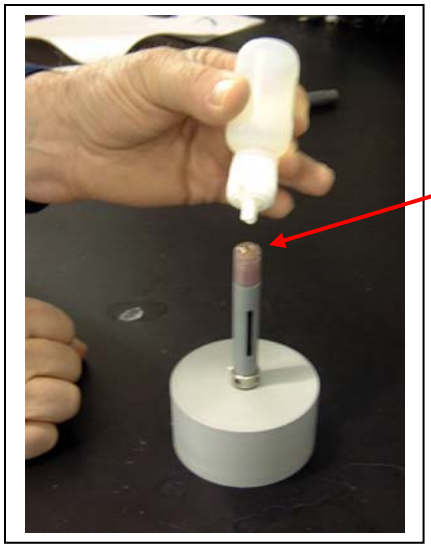
Thread the nut on the end of the 6572 probe into the base plate as shown in the picture below.

Place an o-ring from the 6573 membrane kit in the groove at the bottom of the tool as shown in the picture below left.

Apply a few drops of KCl solution to the tip of the probe as shown in the picture below right. The fluid should completely fill the small moat around the electrodes and form a meniscus on the tip of the sensor.



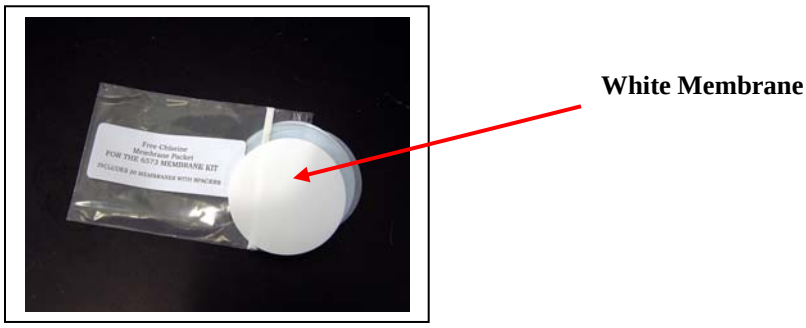
O-Ring in Groove



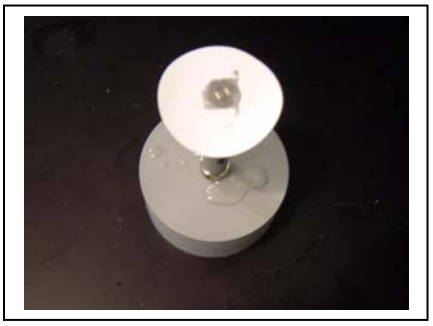
Meniscus

Remove a white membrane sheet from the package in the 6573 membrane kit as shown in the picture below.

CAUTION: The blue sheets are simply protective spacers and CANNOT be used as membranes for the free chlorine sensor.



As shown in the pictures below, lay the membrane on the probe tip that contains the electrolyte so that the probe tip is approximately in the middle of the membrane.

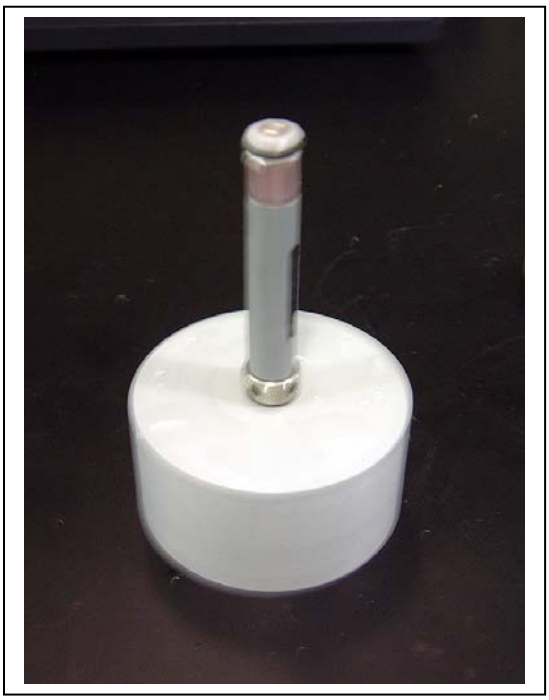


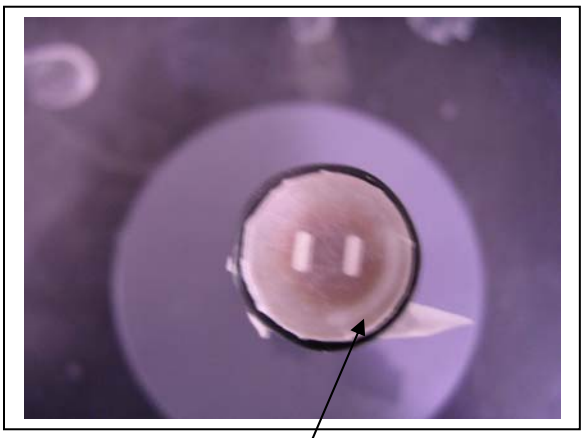
As shown in the picture below, place the bottom of the o-ring installation tool over membrane/probe face and press down securely.

As shown in the picture below left, roll the o-ring off of the end of the installation tool so that it resides in the o-ring groove of the probe. Be sure to hold onto the O-ring prior to removing the installation tool so that it does not pop out of the groove. Then, as shown below right, remove the installation tool and make certain that the o-ring is centered in the groove on probe end.

As shown in the picture below, use a razor blade or knife to trim away the excess membrane material.

The pictures below show a properly installed free chlorine membrane. Note that, because the membrane will not stretch, there may be some points where the membrane is slightly "bunched up" in the o-ring groove. This effect is normal and will not affect sensor function. Also note that the presence of bubbles under the membrane is also normal and should not affect probe function





Note the presence of a bubble after installation. This is acceptable for a free chlorine membrane.

After installing the membrane, either proceed immediately to the sensor activation protocol described above in the Quick Start Guide or store the probe in a beaker of tap water (NOT deioinized or distilled water) as shown in the picture below to prevent drying out. Be sure to place the probe GENTLY into the beaker to avoid damaging the membrane integrity.

NOTE CAREFULLY: Users who are accustomed to installing a Teflon membrane on a YSI dissolved oxygen sensor should note that the methods recommended for the Teflon installation are not likely to work well for the free chlorine membrane because this membrane cannot be stretched. Therefore, dissolved oxygen membrane installation techniques which are outline in the manuals for various YSI instruments, including standard 6-series sondes utilizing the 6562 Rapid Pulse DO sensor, are NOT RECOMMENDED for the free chlorine membrane installation.