YSI *incorporated*

YSI 5905, 5010, 200-BOD, and Pro-BOD Probe Instruction Manual

Table of Contents

INTRODUCTION

The YSI Model 5905/5010/200-BOD/Pro-BOD (Biochemical Oxygen Demand) probe is used for measuring dissolved oxygen in all popular size BOD bottles. These probes feature self stirring, easily replaceable membrane caps, and a refurbishable electrode system.

The 5905 probe is designed for use with all YSI grey-box-style dissolved oxygen meters, except for the Model 55 or Model 550A. It must be used with an adapter (5011) in order to be used on the Model 5000 and 5100 bench top instruments.

The 5010 probe is specifically designed for use with the Model 5000 and 5100 only.

The 200-BOD probe is specifically designed for use with the Model DO200 only.

The Pro-BOD probe is specifically designed for use with the Pro20 and Professional Plus instruments.

This manual also applies to probes 5905-J, 5905-K, 5905-L, 5905-W (Appendix A), and probes 5010-J, 5010-K, 5010-L, and 5010-W (Appendix A)

---IMPORTANT---

Intended Use
The 5905/5010/200-BOD/Pro-BOD probe is intended for laboratory use, not field use. It is not waterproof and should never be immersed past the taper on the stem of the probe.

Operating Principles

The 5905/5010/200-BOD/Pro-BOD probe is a polarographic dissolved oxygen sensor. An oxygen permeable membrane covers an electrolytic cell consisting of a cathode and an anode. This membrane acts as a diffusion barrier and an isolation barrier preventing the fouling of the cathode surface by impurities in the environment. The cathode is the gold electrode, and the anode is the silver electrode which completes the electrolytic cell and acts as a reference electrode.

Upon entering the cell through the membrane, oxygen is reduced at an applied potential of -0.8 V referenced to the silver electrode. The reduction current at the cathode is directly proportional to the partial pressure of oxygen in liquid (expressed as %-air saturation) which is also proportional to the concentration of dissolved oxygen (in mg/L) at a particular temperature. Thus the same partial pressure of oxygen (%-air saturation) in liquid gives different concentrations of dissolved oxygen (mg/L) at different temperatures because of the different solubilities of oxygen at different temperatures.

USING THE PROBE

The 5905/200-BOD/Pro-BOD must be plugged into a YSI meter and the stirrer power plug must be plugged into its power adapter. The 5010 must be plugged into a YSI meter only, as it gets its stirring power from the 5000/5100 instrument.

Changing the Membrane Cap

---IMPORTANT---

New Probe Use

New probes are shipped with a dry membrane cap to protect the electrodes. **A new membrane cap must be installed before first use.** For the 5905/5010, use a Teflon membrane from a 5906 Membrane Kit. For the 200-BOD/Pro-BOD, use a PE membrane from a 5908 Membrane Kit.

Follow these instructions to change membrane caps (Figure 1):

1. Remove the stir paddle from the probe by pulling it straight out.
2. Unscrew the old membrane cap from the probe. Before installing a new membrane, clean the probe tip with deionized water in order to remove any contaminants.
3. Hold the membrane cap and fill it at least ½ full with the electrolyte solution provided. Screw the membrane cap onto the probe moderately tight. A small amount of electrolyte should overflow.
4. Rinse off excess electrolyte from the probe with deionized water.
5. Reinstall the stir paddle.

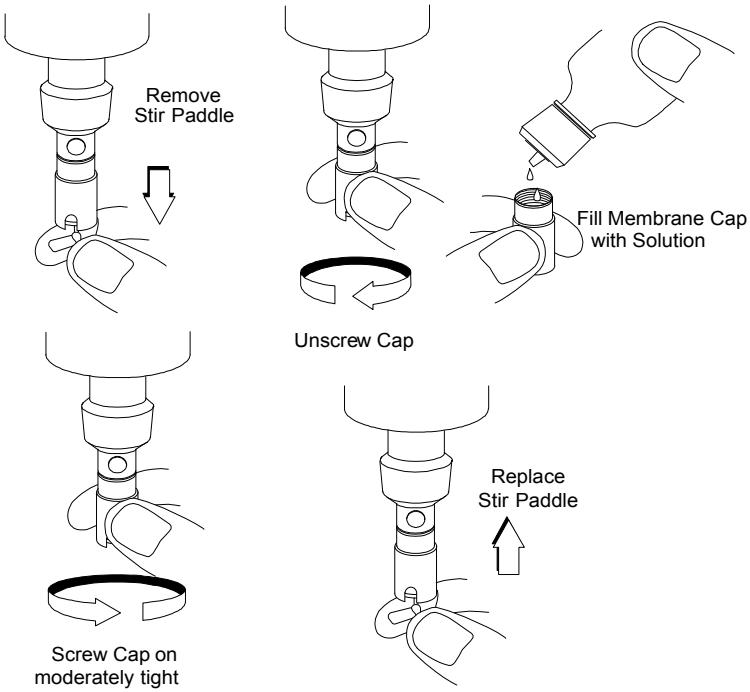

Figure 1: *Membrane Installation on the 5905/5010/200-BOD/Pro-BOD .*

Warm Up

Every time the instrument is turned on, the 5905/5010/200-BOD/Pro-BOD Probe must be allowed to warm up for about 10-20 minutes before taking the first reading. This allows the probe to use up all the oxygen retained in the cap.

---IMPORTANT---

New Probe Break In (motor off)

For best results, please allow the probe more than the usual 20 minutes to warm up after the first membrane is installed. The process may be faster if the probe is allowed to warm up in a BOD bottle filled with clean water. If possible, it's a good idea to let new probes warm up overnight (with a new membrane and KCl) prior to first use.

Electrode Cleaning

The 5905/5010/200-BOD/Pro-BOD should be cleaned only when erratic readings occur or after about every 500 hours of use (two months). Each cleaning removes material and reduces the life of the probe, so excessive cleaning should be avoided.

Gold Cathode

For correct probe operation, the gold cathode must be textured properly (for its location, see figure 2). It can become tarnished or plated with silver after extended use. The gold cathode can be cleaned by using the sanding disc provided in the 5906 and 5908 Membrane Kits. Place the disc in the palm of your hand, then sand the gold with a twisting motion about 3 times or until all silver deposits are removed and the gold appears to have a matte finish. If the cathode remains tarnished, return the probe for service.

Silver Anode

It is normal for a dark layer of silver chloride to cover the silver anode (for its location, see figure 2). After prolonged use it may become necessary to clean the anode. Soak the probe in a 14% ammonium hydroxide solution for 2 to 3 minutes or overnight in a 3% ammonium hydroxide solution. Rinse with deionized water, recharge with electrolyte, and install a new membrane. The anode may also need a very light sanding with the supplied sanding discs. Sand lightly in a helical fashion (down and around), then rinse well with deionized water.

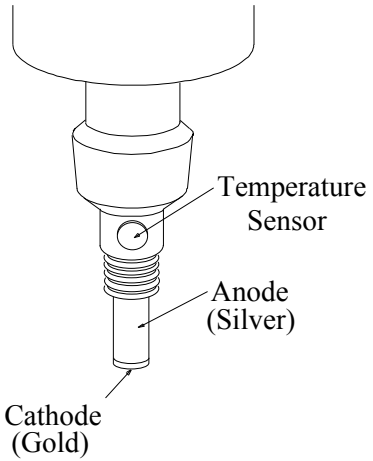

Figure 2: *5905/5010/200-BOD/Pro-BOD Sensor*

OPERATING PROCEDURES AND PRECAUTIONS

---IMPORTANT---

Intended Use
The 5905/5010/200-BOD/Pro-BOD probe is intended for laboratory use, not field use. It is not waterproof and should never be immersed past the taper on the stem of the probe.

Air Calibration

When calibrating in air, make sure there are no water droplets on the membrane. Water droplets will cause a low calibration reading. Excess water may be removed by shaking the probe downward. If droplets persist it may be necessary to carefully remove them using a clean cloth or paper towel.

Checking the Probe Zero

The probe zero is checked by immersing the probe in a sodium sulfite solution (0.08M or 3g Na_2SO_3/300mL), or in water which has an inert gas bubbling through it (e.g. nitrogen, argon). The meter should read less than 1% dissolved oxygen in either of these environments. If it does not, change the membrane or clean the probe.

Membrane Life

Membrane life depends on use. Membranes will last longer if installed properly and treated with care during use. Erratic readings will result from loose, wrinkled, or fouled membranes or from bubbles larger than 1/8" in the electrolyte solution. If erratic readings or other evidence of membrane damage occurs, replace the membrane and KCl solution.

The average replacement interval is two to four weeks. Probes in constant or heavy use may require more frequent membrane changes.

Interferences

Hydrogen sulfide, sulfur dioxide, halogens, carbon monoxide, chlorine, nitric oxide, and nitrous oxide can cause the probe to give erroneous readings. If you suspect erroneous readings, it may be necessary to determine if these are the cause.

Acids

Avoid any environment that contains substances such as concentrated acids, caustics, and strong solvents that may attack the probe. Probe materials that may be damaged by these substances include FEP Teflon or Polyethylene, EPR rubber, ABS plastic, and stainless steel.

Erroneous Readings

Erroneous readings may occur if the membrane is coated with oxygen consuming bacteria or oxygen evolving algae. Heavy residue may coat the membrane causing incorrect readings. Frequent membrane changes will eliminate this problem.

Storage

When the probe is not in use, store the probe in a BOD bottle containing at least 1 inch of water. For long term storage, remove the membrane cap, rinse the probe tip with deionized water, and install a dry membrane cap (without electrolyte solution).

PROBLEM SOLVING

Trouble Shooting Guide

Use this quick reference table to correct symptoms you might be experiencing.

Symptoms	Actions
Unable to calibrate	• Allow approximately 20 min. and up to 30 min. for probe to polarize when first turned on • Change membrane • Clean probe (see instructions under Electrode Cleaning)
Does not return to calibration value	• Allow sufficient time for temperature and oxygen stabilization • Check for water droplets on membrane • Change membrane • Clean probe (see instructions under Electrode Cleaning)
Unstable readings	• Allow sufficient time for temperature and oxygen stabilization • Allow 60 sec for reading to stabilize • Change membrane • Clean probe (see instructions under Electrode Cleaning)

Symptoms	Actions
Unstable readings	• Allow sufficient time for temperature and oxygen stabilization • Allow 60 sec for reading to stabilize • Change membrane • Clean probe (see instructions under Electrode Cleaning)
Motor not working	• Check power supply • Manually turn the stir paddle to help start the motor • Replace motor
Loud motor	• Check if stir paddle is pushed all the way in • Replace motor
Membrane cap is tight	• Use pliers to loosen the cap (turn counter clockwise while facing sensor tip)

SERVICING

The 5905/5010/200-BOD/Pro-BOD has four user replaceable parts. The motor assembly can be replaced if it becomes noisy, unbalanced, or malfunctions. The probe assembly, housing assembly, and stir paddle can also be replaced if they become damaged.

To disassemble the probe, perform the following steps while referring to figure 3:

1. Remove stir paddle by pulling it straight out.
2. Remove the two screws (A) on the outside of the housing using a 3/32 Allen wrench.
3. Loosen the top nut of the cable strain relief (B) from the housing. This will allow the cable to feed through the housing assembly.
4. Pull the probe and motor assembly out of the housing and disconnect the two plugs (C).
5. To remove the motor assembly from the probe assembly, remove the two screws (D) using the 3/32 Allen wrench.

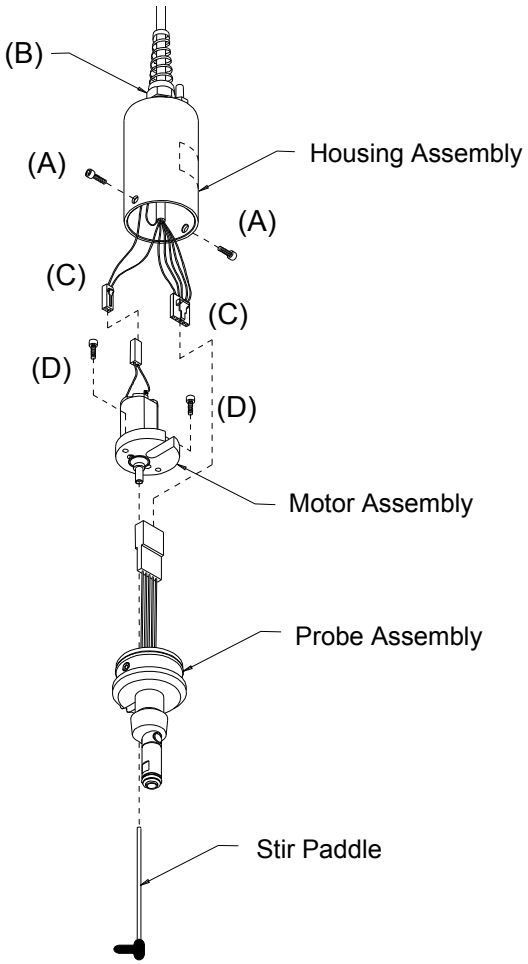

Figure 3: Exploded View of 5905/5010/200-BOD/Pro-BOD Probe

WARRANTY AND REPAIR

YSI Models 5905/5010/200-BOD/Pro-BOD Dissolved Oxygen Probes are warranted for one year from date of purchase by the end user against defects in materials and workmanship. Electrode cleaning or maintenance is not covered under warranty. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

Limitation of Warranty

This warranty does not apply to any YSI product damage or failure caused by (i) failure to install, operate or use the product in accordance with YSI's written instructions, (ii) abuse or misuse of the product, (iii) failure to maintain the product in accordance with YSI's written instructions or standard industry procedure, (iv) any improper repairs to the product, (v) use by you of defective or improper components or parts in servicing or repairing the product, or (vi) modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

Authorized Service Centers

YSI has several Authorized Service Centers in the U.S. and around the world. Please refer to the YSI web site (www.YSI.com) for your nearest Authorized Service Center.

Cleaning Instructions

NOTE: Before they can be serviced, equipment exposed to biological, radioactive, or toxic materials must be cleaned and disinfected. Biological contamination is presumed for any instrument, probe, or other device that has been used with body fluids or tissues, or with wastewater. Radioactive contamination is presumed for any instrument, probe or other device that has been used near any radioactive source.

If an instrument, probe, or other part is returned or presented for service without a Cleaning Certificate, and if in our opinion it represents a potential biological or radioactive hazard, our service personnel reserve the right to withhold service until appropriate cleaning, decontamination, and certification has been completed. We will contact the sender for instructions as to the disposition of the equipment. Disposition costs will be the responsibility of the sender.

When service is required, either at the user's facility or at YSI, the following steps must be taken to insure the safety of our service personnel.

1. In a manner appropriate to each device, decontaminate all exposed surfaces, including any containers. 70% isopropyl alcohol or a solution of 1/4 cup bleach to 1 gallon tap water is suitable for most disinfecting. Instruments used with waste water may be disinfected with .5% Lysol if this is more convenient to the user.
2. The user shall take normal precautions to prevent radioactive contamination and must use appropriate decontamination procedures should exposure occur.
3. If exposure has occurred, the customer must certify that

decontamination has been accomplished and that no radioactivity is detectable by survey equipment.

4. Any product being returned to the YSI Repair Center should be packed securely to prevent damage.
5. Cleaning must be completed and certified on any product before returning it to YSI.

Packing Instructions

1. Clean and decontaminate items to insure the safety of the handler.
2. Complete and include the Cleaning Certificate.
3. Place the product in a plastic bag to keep out dirt and packing material.
4. Use a large carton, preferably the original, and surround the product completely with packing material.

Insure for the replacement value of the product.

Cleaning Certificate
Model Number:
Lot/Serial Number:
Contaminants (if known):
Cleaning Agents used:
☐ Radioactive Decontamination Certified (check only if product has been exposed to radiation and successfully decontaminiated.)
Cleaning Certified by: Signature: X _____ Date:

For more information call +1 937 767 7241 or 800-897-4151 (US), email environmental@ysi.com or visit www.ysi.com.

Alternatively, if you are planning to send your probe directly to YSI for servicing, please visit www.ysi.com, download and fill out the Product Return Form.

Probe Specifications

Cathode: Gold

Anode: Silver

Membrane: FEP Teflon (for 5905/5010)

Polyethylene (for 200-BOD/Pro-BOD)

Dissolved Oxygen Accuracy: ± 0.1 mg/L or ± 2% of reading, whichever is greater

Operating Temperature Range: 0° to 45°C

Temperature Accuracy: ± 0.2°C

Polarizing Voltage: 0.8 volts

Response Time: Typical response to a step change in dissolved oxygen

at 20°C is 90% of the change in 30 seconds.

Appendix A

The 5905 and 5010 probes come in several versions, designed to fit different bottle sizes.

5905 5010 200-BOD Pro-BOD	5° taper per side to fit U.S. Standard BOD bottles.
5905 - J 5010 - J	Includes an adapter to fit 5° taper per side smaller bottles with built - in overflow funnels.
5905 - K 5010 - K	Includes a $\overline{\$}$ 19 funnel.
5905 - L 5010 - L	Includes a $\overline{\$}$ 24 funnel.
5905 - W 5010 - W	6″ long probe for use with wine bottles.

The 5010 probe will only work with the Model 5000 and 5100 Instruments. A 5905 probe will also work on these instruments by using a 5011 plug adapter. A 200-BOD will only work with a DO200 Instrument. The Pro-BOD will only work with the Pro20 and ProPlus Instruments.

APPENDIX B

Accessories and Replacement Parts by Item Number

Description	5905	5905-J	5905-K	5905-L	5905-W	5010	5010-J	5010-K	5010-L	5010-W	200-BOD	Pro-BOD
5906 Membrane Kit	059880	059880	059880	059880	059880	059880	059880	059880	059880	059880	N / A	N/A
5908 Membrane Kit	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	605306	605306
Stir Paddle	059895	059902	059902	059902	059950	059895	059902	059902	059902	059950	059895	059895
Probe Assembly	110590	115904	115904	115904	110593	110590	115904	115904	115904	110593	609204	115776
Motor Assembly	110592	110592	110594	110594	110592	110592	110592	110594	110594	110592	110592	110592
Housing Assembly	110591	110591	110591	110591	110591	115011	115011	115011	115011	115011	609210	115777
Funnel / Adapter	N / A	059929	059933	059911	N / A	N / A	059929	059933	059911	N / A	N / A	N/A
115 V Power Supply	073035	073035	See dealer	073035	073035	N / A	N / A	N / A	N / A	N / A	073035	073035
230 V Power Supply	073047	073047	See dealer	073047	073047	N / A	N / A	N / A	N / A	N / A	073047	N/A

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