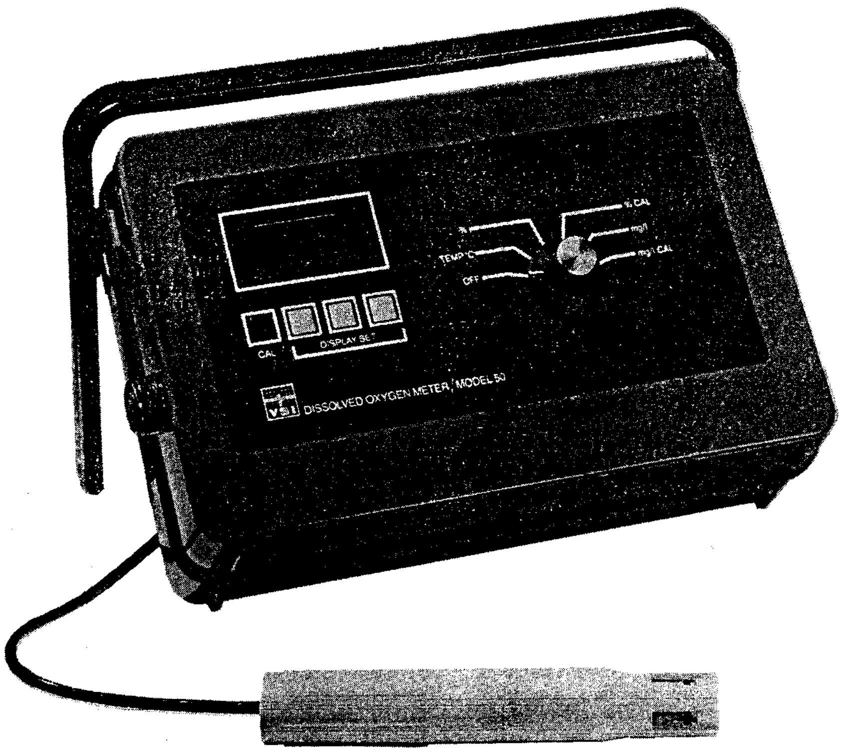
YSI MODEL 50
DISSOLVED OXYGEN METER



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I. YSI MODEL 50 DISSOLVED OXYGEN METER

GENERAL DESCRIPTION

The YSI Model 50 Dissolved Oxygen Meter is a microprocessor-based instrument designed for field or laboratory measurement of dissolved oxygen and temperature in water and wastewater applications. A carrying case, YSI 5890, is available for greater convenience in field use; it holds the meter, probe, cables and other YSI oxygen measurement accessories. The meter may be used with any YSI Series 5700 probe. Dissolved oxygen may be read in either mg/L or in % air saturation. The display provides a reading to two decimal places in the mg/L mode, and to one decimal place in the % air saturation and temperature modes. Temperature is indicated in degrees Celsius. Both the mg/L and the % air saturation modes are automatically temperature compensated for changing permeability of the oxygen probe membrane and for the changing solubility of oxygen in water with changes in temperature.

The capacity of a liquid to carry dissolved oxygen is affected by temperature, pressure, and the presence of other substances in solution, such as salt. The Model 50 incorporates features to simplify and make more rapid the determination of the amount of dissolved oxygen in a wide variety of liquid environments. Instrument calibration is easily performed.

To assure correct operation, the meter performs a self testing routine each time it is turned on. When an error is discovered, the display automatically signals the operator.

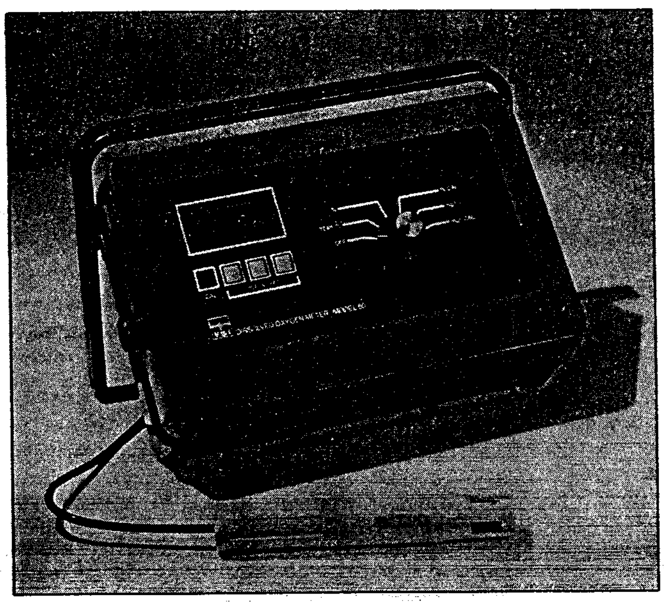

Figure 1. The YSI Model 50 Dissolved Oxygen Meter

Because the measurement of dissolved oxygen is subject to so many variables, this manual provides detailed instructions for a variety of calibration methods to suit different circumstances and protocols. Procedures for calibrating both with and without compensation for temperature, altitude, pressure and salinity are described. Abbreviated instructions are located on a label on the instrument and on the back page of this manual. It is recommended, however, that instrument operators make themselves as familiar as possible with the contents of these instructions and with the principles of dissolved oxygen measurement.

PRINCIPLES OF OPERATION

The probes use Clark-type membrane covered polarographic sensors with built-in thermistors for temperature measurement and compensation. The thin, permeable membrane stretched over the sensor isolates the sensor elements from the environment, but allows oxygen and certain other gasses to enter. When a polarizing voltage is applied across the sensor, oxygen that has passed through the membrane reacts at the cathode, causing a current to flow.

The membrane passes oxygen at a rate proportional to the pressure difference across it. Since oxygen is rapidly consumed at the cathode, it can be assumed that the oxygen pressure inside the membrane is zero. Hence, the amount of oxygen diffusing through the membrane is proportional to the absolute pressure of oxygen outside the membrane. If the oxygen pressure increases, more oxygen diffuses through the membrane and more current flows through the sensor. A lower pressure results in less current.

INSTRUMENT SPECIFICATIONS

OXYGEN MEASUREMENT

Ranges: 0 to 19.99 mg/L dissolved oxygen
0 to 199.9 % air saturation

Accuracy: ±0.1% air saturation; plus 1 least significant digit in % air saturation mode

±0.1% of reading, plus 1 least significant digit in mg/L mode

Temperature Compensation: The % air saturation mode is automatically temperature compensated to an accuracy of ±0.5% of calibration values between 0 and 5 °C; and to an accuracy of ±0.3% of calibration values between 5 and 45°C

The mg/L mode is automatically temperature compensated for probe response to changes in temperature

Resolution: 0.01 in the mg/L mode
0.1 in the % air saturation mode

TEMPERATURE MEASUREMENT

Range: -5.0 to 45.0°C

Accuracy: ±0.1°C, plus probe error

Resolution: ±0.1°C

INSTRUMENT ENVIRONMENT

The ambient temperature range for specification performance is 0 to 45°C.

WATER RESISTANCE

With the probe receptacle capped, every case opening is gasketed to resist the entry of water.

POWER SUPPLY

6 D-size alkaline batteries typically provide approximately 1000 hours of useful life. Replace with 6 fresh alkaline batteries as soon as possible when **LO BAT** appears on the display.

SELF TESTING AND ERROR DISPLAY

Each time the Model 50 is turned on, a Power On Self Testing (POST) routine is executed to determine whether all functions are operating correctly. Oxygen sensor errors are automatically signaled on the display with the letter E and a number whenever they occur during calibration; temperature sensor errors are likewise automatically signaled on the display whenever they occur. The **LO BAT** indication will be signaled when it is time to replace the battery.

Error display messages, with their explanations, are listed in the table in the Troubleshooting section.

INITIAL SETUP

1. Prepare the probe according to the 5700 probe instructions.

2. Connect the probe to the meter, then place the probe in a constant oxygen environment, such as a B.O.D. bottle or the bottomless calibration bottle supplied.

3. Set the function switch to the **TEMP °C** position. An audible tone will sound. This is a signal that the microprocessor's Power On Self Testing (POST) diagnostic mode has been activated. Simultaneously, the display will appear as shown below. Check to see that all meter segments are displayed. A second tone will sound in about 7 seconds to signal the end of the POST diagnosis, and the display will blank briefly.

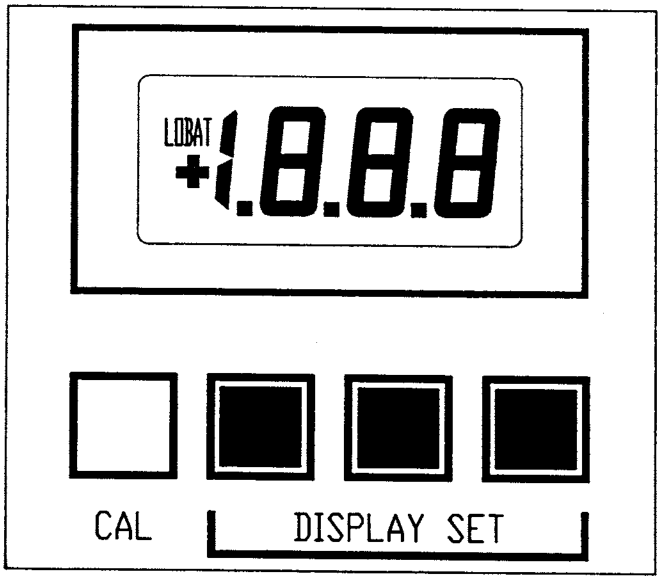

Figure 2. The Model 50 Meter Display and Keyboard

4. If the POST diagnosis discovers a fault in instrument operation, the display shown above will not appear, or will "freeze." Should this occur, it is necessary to return the instrument for repair to the dealer or to YSI. See Warranty and Repair.

5. Temperature will be displayed after the second tone. Observe the reading for stability. Temperature equilibration may take up to 5 minutes.

6. Set the function switch to either the **%** or the **mg/L** position and allow 15 minutes for the system to stabilize. If calibration is attempted prematurely, calibration values will drift and may be out of specification.

It is not necessary or desirable to turn the instrument off after each measurement. In normal laboratory use, the meter may be left on in any switch position between measurements, and turned off only at the end of the day. Each startup from **OFF** could require a 5 to 15 minute wait for probe stabilization.

USING THE MODEL 50 KEYBOARD

See Figure 2. Using the keyboard to set calibration values is very simple. There are only four key pads. The key pad on the left is labeled **CAL.** It has several functions, depending on switch position.

THE CAL KEY PAD

1. With the function switch set to **% CAL**, press it once to set the display to 100.0. Do this when you are calibrating to 100% air saturation.

2. Press it 4 times to set the display to 0.0. Do this only when you are offsetting the zero (see Highest Accuracy Measurements, under OPERATION).

3. With the function switch set to **mg/L CAL**, press **CAL** once; the display will show **SEt**. This automatically makes the mg/L reading correspond to the percentage of oxygen dissolved in the sample. (For fresh water measurements only.) When you turn the switch to **mg/L**, the display will show **CAL** and the instrument will automatically calibrate and reset, then show the correct reading in mg/L.

THE DISPLAY SETTING KEY PADS

The other three keys lower the digit in the display directly above each key by one count. If you miss the number you mean to set, continue your key pressures and the display will continue to cycle through 1, 0, 9, and so forth. The key next to the **CAL** keypad controls two positions in the display, and permits cycling through 1, 0, 19, 18, etc.

CALIBRATION

Calibration is accomplished by exposing the probe to a known oxygen concentration, such as water-saturated air (%), or water of a known oxygen content (mg/L), and then adjusting the calibration controls so the display shows a reading that matches the oxygen concentration of the known sample.

The Model 50 may be calibrated in either air or in water. Both pressure compensated and uncompensated calibration methods are described in the following instructions, which include procedures for Winkler Titration and for calibration in salt water.

Daily calibration is generally appropriate. Calibration can be disturbed by physical shock, touching the membrane, fouling of the membrane or drying out of the electrolyte. Check calibration after each series of measurements, and in time you will develop a realistic schedule for recalibration. When probes are not in use, store them according to the procedures recommended in Probe Service.

CALIBRATION IN AIR

It is quicker and easier to calibrate in air than in water. Experience has shown air calibration to be reliable and accurate, and it is the technique recommended by YSI for the Model 50.

Calibration in air, for either the % air saturation or the **mg/L** mode, is quick and simple. Instructions for compensated calibration in air are also given.

Calibration to 100% Air Saturation:

The measurement displayed when the function switch is set to the % position is the percent of oxygen saturation in a liquid sample saturated with air under a barometric pressure of 1013 millibars (760 mm or 29.92 inches of mercury). Measurements resulting from calibration by this method should be reported as % air saturation corrected to "standard pressure."

For highest accuracy, calibrate at a temperature as close as possible to the temperature of the sample to be measured. Proceed as follows:

1. Follow the Initial Setup procedures described above.

2. Set the function switch to **% CAL.**

3. Any of the YSI 5700 Series BOD probes may be placed in a BOD bottle containing about 1" of water to provide a 100% relative humidity calibration environment.

To calibrate the YSI 5739 probe, place a moist sponge or a wet piece of cloth in the plastic calibration bottle provided with the probe. Loosen the bottle lid about one-half turn and slip the open end of the bottle over the probe guard up to the body. Place the probe in a protected location where temperature is not changing, or wrap in a cloth or other insulator, and allow 3 to 5 minutes for temperature equilibration.

4. Press the **CAL** button once. 100.0 will appear on the display.

5. Turn the function switch to **%**. **CAL** will appear on the display, then one or two audible tones will sound, followed by the display of **100.0** (±0.2). Observe the reading for stability for one minute. Drift in the reading of more than two digits may mean that insufficient time was allowed for instrument stabilization.

This completes Calibration to 100% Air Saturation.

NOTE: If you are calibrating at an altitude or pressure significantly different from "standard," you should adjust the calibration value according to the data in Table B.

EXAMPLE: At 5067 feet, or 631 mm Hg, the calibration value you would enter (see Using The Model 50 Keyboard) instead of 100 would be 83.0.

Calibration in Air in MG/L for Fresh Water Measurements

1. Follow the Initial Setup procedures described above.

2. Set the function switch to **mg/L CAL.**

3. Place the probe in moist air as described in the previous calibration instructions.

4. Press the **CAL** button once. The message **SEt** will appear on the display. This indicates that the mg/L reading will automatically correspond to the percentage of oxygen in the sample. This is true for fresh water (zero salinity) only.

5. Turn the function switch to **mg/L**. **CAL** will appear on the display, followed in a few seconds by one or two audible tones.

Next, the appropriate calibration value in mg/L (±0.02 mg/L) will be displayed. Observe the reading for stability for two or three minutes. Drift in the reading of more than two digits may mean that insufficient time was allowed for instrument stabilization.

This completes Calibration in Air in MG/L for fresh water measurements.

Calibration in Air in MG/L, Correcting for Atmospheric Pressure or Altitude

1. Follow the Initial Setup procedures described earlier.

2. Set the function switch to **TEMP °C.**

3. Place the probe in moist air as described earlier. From the Solubility of Oxygen Chart (Table A), record the mg/L value, in the zero salinity column, corresponding to the temperature indicated on the display. This chart appears later in the manual, and on the back panel of the instrument.

4. Determine the local altitude or the true atmospheric pressure. (Note that "true" atmospheric pressure is as read on a mercury barometer. Weather Bureau reporting of atmospheric pressure is corrected to sea level.) Using the Atmospheric Pressures and Altitudes Table, determine the calibration correction for your pressure or altitude.

5. Multiply the value in mg/L recorded in step 3 by the correction determined in step 4. The result, divided by 100, is the correct calibration value.

EXAMPLE USING ALTITUDE: At a temperature of 21°C, the oxygen value at sea level or 760 mm Hg atmospheric pressure is 8.92 mg/L for saturated air (Table A).

At an altitude of 1400 feet, the calibration correction is 95% (Table B).

The correct calibration value is (8.92 mg/L x 95)/100 = 8.47 mg/L.

EXAMPLE USING ATMOSPHERIC PRESSURE: At a temperature of 18°C, the oxygen value at sea level is 9.47 mg/L.

At a pressure of 745 mm Hg, the calibration correction is 98%.

The correct calibration value is (9.47 mg/L x 98)/100 = 9.28 mg/L.

6. Turn the function switch to **mg/L CAL.** Using the key pads beneath the digit positions in the display, set the calibration value determined in step 5.

Each separate pressure on a key pad lowers the displayed digit by one count. Continuous pressure will cause the displayed value to cycle.

7. Turn the function switch to **mg/L**. **CAL** will appear on the display, followed in a few seconds by one or two tones. Next the calibration value you have set will appear. Observe the reading for stability for two or three minutes. Drift in the reading of more than two digits may mean that insufficient warm-up time was allowed.

This completes the Manual Calibration in Air in MG/L.

CALIBRATION IN WATER

Calibration in air-saturated water may also be accomplished by both semi-automatic and manual methods. These are described below.

Note that oversaturating or undersaturating the sample will affect calibration accuracy.

Calibration in Air Saturated Water to 100% Air Saturation:

1. Follow the Initial Setup procedures described earlier.

2. Air-saturate a volume of water by aerating for at least 15 minutes at a constant temperature.

3. Place the probe in the sample and stir.

4. Set the function switch to **% CAL.** Press the **CAL** button once. **100.0** will appear on the display.

5. Set the function switch to **%.** **CAL** will appear on the display, followed in a few seconds by one or two audible tones.

Next, the display will show the calibration value **100.0** (±0.2). Leave the probe in the sample for two minutes to ascertain stability. Repeat steps 4 and 5 if necessary.

This completes Calibration in Air Saturated Water to 100% Air Saturation.

Calibration in Air Saturated Water in MG/L:

1. Follow the Initial Setup procedures described earlier.

2. Air-saturate a volume of water by aerating for at least 15 minutes at a constant temperature.

3. Place the probe in the sample and stir. Set the function switch to Temp°C. From the Solubility of Oxygen Chart (Table A), record the mg/L value, in the zero salinity column, corresponding to the temperature indicated.

4. Determine the local altitude or the true atmospheric pressure. (Note that "true" atmospheric pressure is as read on a mercury barometer. Weather Bureau reporting of atmospheric pressure is corrected to sea level.) Using the Atmospheric Pressures and Altitudes Chart (Table B), determine the calibration correction for your pressure or altitude.

5. Multiply the value in mg/L recorded in step 3 by the correction determined in step 4. The result, divided by 100, is the correct calibration value.

EXAMPLE: At a temperature of 21°C, the oxygen value at sea level or 760 mm Hg atmospheric pressure is 8.92 mg/L (Table A).

At an altitude of 1400 feet, the calibration correction is 95 (Table B).

The correct calibration value is (8.92 mg/L x 95)/100 = 8.47 mg/L.

EXAMPLE USING ATMOSPHERIC PRESSURE: At a temperature of 18°C, the oxygen value at sea level is 9.47 mg/L.

At a pressure of 745 mm Hg, the calibration correction is 98%.

The correct calibration value is (9.47 mg/L x 98)/100 = 9.28 mg/L.

6. Turn the function switch to **mg/L CAL.** Using the button beneath the digit positions in the display, set the calibration value determined in step 5. Each separate pressure on a key pad lowers the displayed digit by one count. Continuous pressure will cause the displayed value to cycle.

7. Turn the function switch to **mg/L. CAL** will appear on the display, followed in a few seconds by one or two tones.

Next, the calibration value you have set (±0.02 mg/L) will appear. Observe the reading for stability for two to three minutes. Drift in the reading of more than two digits may mean that insufficient warm-up time was allowed.

This completes the Manual Calibration in Air Saturated Water in MG/L.

NOTE: If a calibration value for fresh water in mg/L was set, the value in the % saturation mode will automatically correspond to the mg/L value. However, if a mg/L value for was entered for a non-fresh water sample, or a sample that is not 100% saturated, the value in the % saturation mode will neither correspond nor be correct. In other words, when measuring fresh water, you may switch from **mg/L** to **%** and back without recalibrating; when measuring saline waters, you may not switch between measurement modes without recalibrating.

Calibration by Winkler Titration:

Winkler titration is a traditional method of calibration.

1. Follow the Initial Setup procedures described earlier.

2. Draw a volume of air-saturated water from a single source and divide it into four samples. Determine the oxygen content in three of the samples using standard Winkler Titration techniques, and average the three values. If one of the values differs from the other two by more than 0.5 mg/L, discard it and average the remaining two.

3. Place the probe in the fourth sample and stir.

4. Set the function to **mg/L CAL** and leave the probe in the sample for at least 2 minutes while continuing to stir. Using the calibration setting key pads, set the display to the average value determined above.

5. Turn the function switch to **mg/L. CAL** will appear on the display, followed in a few seconds by one or two tones.

Next, the calibration value you have set (±0.02%) will appear on the display. Leave the probe in the sample for an additional two minutes to verify stability. Repeat steps 4 and 5 if necessary.

This completes Calibration by Winkler Titration.

NOTE: If a calibration value for fresh water in mg/L was set, the value in the % saturation mode will automatically correspond to the mg/L value. However, if an mg/L value for a non-fresh water sample was entered, the value in the % saturation mode will neither correspond nor be correct. In other words, when measuring fresh water, you may switch from **mg/L** to **%** and back without recalibrating; when measuring saline waters, you may not switch between measurement modes without recalibrating.

Salt Water Calibration:

To calibrate for estuarial waters where fresh and sea water are mixed in changing or undetermined proportions, the solubility of oxygen in the particular sample to be measured must be determined by calculations which take account of salinity, temperature and pressure. Even water drawn from the open sea will vary in salinity, and of course in temperature as well.

Calibration in mg/L for salt water is accomplished as follows:

1. Follow the Initial Setup procedures described earlier.

2. Air-saturate a sample of the water to be measured, and determine its salinity or chlorinity (as with a YSI Model 33). Chlorinity is defined as salinity/1.806.

3. Measure the temperature of the sample. Referring to the Solubility of Oxygen Chart (Table A), record the mg/L value corresponding to the temperature and salinity determined above.

EXAMPLE: In water at a temperature of 21°C and a salinity of 9.0 (ppt), the solubility of oxygen is 8.46 mg/L.

4. Turn the function switch to **mg/L CAL** and, using the calibration setting key pads, set the display to the value recorded. Correct for altitude or pressure if desired, as described in Calibration in Air in MG/L, Correcting for Atmospheric Pressure.

5. Turn the function switch to **mg/L**. **CAL** will appear on the display, followed in a few seconds by one or two audible tones.

Next, the calibration value you have set ($\pm$0.02%) will be displayed. Observe for stability.

This completes calibration for mg/L in salt water.

NOTE: If a calibration value for fresh water in mg/L was set, the value in the % saturation mode will automatically correspond to the mg/L value. However, if an mg/L value was entered for a non-fresh water sample, or a sample that is not 100% saturated, the value in the % saturation mode will neither correspond nor be correct. In other words, when measuring fresh water, you may switch from **mg/L** to **%** and back without recalibrating; when measuring saline waters, you may not switch between measurement modes without recalibrating.

OPERATION

A brief summary of these procedures is printed on the back panel of the instrument. The operator should be thoroughly familiar with the contents of this manual, however, before using the instrument.

TEMPERATURE MEASUREMENT

1. Connect a YSI 5700 probe and set the function switch to the **TEMP $^{\circ}$C** position.

2. Place the probe in the sample and wait 3 to 5 minutes for temperature equilibration.

3. Observe the temperature reading.

DISSOLVED OXYGEN MEASUREMENT

Because the oxygen level in the layer of liquid sample at the membrane surface is continuously being depleted, it is essential that water movement of 1 foot per second or more be maintained when making measurements. A moving stream will usually provide this motion, as will moving the probe through the sample by hand. The YSI 5795A Submersible Stirrer provides the necessary stirring for use with the YSI 5739 Probe. YSI 5720 BOD probes have their own line powered stirrers for laboratory use. When the YSI 5750 BOD probe is used, auxiliary stirring must be provided, as with a magnetic stirrer.

Make oxygen measurements as follows:

1. Perform the initial setup and calibration procedures as described in earlier sections of this manual.

2. Set the function switch to the position appropriate to the sample and the read-out desired (**%** or **mg/L**). Allow 3 to 5 minutes for the probe to come to temperature equilibrium with the sample.

3. Begin stirring at least 30 seconds before taking the reading. Observe the reading when the display has stabilized.

4. Should negative values appear when measuring low or zero oxygen samples, see Highest Accuracy Measurements, below.

NOTE: Should it ever happen that the instrument is operated in a **LOBAT** condition when it has not been possible to replace the batteries immediately, confirm your reading by repeating the INITIAL SETUP procedures

Measuring Oxygen In Fluids Other Than Water

The Model 50 is normally used for measuring the oxygen content of naturally occurring waters and of wastewaters. The % air saturation feature of the instrument additionally permits oxygen measurement in some non-water fluids including air, most gases, foods and some non-aqueous liquids.

Suitable fluids for measurement are those which do not attack the sensor materials and are of sufficiently low viscosity to permit sample stirring across the probe's membrane. Strong acids and solvents capable of swelling or dissolving the probe's ABS plastic body or EPR O-rings must be avoided. (Also see list of interfering gases under Operation and Operating Precautions.)

The % air saturation of any fluid not excluded in the description above may be measured directly. The instrument is calibrated by the customary air calibration technique and measurement is carried out just as in natural waters.

In measuring non-aqueous liquids, the mg/L mode should not be used. Such samples may have an oxygen solubility or Bunsen coefficient significantly different from that automatically programmed in the mg/L mode for water.

HIGHEST ACCURACY MEASUREMENTS

Setup, calibration and measurement procedures already described will give specification performance with the Model 50. However, the background current of any probe will shift slightly over time, depending on use and the history of the membrane in place. This is of little consequence when measuring high oxygen levels; but when measuring very low oxygen samples, or samples containing interfering substances, offsetting the meter zero will cancel out background signals influencing the reading.

Offset the meter zero as follows:

1. Perform the initial setup procedures.

2. Place the probe in a zero oxygen environment, such as 100% nitrogen or a saturated sodium sulfite solution (see below), for at least 20 minutes.

3. Set the function switch to % and observe the display for stability. If the reading is 0.0, no offset is needed. If it is not, proceed with the following steps.

4. When the display is stable, turn the function switch to **% CAL.**

5. Press the left most calibration setting button **four** times to set the display to **0.0.**

6. **Recalibrate,** and proceed with oxygen measurement as described above.

7. Repeat all of the preceding steps once more to verify correct zeroing and calibration. If the meter shows a negative value when you switch to % the second time, allow 15 more minutes for further system stabilization, then repeat the zeroing procedures again. Repeated negative readings indicate a malfunctioning probe.

NOTE: It is absolutely essential that the probe be connected and in a known zero oxygen environment when this procedure is done. If the probe is disconnected, or is exposed to oxygen when the zero offset is attempted, an **E2** message may be displayed. Should a mistake in zero offsetting occur, correct the setup error and repeat.

A standard method for creating a zero oxygen environment is to dissolve in water (preferably from the sample to be measured) **excess** sodium sulfite Na_2SO_3 and a trace of cobalt chloride $CoCl_2$. After zeroing, rinse the probe **thoroughly** to remove any residual trace of chemicals. (See Standard Methods, 16th edition, 1985, page 424.)

Restoring the Zero Value

Whenever the meter zero has been offset by the method described above, the programmed default value for zero is rendered inoperative. When returning to normal measurement conditions, and whenever installing a new probe or probe membrane, you must restore the default value to assure correct meter operation. This is done as follows:

1. Turn the meter off. Press **both** the **CAL** and the **DISPLAY SET** keypad next to it, and turn the switch to any on position while continuing to hold down both keypads.

2. When the display shows **E.00,** release the keypads.

3. Recalibrate.

MAINTENANCE AND TROUBLESHOOTING

BATTERIES

IMPORTANT: Clean the battery terminals every 250 hours by rubbing them with a pencil eraser, or the like, to remove the oxide layer.

Whenever **LO BAT** appears on the display, replace the batteries with 6 fresh alkaline batteries as soon as possible. When the 4 case screws are removed, the back lifts off and the batteries are accessible. Carefully observe correct battery polarity. NOTE: Each opening of the case is gasketed to resist entry of water. When the case has been opened for any reason, be sure that the main case gasket is accurately seated between both halves of the case, and that the four case screws are drawn down securely (but not so tightly as to deform the rubber feet).

POWER ON SELF TESTING AND ERROR DISPLAY MESSAGES

The instrument will perform a Power On Self Test each time it is turned on. In addition, the following error displays are provided to facilitate troubleshooting. The E0 through E1 Error Modes are operational throughout the Model 50's operation; E2 through E4 are active only during calibration.

ERROR	INDICATION	CAUSE	CORRECTION
E. 0	System error	Defective ROM	Return for service
E.00	Lost calibration value	Defective RAM backup battery	Return for service
E.01	Defective RAM	Defective RAM	Return for service
E .1	Open circuit Temperature Probe	Connector improperly installed	Check connection
		Intermittent connection in cable or plug	Repair or replace
		Faulty temperature sensor	Repair or replace
E .2	High background	Insufficient warm-up time	See start-up procedures
		Improper probe zeroing procedure	See Highest Accuracy Measurements
		Probe needs servicing	See probe instructions
		Probe malfunction	Repair or replace
E .3	Low sensitivity	Insufficient electrolyte	See probe instructions
		Contaminated electrodes or fouled membrane	See probe instructions
		Membrane too thick	Try another membrane
		High resistance in probe connection	Return for evaluation
E .4	Output too high	Membrane too thin	Try another membrane
		Short circuit	Repair or replace
		Electrodes need resurfacing	Repair or replace
		Internal leakage in probe or cable connector	Repair or replace

OXYGEN SOLUBILITY AND CALIBRATION VALUE TABLES

TABLE A — SOLUBILITY OF OXYGEN IN MG/L IN WATER EXPOSED TO WATER-SATURATED AIR AT 760 mm Hg PRESSURE

Temp °C	Chlorinity:0 Salinity :0	5.0 9.0	10.0 18.1	15.0 27.1	20.0 36.1	25.0 45.2
0.0	14.62	13.73	12.89	12.10	11.36	10.66
1.0	14.22	13.36	12.55	11.78	11.07	10.39
2.0	13.83	13.00	12.22	11.48	10.79	10.14
3.0	13.46	12.66	11.91	11.20	10.53	9.90
4.0	13.11	12.34	11.61	10.92	10.27	9.66
5.0	12.77	12.02	11.32	10.66	10.03	9.44
6.0	12.45	11.73	11.05	10.40	9.80	9.23
7.0	12.14	11.44	10.78	10.16	9.58	9.02
8.0	11.84	11.17	10.53	9.93	9.36	8.83
9.0	11.56	10.91	10.29	9.71	9.16	8.64
10.0	11.29	10.66	10.06	9.49	8.96	8.45
11.0	11.03	10.42	9.84	9.29	8.77	8.28
12.0	10.78	10.18	9.62	9.09	8.59	8.11
13.0	10.54	9.96	9.42	8.90	8.41	7.95
14.0	10.31	9.75	9.22	8.72	8.24	7.79
15.0	10.08	9.54	9.03	8.54	8.08	7.64
16.0	9.87	9.34	8.84	8.37	7.92	7.50
17.0	9.67	9.15	8.67	8.21	7.77	7.36
18.0	9.47	8.97	8.50	8.05	7.62	7.22
19.0	9.28	8.79	8.33	7.90	7.48	7.09
20.0	9.09	8.62	8.17	7.75	7.35	6.96
21.0	8.92	8.46	8.02	7.61	7.21	6.84
22.0	8.74	8.30	7.87	7.47	7.09	6.72
23.0	8.58	8.14	7.73	7.34	6.96	6.61
24.0	8.42	7.99	7.59	7.21	6.84	6.50
25.0	8.26	7.85	7.46	7.08	6.73	6.39
26.0	8.11	7.71	7.33	6.96	6.62	6.29
27.0	7.97	7.58	7.20	6.85	6.51	6.18
28.0	7.83	7.44	7.08	6.73	6.40	6.09
29.0	7.69	7.32	6.96	6.62	6.30	5.99
30.0	7.56	7.19	6.85	6.51	6.20	5.90
31.0	7.43	7.07	6.73	6.41	6.10	5.81
32.0	7.31	6.96	6.62	6.31	6.01	5.72
33.0	7.18	6.84	6.52	6.21	5.91	5.63
34.0	7.07	6.73	6.42	6.11	5.82	5.55
35.0	6.95	6.62	6.31	6.02	5.73	5.46
36.0	6.84	6.52	6.22	5.93	5.65	5.38
37.0	6.73	6.42	6.12	5.84	5.56	5.31
38.0	6.62	6.32	6.03	5.75	5.48	5.23
39.0	6.52	6.22	5.93	5.66	5.40	5.15
40.0	6.41	6.12	5.84	5.58	5.32	5.08
41.0	6.31	6.03	5.75	5.49	5.24	5.01
42.0	6.21	5.93	5.67	5.41	5.17	4.93
43.0	6.12	5.84	5.58	5.33	5.09	4.86
44.0	6.02	5.75	5.50	5.25	5.02	4.79
45.0	5.93	5.67	5.41	5.17	4.94	4.72

TABLE B — CALIBRATION VALUES FOR VARIOUS ATMOSPHERIC PRESSURES AND ALTITUDES

PRESSURE			ALTITUDE		CALIBRATION
inches Hg	mm Hg	kPa	Feet	m	VALUE
30.23	768	102.3	-276	-84	101
29.92	760	101.3	0	0	100
29.61	752	100.3	278	85	99
29.33	745	99.3	558	170	98
29.02	737	98.3	841	256	97
28.74	730	97.3	1126	343	96
28.43	722	96.3	1413	431	95
28.11	714	95.2	1703	519	94
27.83	707	94.2	1995	608	93
27.52	699	93.2	2290	698	92
27.24	692	92.2	2587	789	91
26.93	684	91.2	2887	880	90
26.61	676	90.2	3190	972	89
26.34	669	89.2	3496	1066	88
26.02	661	88.2	3804	1160	87
25.75	654	87.1	4115	1254	86
25.43	646	86.1	4430	1350	85
25.12	638	85.1	4747	1447	84
24.84	631	84.1	5067	1544	83
24.53	623	83.1	5391	1643	82
24.25	616	82.1	5717	1743	81
24.94	608	81.1	6047	1843	80
23.62	600	80.0	6381	1945	79
23.35	593	79.0	6717	2047	78
23.03	585	78.0	7058	2151	77
22.76	578	77.0	7401	2256	76
22.44	570	76.0	7749	2362	75
22.13	562	75.0	8100	2469	74
21.85	555	74.0	8455	2577	73
21.54	547	73.0	8815	2687	72
21.26	540	71.9	9178	2797	71
20.94	532	70.9	9545	2909	70
20.63	524	69.9	9917	3023	69
20.35	517	68.9	10293	3137	68
20.04	509	67.9	10673	3253	67
19.76	502	66.9	11058	3371	66

REQUIRED NOTICE

(The Federal Communications Commission defines this product as a computing device and requires the following notice):

This equipment generates and uses radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A or Class B computing device in accordance with the specification in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

* reorient the receiving antenna
* relocate the computer with respect to the receiver
* move the computer away from the receiver
* plug the computer into a different outlet so that the computer and receiver are on different branch circuits

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 0004-000-00345-4.

DISCUSSION OF MEASUREMENT ERRORS

The major sources of error affecting any determination of dissolved oxygen for a fully digital processing instrument are the accuracy of the instrument components, the truncation error from the numerical calculation, the accuracy of the probe, and the user's ability to calibrate the system precisely. Most errors can be reduced substantially by calibration at dissolved oxygen levels and probe temperatures as close as possible to the expected measurement D.O. levels and temperatures.
In the following, individual sources of error are listed along with equations for calculating their effect on a reading of dissolved oxygen. These calculations will yield an estimate of the maximum possible error for any particular D.O. reading. By calculating the root-mean-squared sum of these individual uncertainties (usually less than half the possible error), the user can estimate the probable error in any reading.

Note that not all types of errors discussed are necessarily even potentially present in a given situation. Whenever the instrument is calibrated in the same mode in which readings are to be taken, any mode to mode error is, of course, eliminated. Likewise, if salinity compensation is not used, no salinity compensation error need be considered. If calibration is to a Winkler Titration sample, calibration errors (3, below) are replaced by the Winkler uncertainty.

1. INSTRUMENT COMPONENT ERRORS

a. Mode to Mode (in the mode other than the one in which calibration was done)

Error = ± 0.25% of dissolved oxygen reading ± 2 least significant digits(in mg/L mode)

2. PROBE RELATED ERRORS

a. Probe Background Signal Effects

Error = (Background Factor*) x (1 - a/b)b, where **a** is the D.O. reading, and **b** is the saturation D.O. at measurement temperature, at 760 mm Hg.

Both **a** and **b** measured in mg/L or both measured in air saturation.

* probe temperature	background factor(%)
0	2.3
10	1.5
20	1.0
30	.8
40	.6

b. Probe Non-Linearity

Error = ± 0.3 % of D.O. reading

c. Variation from Nominal Response to Sample Temperature

Error = ±0.2 % of D.O. reading per °C of temperature difference between the temperature of the sample and the temperature at which the probe was calibrated.

3. CALIBRATION RELATED ERRORS

a. Sample Temperature Uncertainty

Error = ±1% of D.O. reading. This error is zero when calibrating in the % air saturation mode or when calibrating to a Winkler Titration sample.

b. Barometric Pressure Uncertainty of ± 13 mm Hg

Error = ± 1.7% of reading

c. Altitude Uncertainty of ±500'

Error = ± 1.8% of reading

EXAMPLE:

Measurement Related Data:

Calibration condition:

Method	air calibration in % air saturation mode
Temperature	24°C
Altitude	600 feet
Calibrated to 97.9%	

Measurement condition:

Mode	mg/L mode
Temperature	20°C
Dissolved Oxygen	7.26 mg/L

1,a (±.0025 x 7.26 mg/L)±.02 mg/L	= ±0.04 mg/L
	SUB TOTAL ±0.04 mg/L
2,a ± .01 x (1 -(7.26/9.07)) x 9.07 mg/L	= ±0.02 mg/L
2,b ± .003 x 7.26 mg/L	= ±0.02 mg/L
2,c ± (24°C - 20°C) x .002 /°C x 7.26 mg/L	= ±0.06 mg/L
	SUB TOTAL ±0.10 mg/L
3,a ±.00 x 7.26 mg/L	= ±0.00 mg/L
3,b ±.017 x 7.26 mg/L	= ±0.12 mg/L
3,c ±.018 x 7.26 mg/L	= ±0.13 mg/L
	SUB TOTAL ±0.25 mg/L

Total of type 1, 2, and 3 Errors: 0.39 mg/L

This the worst case error possible for the specified calibration and measurement. The reported D.O. value would be 7.26 ± .39 mg/L. An estimate of the probable error would require a Root Mean Square (R.M.S.) analysis as follows:

R.M.S. Error = Square Root $[(1,a)^2 + (2,a)^2 + (2,b)^2 + \ldots\ldots)]$

For the example above,
R.M.S. Error = Square Root $[(.04)^2 + (.02)^2 + (.02)^2 + (.06)^2 + (.12)^2 + (.13)^2)] = \pm 0.19$ mg/L

II. YSI 5700 SERIES DISSOLVED OXYGEN PROBES

PROBE SPECIFICATIONS

Cathode: Gold
Anode: Silver
YSI 5793 Standard Membrane: .001" FEP Teflon
YSI 5794 High Sensitivity Membrane: .0005" FEP Teflon
YSI 5675 Membrane Kit: .002 FEP Teflon (not recommended for temperatures below 10°C)
Electrolyte: Half saturated KCl
Temperature Range: -5° to 45°C
Thermistor Accuracy: ±0.1°C
Temperature Compensation: (see instrument specifications)
Polarizing Voltage: 0.8 Volts (nominal)
Probe Current: in Air at 30°C: 19 microamps (nominal)
in Nitrogen at 30°C: 0.15 microamps or less
Response Time: Typical response for dissolved oxygen, using standard membranes, is 90% in 10 seconds at a constant temperature of 30°C. Response at low dissolved oxygen levels is typically 90% in 30 seconds.

ACCESSORIES AND REPLACEMENT PARTS

Accessories for the 5720A, 5739 and 5750

YSI 5680 Probe Reconditioning Kit. Includes a sanding tool and ten adhesive disks.
YSI 5775 Membrane and KCl Kit, Standard. Includes two 15-membrane packets (.001" thick standard FEP Teflon membranes) and a 30 ml bottle of KCl with Kodak Photo Flo.
YSI 5793 Membranes, Standard. Ten 15-membrane packets.
YSI 5776 Membrane and KCl Kit, High Sensitivity. Includes two 15-membrane packets (.0005" thick FEP Teflon membranes) and a 30 ml bottle of KCl with Kodak Photo Flo. Used for measurements below 15°C or for low oxygen levels
YSI 5794 High Sensitivity Membranes. Ten 15-membrane packets
YSI 5945 O-ring pack (Contains replacement sensor O-rings)

Accessories for the 5720A Only

YSI 5486 Stirrer Boot Assembly

Accessories for the 5739 Only

YSI 5075A Calibration Chamber
YSI 5986 Diaphragm Kit

YSI 5740-10 detachable 10' cable
YSI 5740-25 detachable 25' cable
YSI 5740-50 detachable 50' cable
YSI 5740-100 detachable 100' cable
YSI 5740-150 detachable 150' cable
YSI 5740-200 detachable 200' cable

YSI 5795A Submersible Stirrer with 50' combined probe and stirrer cable
YSI 5492A Battery Pack. Powers the submersible stirrer
YSI 5075A Calibration Chamber

YSI 5720A B.O.D. BOTTLE PROBE

The 5720A bottle probe (Figure 3) is used for measuring dissolved oxygen in standard B.O.D. bottles. It is provided with a stirrer powered by a DC supply available for 115 or 230 VAC input.

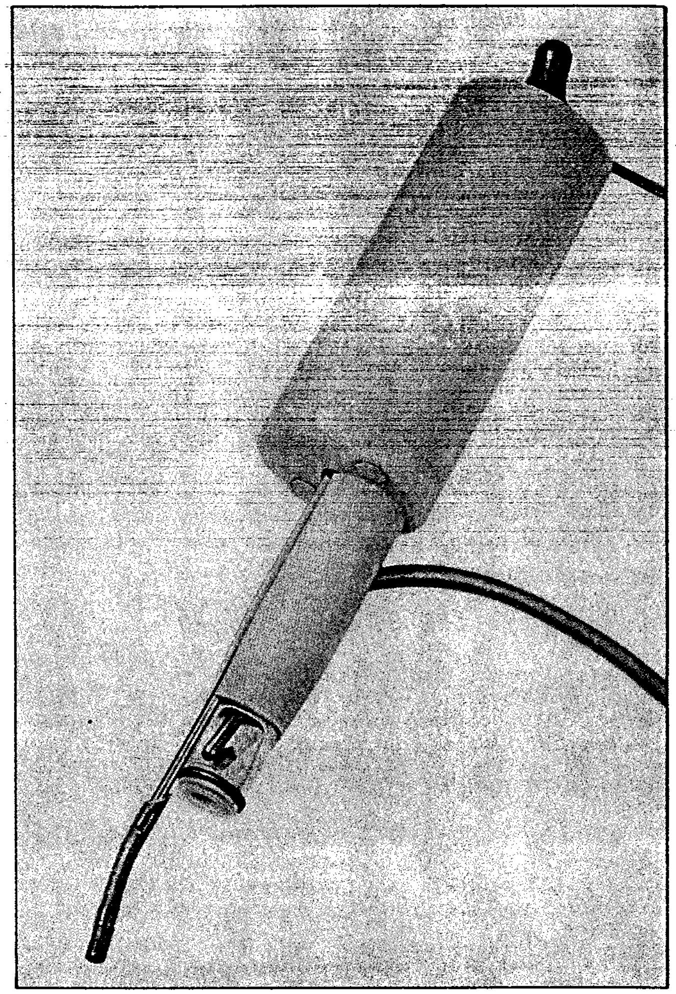

Figure 3. The YSI 5720A Probe

To use the 5720A, plug the stirrer power supply into line power and the probe plug in the instrument. With the stirrer off, place the tapered probe end into the B.O.D. bottle and turn on the stirrer. The probe should be operated with a minimum of trapped air in the bottle. A slight amount of air in the unstirred region at the top may be neglected, but no bubble should be permitted around the sensor. CAUTION; The motor housing is not waterproof; do not submerge this probe beyond the part that is inserted into a B.O.D. bottle.

Stirrer Boot

The 5720A uses a flexible stirring boot to transmit motion from the motor housing to the sample. If the boot shows signs of cracking or other damage liable to allow leakage into the motor housing, it must be replaced. Boot life may be shortened by exposure to hydrocarbons, moderate to strong acids or bases, ozone, or direct sunlight. For maximum life, rinse the boot after each use. Boots are replaced as follows:

1. Pull off the old assembly and clean the stir rod housing.

2. Slide on the new assembly, making sure the back spring is over the grooved area of the stir rod housing. A drop of alcohol will aid installation by providing lubrication.

3. Do not permit the stir rod to press against the end of the stirrer boot tip or it will bind.

YSI 5739 DISSOLVED OXYGEN PROBE

The 5739 probe system consists of the probe body plus a detachable cable (see Figure 4. The detachable cable is a convenience feature that facilitates changing cable lengths and replacing damaged cables or probes. The probe and cable assembly is held together with a threaded retainer. The assembly is not intended for casual disconnection; cable and probe should be separated only when necessary.

To detach the cable, unscrew the retainer and slide it down the cable to expose the connector. Pull gently on the connector until it comes away from the probe body. If the O-ring is frayed or damaged, replace it: a replacement O-ring is supplied with each 5740 cable. Reassemble by pushing the connector into the probe body, rotating it until the two halves mate. A light coating of silicone grease on the O-ring will make reassembly easier. Be sure the connector is dry; otherwise, erratic readings may result. Screw on the retainer finger-tight only.

PRESSURE COMPENSATION

The 5739 probe has a unique pressure compensating system that helps assure accurate readings at great depths. Pressure compensation is effective to 1/2% of reading with pressures up to 100 psi (230 feet of water). The compensating system does not normally require service and should not be taken apart. However, if electrolyte is leaking through the diaphragn, or if there is an obvious puncture, the diaphragm must be replaced. A spare is supplied with the probe. Use a coin to unscrew the retaining plug and remove the washer and diaphragm. Flush any salt crystals from the reservoir, install a new diaphragm if necessary (flat side out), replace the washer and securely screw in the retaining plug.

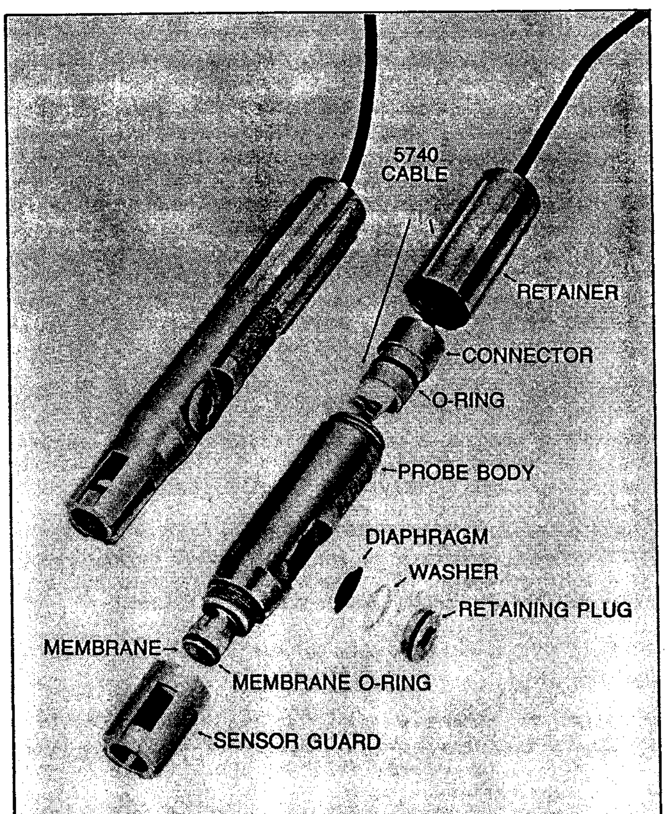

Figure 4. The YSI 5739 Probe

YSI 5075A CALIBRATION CHAMBER

The YSI 5075A Calibration Chamber is an accessory that helps obtain optimum air calibration in the field. It is also a useful tool for measuring at shallow depths (less than 4') and in rapidly flowing streams. It is used only with the YSI 5739 probe, and is illustrated in Figure 5.

It consists of a 4-1/2' stainless steel tube (1) attached to the calibration chamber (2), the measuring ring (3), and one solid and one hollow rubber stopper (4 and 5).

Set it up for use as follows: Insert the solid stopper (4) into the bottom of the calibration chamber (2). Push the oxygen probe (6) through the hollow stopper (5) until the small end of the stopper is situated at about the top of the notch where the pressure compensation unit is located It is important that this stopper be positioned so that a water-tight seal is formed when stopper and probe are inserted into the calibration chamber.

Use the assembly as follows: First place the probe in the measuring ring (3) and immerse for five minutes in the sample; this permits the probe to come to the same temperature as the sample. Wet the inside of the calibration chamber with fresh water to create a 100% relative humidity environment for calibration. Drain excess water from the chamber, shake any droplets from the probe membrane, and promptly insert the probe into the calibration chamber. Place the chamber in the sample for an additional five minutes for final thermal equilibration. Calibrate the probe as described in the air calibration procedures. Keep the handle above water at all times.

After calibration, return the probe to the measurement ring for shallow measurements. Move the probe up and down, or horizontally, approximately one foot a second while measuring. In rapidly flowing streams (greater than 5 feet per second) install the probe in the measuring ring with the pressure compensating diaphragm towards the chamber.

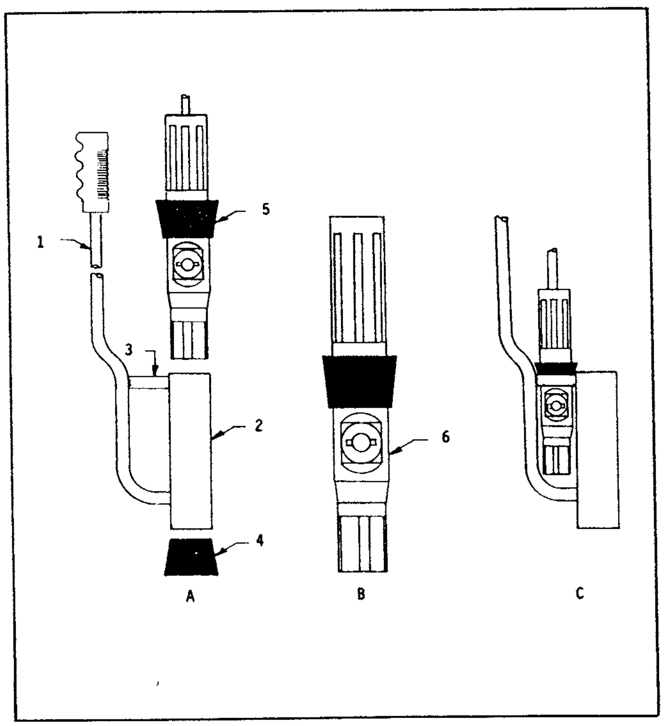

Figure 5. The YSI 5075A Calibration Chamber

YSI 5795A SUBMERSIBLE STIRRER

The YSI 5795A Stirrer (Figure 6) features a single cable for both probe and stirrer to permit convenient manipulation and storage. When a stirrer and probe are assembled, the stirrer agitates the sample directly in front of the sensor by means of a rotating eccentric weight which causes the spring-mounted, sealed motor housing to vibrate. An impeller on the end of the motor housing flushes the fluid being assayed across the sensor surface. (See sales literature and Stirrer instructions for further information.)

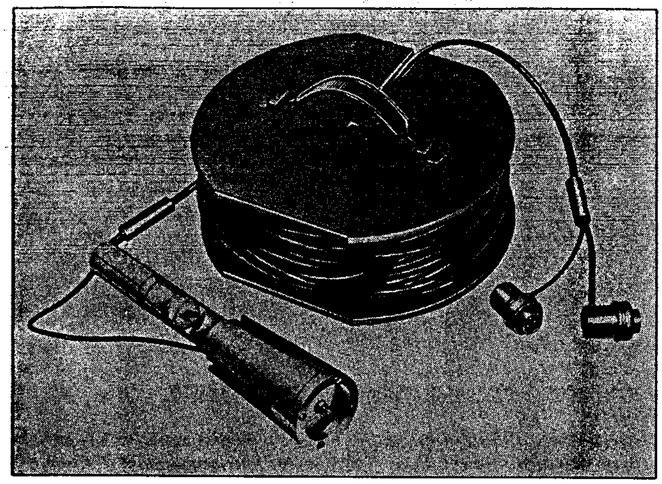

Figure 6. YSI 5795A Submersible Stirrer with reel and cable; YSI 5739 probe attached.

The stirrer is powered by the 5492A Battery Pack.

YSI 5492A BATTERY PACK

The 5492A Battery Pack is designed to attach to the case of the meter to provide power of operating the submersible stirrer. (See sales literature and stirrer instructions sheet for further information.)

YSI 5750 B.O.D. BOTTLE PROBE

The 5750 (Figure 7) is similar to the 5720A except that it does not have a stirrer. Agitation of the sample must be provided by other means, such as a magnetic stirrer.

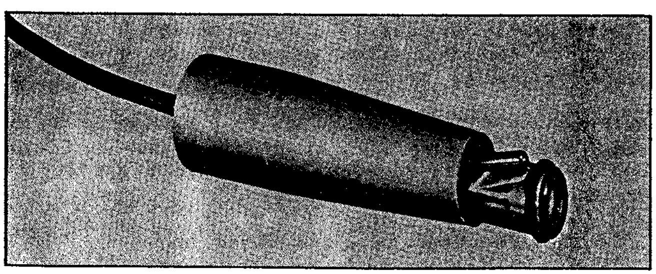

Figure 7. The YSI 5750 Probe

PROBE PREPARATION

All probes are shipped dry. You must follow these instructions when preparing a new probe or when changing membranes. Prepare the electrolyte by dissolving the KCl crystals which are supplied in a dropper bottle that should be filled to the neck with distilled water. Then, proceed as follows:

1. Unscrew the sensor guard (5739 only). Remove the O-ring and membrane, then thoroughly rinse the sensor with distilled water.

2. To fill the probe with electrolyte and install a new membrane, follow these steps:

a. Grasp the probe in your left hand. (See the sketches in Figure 8.) When preparing the 5739 probe, the pressure compensating port should be to the right. Successively fill the sensor body with electrolyte while pumping the diaphragm with the eraser end of a pencil or a similar soft, blunt tool. Continue filling and pumping until no more air bubbles appear. When preparing the 5720A or 5750 probes, simply fill the sensor body until no more air bubbles appear.

b. Secure a membrane between your left thumb and the probe body. Add more electrolyte to the probe until a large meniscus completely covers the gold cathode. NOTE: Handle membrane material with care, touching it at the ends only.

c. With the thumb and forefinger of your other hand, grasp the free end of the membrane.

d. With a continuous motion, STRETCH it UP, OVER and DOWN the other side of the sensor. Stretching forms the membrane to the contour of the probe.

e. Secure the end of the membrane under the forefinger of your left hand while holding the probe.

f. Roll the O-ring over the end of the probe, being careful not to touch the membrane surface. There should be no wrinkles in the membrane or trapped air bubbles. Some wrinkles may be removed by lightly tugging on the edges of the membrane beyond the O-ring.

g. Trim off excess membrane with scissors or sharp knife. Check that the stainless steel temperature sensor is not covered by excess membrane.

3. Shake off excess KCl. On the 5739, reinstall the sensor guard. Place the probe in a humid environment until ready for use, and between measurements.

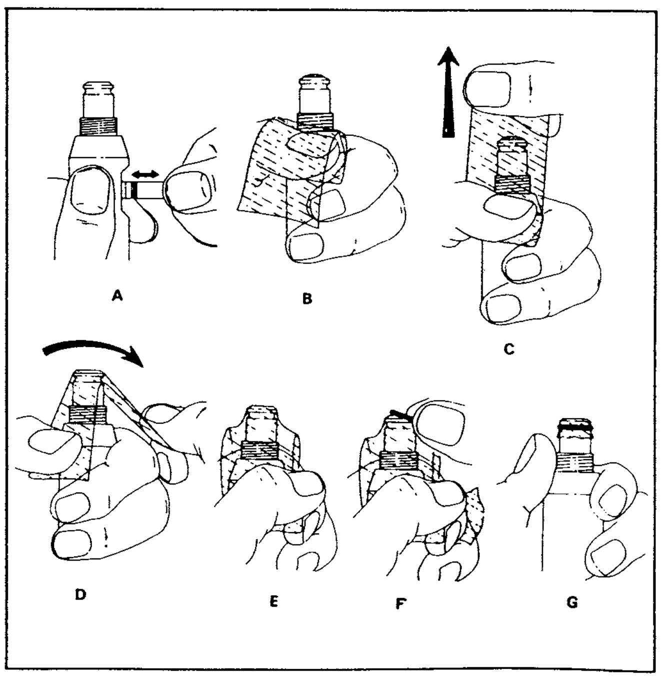

Figure 8. Membrane Application on the 5739, 5720A and 5750 Probes.

PROBE PERFORMANCE CHECK

Every month when the probe is in daily use (less frequently otherwise), or whenever probe response is slow or calibration is unstable, check probe performance.

1. Speed of Response

a. Prepare and calibrate the probe.
b. With probe in air, switch to the % air saturation mode.
c. Immerse the probe in a 25°C oxygen-depleted sample. (Preparation of an oxygen depleted sample is discussed under Highest Accuracy Measurements in the instrument Operation section.)
d. A properly functioning probe will respond downscale to 10% air saturation in 30 seconds or less.

2. Background Current

a. After performing the Speed of Response steps, leave the probe in the depleted sample for approximately 15 minutes. The reading should fall below 1 % air saturation.

3. Calibration Stability

a. Carefully calibrate the probe in moist air inside the calibration bottle with the instrument set in the % air saturation mode.
b. Allow the instrument to operate for 1 hour.
c. A properly functioning probe will hold calibration within ±1% for 1 hour, after the first hour of operation.

PROBE SERVICE

If the probe fails any of the three tests above, check for:

1. Damaged or wrinkled membrane. Change the membrane and retest.

2. Fouled or silver coated cathode. Clean as instructed in "Preparing the Probe," step 10, page 14.

3. Fouled anode. Soak for 24 hours in 3% ammonia (NH); rinse thoroughly with distilled water and retest.

4. Damaged cable or connector. Inspect and replace if necessary.

If these steps do not restore specification performance, return the probe to the factory for service.

PROBE STORAGE

A bottomless plastic bottle is provided with the YSI 5739 probe for convenient storage. Place a small piece of moist towel or sponge in the bottle and insert the probe into the open end. This keeps the electrolyte from drying out.

The 5720A and 5750 probes can be stored in a B.O.D. bottle containing about 1" of water.

CHOOSING THE CORRECT MEMBRANE

An extremely thin membrane increases oxygen permeability and probe signal current, and hastens a probe's response; but it achieves this at the expense of ruggedness. The membrane normally used with the Model 50 is the 1 mil (.001") membrane. (Order YSI 5775 Membrane and KCl Kit, Standard.) This 1 mil membrane represents a compromise between quickness of response and membrane strength and integrity.

For special circumstances, an 0.5 mil (.0005") membrane is available. (Order YSI 5776 Membrane and KCl Kit, High Sensitivity.) This half-thickness membrane hastens response at low temperatures and helps suppress background current at very low dissolved oxygen levels. (When data is routinely collected with sample temperatures below 15°C and at dissolved oxygen levels below 20% air saturation, the low signal current resulting from the use of the standard membranes tends to magnify the probe's inherent constant background signal. Using the high sensitivity membranes in this situation will decrease the percentage of error due to the probe's background current.)

For long-term monitoring situations only, a half-sensitivity, double-thickness 2 mil (.002") membrane is available. (Order the YSI 5675 Monitoring Probe Service Kit, which includes membranes, electrolyte, probe service tool and monitor service instructions for the 5739 probe.) For further details on the use of the Model 50 for monitoring, consult the factory.

PROBE OPERATION AND OPERATING PRECAUTIONS

1. Membrane life depends on use. Membranes will last a long time if installed properly and treated with care during use. Erratic readings result from loose, wrinkled or fouled membranes, or from large bubbles in the electrolyte reservoir. If erratic readings, or evidence of membrane damage occur, you should replace the membrane and KCL. The average replacement interval is two to four weeks. If the sensor O-ring on any of the 5700 Series probes is worn or loose, replace it with the O-ring provided in the YSI 5945 O-ring Pack.

2. The gold cathode should always be bright and untarnished. If it is tarnished (which can result from contact with certain gasses) or plated with silver (which can result from extended use with a loose or wrinkled membrane), it needs to have its surface restored. 5700 Series may either be returned to the factory, or cleaned with the YSI 5780 Probe Reconditioning Kit; never use chemicals or any abrasive not supplied with this kit.

3. It is also possible that the silver anode may become contaminated, which will prevent successful calibration. Try soaking the probe overnight in a 3% ammonia solution; rinse with deionized water, recharge with electrolyte, and install a new membrane. If still unable to calibrate after several hours, return the probe for service.

4. Hydrogen Sulfide, Sulfur Dioxide, Halogens, Neon, and Carbon Monoxide are interfering gasses. If you suspect erroneous readings, it may be necessary to determine if these are the cause.

These gasses have been tested for response:

100% Carbon Monoxide	less than 1%
100% Carbon Dioxide	around 1%
100% Hydrogen	less than 1%
100% Chlorine	2/3 O_2 response
100% Helium	none
100% Nitrous Oxide	1/3 O_2 response
100% Ethylene	none
100% Nitric Oxide	1/3 O_2 response

5. The correct liquid level in B.O.D. bottles is achieved by overfilling, then inserting a stopper and pouring off the excess.

6. Erroneous readings will be made in any environment where the probe's Teflon membrane will become rapidly coated with oxygen consuming or oxygen evolving organisms. In some cases, the YSI 5795A Submersible Stirrer can provide adequate cleaning action because of its high turbulence.

7. Erroneous readings will be made in any environment where heavy residue may coat the probe's membrane. In such instances, problems generally can be eliminated by more frequent probe service and cleaning.

8. When using the 5720A in samples containing heavy particulate solids, additional stirring may be needed.

9. Avoid any environment that contains substances that may attack the probe materials. Some of these substances are concentrated acids caustics and strong solvents. The probe materials that come in contact with the sample include FEP Teflon, acrylic plastic, ABS plastic, EPR rubber, stainless steel, epoxy and the polyurethane cable covering.

10. Long-term use, as for monitoring, in certain applications can magnify the effect of factors which impair probe accuracy.

WARRANTY AND REPAIR

All YSI products carry a one-year warranty on workmanship and parts, exclusive of batteries. Damage through accident, misuse, or tampering will be repaired at a nominal charge, if possible, when the item is returned to the factory or to an authorized YSI dealer. Electrode cleaning is not covered by warranty.

If you are experiencing difficulty with any YSI product, it may be returned for repair, even if the warranty has expired. YSI maintains complete facilities for prompt servicing on all its products. This warranty is limited to repair or replacement (YSI's option) at no charge.

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YSI MODEL 50 OPERATING INSTRUCTIONS

IMPORTANT: Before using this instrument, operators should be familiar with the Model 50 manual and with the 5700 oxygen probe instructions.

STARTUP

1. Prepare and connect YSI 5700 Series Dissolved Oxygen Probe.
2. Turn switch to **TEMP °C**. Observe reading for stability within ±0.2°C. Replace batteries if **LO BAT** appears on the display.
3. Turn switch to % or **mg/l** and wait until display shows a stable reading for at least one minute before calibrating.

CALIBRATION TO 100% AIR SATURATION
(Other calibration procedures are described in the **CALIBRATION** section of the Model 50 Instruction Manual)

4. Turn switch to **% CAL.**
5. Place YSI 5700 Series probe in BOD bottle containing about 1" of water. (Place 5739 probe in calibration bottle with moist sponge, or wrap in moist cloth to provide stable humidity. Wait for temperature equillibration. Temperature stability is essential for precise calibration.
6. Press **CAL** button once. **100.0** will appear on the display.
7. Turn switch to **%. CAL** will appear, then **100.0** (± 0.2). Observe reading for stability for at least 1 minute.

TEMPERATURE MEASUREMENT

8. Turn switch to **TEMP °C,** place probe in sample. Observe reading for stability.

OXYGEN MEASUREMENT

9. With probe in sample as for temperature measurement, turn switch to %. (To read in **mg/l,** see instruction manual.)
10. Stir sample for at least 30 seconds, then take oxygen reading. Observe reading for stability for at least one minute.

For measuring low levels of dissolved oxygen (1.00 mg/l or 10.0% air saturation), refer to **Highest Accuracy Measurements** in the Model 50 Instruction Manual. Also, consult the manual for discussion of salinity compensation.

ERROR INDICATION	
E. 0	System ROM
E.00	Lost calib. value
E.01	Defective RAM
E .1	Temperature probe
E .2	High background
E .3	Low sensitivity
E .4	High output

Compliance with FCC emanation rules (47CFR Part 15 Subpart J) as applicable has been verified on this product design for Class A and Class B environments.

SOLUBILITY OF OXYGEN IN WATER EXPOSED TO WATER SATURATED AIR AT 760 mm Hg PRESSURE

Temp. °C	Solubility mg/l	Temp. °C	Solubility mg/l	Temp. °C	Solubility mg/l
0	14.62	16	9.87	32	7.31
1	14.22	17	9.67	33	7.18
2	13.83	18	9.47	34	7.07
3	13.46	19	9.28	35	6.95
4	13.11	20	9.09	36	6.84
5	12.77	21	8.92	37	6.73
6	12.45	22	8.74	38	6.62
7	12.14	23	8.58	39	6.52
8	11.84	24	8.42	40	6.41
9	11.56	25	8.26	41	6.31
10	11.29	26	8.11	42	6.21
11	11.03	27	7.97	43	6.12
12	10.78	28	7.83	44	6.02
13	10.54	29	7.69	45	5.93
14	10.31	30	7.56	46	5.84
15	10.08	31	7.43	47	5.74

CALIBRATION VALUES FOR VARIOUS ATMOSPHERIC PRESSURES AND ALTITUDES.

Pressure inches Hg	mm Hg	kPa	Altitude Ft.	m	Calibration Value
30.23	768	102.3	−276	−84	101
29.92	760	101.3	0	0	100
29.61	752	100.3	278	85	99
29.33	745	99.3	558	170	98
29.02	737	98.3	841	256	97
28.74	730	97.3	1126	343	96
28.43	722	96.3	1413	431	95
28.11	714	95.2	1703	519	94
27.83	707	94.2	1995	608	93
27.52	699	93.2	2290	698	92
27.24	692	92.2	2587	789	91
26.93	684	91.2	2887	880	90
26.61	676	90.2	3190	972	89
26.34	669	89.2	3496	1066	88
26.02	661	88.2	3804	1160	87
25.75	654	87.1	4115	1254	86
25.43	646	86.1	4430	1350	85
25.12	638	85.1	4747	1447	84
24.84	631	84.1	5067	1544	83
24.53	623	83.1	5391	1643	82
24.25	616	82.1	5717	1743	81
23.94	608	81.1	6047	1843	80
23.62	600	80.0	6381	1945	79
23.35	593	79.0	6717	2047	78
23.03	585	78.0	7058	2151	77
22.76	578	77.0	7401	2256	76
22.44	570	76.0	7749	2362	75
22.13	562	75.0	8100	2469	74
21.85	555	74.0	8455	2577	73
21.54	547	73.0	8815	2687	72
21.26	540	71.9	9178	2797	71
20.94	532	70.9	9545	2909	70
20.63	524	69.9	9917	3023	69
20.35	517	68.9	10293	3137	68
20.04	509	67.9	10673	3253	67
19.76	502	66.9	11058	3371	66

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