YSI Calibration Logbooks and Log Sheet Revisions

Following completion of the October 2008 revision of the *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415), changes were made to the YSI calibration log sheets. These changes were made to better accommodate temperature sensor checks, track post-calibration checks, and added space for optical sensor calibration. The new log forms replace Figures 8.3 and 8.4 in Chapter 8. TCEQ is also phasing out the small calibration logbooks because the increasing complexity of logged information has made the smaller format obsolete. The calibration log book is now provided in 8"x11" format.

Download the updated YSI calibration log sheet and calibration logbook on the Web at: <http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm_resources.html#manuals>.

SURFACE WATER QUALITY MONITORING PROGRAM

YSI

MULTIPROBE CALIBRATION LOGBOOK

Sonde Model: _____

Sonde Serial No: _____

Inventory Number: _____

Dates of Use (mm/yy) from: _____**to:**_____

TCEQ

For more information, contact:

Texas Commission on Environmental Quality
Monitoring and Assessment Section
Surface Water Quality Monitoring Program
MC 234
PO Box 13087
Austin, TX 78711-3087

Calibration

Please refer to Chapter 8 of the Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, TCEQ Publication RG-415 for detailed information on calibration and maintenance of YSI multiprobe instruments. The manual is available online at <www.texaswaterdata.org>, click on the SWQM Program link, then "SWQM Guidance and Forms".

Calibration Order

According to YSI, the sensors should be calibrated in the following order:

- Specific Conductance
- pH mid-range (7.0)
- pH low (4.0) or high range (10)
- Dissolved Oxygen

Specific Conductance

► Calibrate specific conductance first to avoid any contamination of the standard.

► The standard chosen should be within the same conductivity range as the ambient water to be measured. However, **never** calibrate with standards that are less than 1.0 mS/cm (1,000 µS/cm). Standards less than 1.0 mS/cm are easily contaminated and this can affect calibration and performance.

► When the calibration has been accepted, check the conductivity cell constant which can be found in the sondes "Advanced Menu" under "Cal Constants". The acceptable range is 4.5 to 5.5. Numbers outside of this range usually indicate a problem in the calibration process or use of a contaminated standard. Record the conductivity cell constant on the calibration log sheet.

► If the sonde should report "Out of Range", investigate the cause. **Never override a calibration error message without fully understanding the cause**. A typical cause for error messages is incorrect entry, for example, entering 1,000 µS/cm instead of 1.0 mS/cm (Note: the sonde requires the input in mS). Low fluid level and/or bubbles in the probe bore are other causes for error.

Note: This procedure calibrates specific conductance, salinity and total dissolved solids.

pH Sensor

► The pH system is calibrated first with a pH 7.0 buffer and either pH 4.0 for naturally acidic waters or pH 10.0 for alkaline waters.

► Record the pH mV value on the calibration log sheet for each buffer used for calibration. The mV value should be within the range listed for the specific pH buffer. If the mV value exceeds the given range, it may be time to clean or change the pH sensor.

► pH buffers contain high concentrations of phosphate. Care must be taken during calibration to avoid leaving traces of buffer on equipment or at the work place that could contaminate water samples. Buffer solutions prepared in the field offices from reagent powder or concentrate are labeled with date of preparation and replaced after one month.

Dissolved Oxygen

Air calibration is the preferred method for dissolved oxygen. In this method three factors are important: water temperature, water-saturation, and barometric pressure. Water temperature is measured directly by the sensor. The air in the calibration cup then becomes saturated by exposure to water. Finally, barometric pressure is directly measured (barometer), obtained from a local weather bureau, or estimated based on altitude only.

Setup for Unattended Mode

► When using the Model 600 XLM or Model 6920 in the unattended mode the auto sleep must be enabled. Ensure that Auto Sleep RS232 and Auto Sleep SDI12 are enabled.

Calibration

► Set the sonde into the calibration cup with approximately 1/8 inch of water, do not allow water to touch the membrane. The sonde should sit in the calibration cup for 10 minutes to allow the air to saturate.

► Calibrate the sonde in DO %, and be sure to enter the local barometric pressure in mm/hg.

► When the calibration is complete, go to the sondes "**Advanced Menu**" and then to the "**Cal Constants**" and record the "**DO Gain**". The gain should be 1.0 with a range of -0.3 to + 0.5.

***Note*:** YSI Instruments will not automatically calibrate to 100%. Do not attempt to adjust to 100%. YSI instruments calibrate to the % saturation appropriate for a given altitude or pressure.

Uncorrecting Barometric Readings Corrected to Sea Level

Most barometric readings obtained from local and Internet sources are corrected to sea level (the effect of altitude is removed) and reported in inches of mercury.

To uncorrect the barometric pressure that was set to sea level:

Barometric Pressure (BP) = Corrected Barometric Pressure (CBP) -2.5 (A/100)

Where: BP = estimated absolute barometric pressure

CBP = local barometric pressure corrected to sea level (from weather bureau other source; convert reading supplied in inches to mm; inches x 25.4 = mm

2.5 = a constant. Atmospheric pressure decreases 2.5 mm Hg for each increase in altitude of 30.5 meters (100 feet)

A = local altitude in feet above mean sea level

For example: A barometric pressure reading of 29.50 inches Hg , corrected to sea level at an altitude of 650 feet above sea level is recalculated (uncorrected) by:

29.5 inches x 25.4 = 749 mm Hg
BP = 749 mm - 2.5 (650/100)
BP = 732.8 mm Hg

The above equation (with the elevation included) should be posted in the laboratory or site where the instruments are routinely calibrated. Once an initial calculation is made, the back half of the equation, i.e., 2.5 (A/100), will then be constant and can be subtracted from the corrected barometric pressure for calibrations at the specific laboratory.

If an instrument needs to be calibrated at a remote location where the barometric pressure is not available from the usual sources, the barometric pressure can be estimated from the following equation:

Barometric Pressure (BP) = 760 - 2.5 (A/100)

For example: If the altitude at the site of calibration is 1,200 feet above sea level, the estimated barometric pressure is:

BP = 760 - 2.5 (1200/100)
BP = 730 mm Hg

Post Calibration

- Post calibration must be performed after each use of the instrument and before any instrument maintenance is performed.

- Calibration and post calibration should never be more than 24-hours apart when used for instantaneous monitoring. Sondes used in a long-term deployment should be calibrated as soon as possible following retrieval. See Chapter 3 for details on 24-hour deployments.

- When the instrument is used several days in a row, the adjustments made during calibration on the following day can be recorded as post calibration.

- If post-calibration values fall outside the error limits for DO, pH, and specific conductance, data collected does not meet quality assurance (QA) and should not be reported. If post-calibration measurements do not consistently fall within the error limits after in-house trouble shooting, the instrument should be returned to the manufacturer for maintenance.

Post-Calibration Check Error Limits

Parameter	Value
Dissolved oxygen	± 0.5 mg/L, ± 6% saturation
pH	± 0.5 standard units
Specific conductance	± 5%
Temperature	± 0.2 °C
Depth	± 0.2 at 1 m

Temperature Sensor Check

- Check the accuracy of the temperature sensor during routine instrument maintenance. See Chapter 8 for temperature check details. Temperature sensors are factory calibrated and cannot be adjusted by the user. Calibration and maintenance (other than general cleaning) of the sensor is not required

pH Calibration Standards

Temperature (°C)	pH 4 Standard	pH 7 Standard	pH 9 Standard	pH 10 Standard
10	4.00	7.06	9.33	10.15
11	4.00	7.06	9.32	10.14
12	4.00	7.05	9.31	10.13
13	4.00	7.05	9.30	10.12
14	4.00	7.04	9.29	10.11
15	4.00	7.04	9.28	10.10
16	4.00	7.04	9.27	10.09
17	4.00	7.03	9.26	10.08
18	4.00	7.03	9.25	10.07
19	4.00	7.02	9.24	10.06
20	4.00	7.02	9.23	10.05
21	4.00	7.01	9.22	10.05
22	4.00	7.01	9.21	10.04
23	4.00	7.00	9.20	10.03
24	4.00	7.00	9.19	10.01
25	4.00	7.00	9.18	10.00
26	4.00	7.00	9.17	9.99
27	4.00	7.00	9.16	9.98
28	4.01	6.99	9.16	9.98
29	4.01	6.99	9.15	9.97
30	4.01	6.99	9.14	9.96
31	4.01	6.99	9.13	9.95
32	4.01	6.99	9.13	9.94
33	4.02	6.98	9.12	9.93
34	4.02	6.98	9.12	9.92
35	4.02	6.98	9.11	9.91
36	4.02	6.98	9.10	9.90
37	4.02	6.98	9.09	9.89
38	4.02	6.98	9.08	9.88

TCEQ Surface Water Quality Monitoring
YSI Mulitprobe Calibration and Maintenance Log

Date: Time: Employee name:

Battery Voltage: Sonde Type and Serial No.

Calibration

Function	Temp. of Standard	Value of Standard	Initial Reading	Calibrated to	Comments
Specific conductance (high) ≥1,000 µS/cm					
Conductivity cell constant					Range 5.0 ± 0.5
pH calibrated (~7)					
pH mv for pH 7 solution					Range 0 ± 50 mv
pH slope (~ 4/10)					
pH mv for pH 10 pH mv for pH 4					Range: -130 to -230 mv Range: 130 to 230 mv
Dissolved oxygen (%sat) *					
Dissolved oxygen charge					Range 25 to 75
Dissolved oxygen gain					Range 0.7 to 1.4
Optional Sensors (include parameter: turbidity, etc.)					

DATA NEEDED FOR DISSOLVED OXYGEN CALIBRATION

Altitude (A) =_____feet above msl Barometric pressure _____ inches _____ mm

Barometric Pressure (BP) Options	Barometric Pressure Formulas
Barometer	Barometric pressure (inches) _____ x 25.4 = BP _____mm
From local source after correction (CBP)	BP _____ mm = CBP _____mm - 2.5 (altitude ____/100)
Estimated from altitude only	BP _____ mm= 760 mm - 2.5 (altitude _____/100)
DO % saturation standard calculation *	**DO% sat Standard = Absolute BP mmHg/760 x 100**

Deployment Checklist (required for data logging only)

Logging interval: Yes No	SDI-12 Autosleep enabled: Yes No	RS 232 autosleep enabled: Yes No	DO warm-up time:	Battery volts in Sonde (days):	Available memory in Sonde (days):

Post-Calibration Check

Date: Time: Employee Name:

Battery Voltage: Sonde Type and Serial No.

Function	Temp. of Standard	Value of Standard	Initial Reading	Pass Post-Cal?	Comments
Specific conductance				☐Yes ☐No	
pH calibrated (~7)				☐Yes ☐No	
pH slope (~ 4/10)				☐Yes ☐No	
Dissolved oxygen (%sat) *				☐Yes ☐No	
Optional Sensors (include parameter: turbidity, etc.)				☐Yes ☐No	
				☐Yes ☐No	

Location of Deployment, Routine Run, or Special Study:	Date/Time Deployed:	Date/Time Retrieved:

Use(circle one): 24-hour Continuous Grab Referee

MAINTENANCE
(Refer to Chapter 8 for maintenance requirements)

Sensor	Date	Initials	Maintenance Completed
pH			
DO			
Specific Conductance			

Perform temperature check along with regular maintenance. The laboratory thermometer must be checked against NIST traceable thermometer annually.

Annual NIST traceable check	Date:	NIST Temp:	Lab Thermometer Temp:	Correction Factor:
Maintenance temperature check	Date:	Sonde Temp:	Lab Thermometer Temp:	

Factory maintenance/repair notes:

TCEQ-20118 (rev. 11/07/08)