

Calibration of YSI 6 Series Sonde w/ 650 MDS Handheld

Getting Ready To Calibrate – Calibration Tips:

1. If you use the calibration cup for dissolved oxygen (DO) calibration, make certain to loosen the seal to allow pressure equilibration before calibration. The DO calibration is a water-saturated air calibration.
2. The key to successful calibration is to insure that the sensors are completely submersed when calibration values are entered. Set calibration standards out ahead of time in room where calibration is to occur for temperature stability.
3. For maximum accuracy, use a small amount of previously used calibration solution to pre-rinse the sonde. You may wish to save old calibration standards for this purpose.
4. Fill a bucket or sink with ambient temperature water to rinse the sonde between calibration solutions.
5. Have several clean, absorbent paper towels or cotton cloths available to dry the sonde between rinses and calibration solutions. Shake excess rinse water off the sonde, especially when the probe guard is installed. Dry off the outside of the sonde and probe guard. Drying the sonde reduces carry-over contamination of calibrator solutions and increases calibration accuracy.
6. Remove the stainless steel weight from the sonde bottom by turning the weight counterclockwise. When the weight is removed, the calibration solutions have access to the sensors without displacing a lot of fluid. This also reduces the amount of liquid that is carried between calibrations.
7. Make certain that port plugs are installed in all ports where probes are not installed. It is extremely important to keep these electrical connectors dry.

YSI handheld and sonde equipment set-up prior to calibration and sampling

Once this set-up is initially done, it will not be necessary to go through these set-up procedures each time calibration is done:

1. Press the **Power** (Green “Ⓞ”) button to turn the YSI 650 MDS handheld on.
2. From the “650 Main Menu” select **Sonde menu**.
3. From the “Main” menu screen scroll down and select **Advanced**.
4. From the “Advanced Menu” scroll down and select **Setup**.
5. From the “Advanced Setup” menu ensure that **Auto sleep RS232** and **Auto sleep SD112** are not enabled. It is also suggested that **Power up to Run** be selected in this screen.
6. Press **Escape** twice to return to “Main” menu and select **Report**.
7. From the “Report setup” menu scroll through and minimally enable by selecting the following: Temp C; SpCond uS/cm; DOsat %; DO mg/l; DO Charge; pH; and pH mV. Enable other options as per your instrument capabilities and your monitoring program reporting needs.
8. Press **Escape** and turn power off or begin calibration process. The sonde is now set up for calibration and sampling.

CALIBRATION TIPS - CONDUCTIVITY

Calibrate conductivity first to avoid contamination of the standard.

For maximum accuracy, the conductivity standard you choose should be within the same conductivity range as the water you are preparing to sample. However, it is not recommended to calibrate with conductivity standards that are less than 1.0 millisiemens/cm (mS/cm) [which is equal to 1,000 microsiemens (μ S/cm)]. These low standards are easily contaminated and can be interfered with by outside noise sources (RF, etc.)

TIP: During calibration for conductivity and pH, you may remove the stainless steel weight from the bottom of the sonde by unscrewing the weight counterclockwise. When the weight is removed, the calibration solutions have access to the sensors while displacing less fluid. This also reduces the amount of liquid that is potentially carried between calibrations.

1. Pre-rinse the calibration cup and sonde sensors with a small amount of the conductivity standard to be used to eliminate contamination. Discard, and then place approximately the correct amount of conductivity standard into the pre-rinsed calibration cup.
2. Immerse the probe end of the sonde into the calibration cup. Gently rotate and/or move the sonde up and down to remove any bubbles from the conductivity cell. Insure that the conductivity probe is completely submerged in standard. The hole in the side of the probe must be under the surface of the solution and not have any trapped bubbles in the opening.
3. Allow at least one minute for temperature equilibrium before proceeding.
4. With the YSI 650 MDS Handheld on, scroll to “**Sonde menu**” and press the **Enter** key.
5. The handheld will make a sound that indicates you are actively connected to the sonde and its menus. From the displayed screen, scroll to “**Calibrate**” and press the **Enter** key.
6. Scroll to “**Conductivity**” and press **Enter** to access the Conductivity calibration procedure.
7. From the next “Cond Calibration” screen scroll to **SpCond** and press **Enter** to access the specific conductance calibration procedure. Then enter the calibration value of the standard you are using. **Note:** The sonde requires the input in milliSiemens (mS/cm). 1,000 microsiemens (μ S/cm) = 1 millisiemen thus when using a 1,000 microSiemen/cm standard, enter **1.000**. Record the conductivity of the standard being used on the calibration work sheet. Press **Enter**. The current value of all enabled sensors will appear on the screen and will change with time as they stabilize.
8. If the sonde should report “**Out Of Range**”, investigate the cause. Never override a calibration error message without fully understanding the cause. Typical causes for error messages are incorrect entries, for example, entering 1000 microSiemens instead of 1.0 milliSiemens. Low fluid level and/or air bubbles in the probe bore are other error causes.
9. Observe the readings under Specific Conductance or Conductivity and when they show no significant change for approximately 30 seconds, record the temperature and conductivity value being displayed as the “pre-calibration conductivity” on the calibration work sheet, then press

Enter. The top of the screen will show “Calibrated” which indicates that the calibration has been accepted. Record the conductivity value being displayed as the “post-calibration conductivity” on the calibration worksheet, then press **Enter** again to continue and return to the Calibrate menu.

10. When the calibration has been accepted check the conductivity cell constant which can be found by pressing **Escape** three times to return to the sonde’s “Main Menu.” Scroll to **Advanced** at the bottom and press **Enter**. Press “**Cal Constants**” and record the conductivity cell constant value on the calibration work sheet. The acceptable range is 5.0 +/- 0.45. Numbers outside of this range usually indicate a problem in the calibration process or a contaminated standard was used.

At this point rinse the sonde with tap water and turn the **Power** off or press **Escape** two times to return to the “Main” menu and select “**Calibrate**” to proceed with calibration for other variables as needed.

CALIBRATION TIPS - pH

If initial set-up has not been done, go to the sondes report menu and turn on the pH mv output. This will allow the sonde to display the millivolts or the probes raw output, as well as the pH units during the calibration process.

Note: In most cases, a two point calibration using pH buffers 7 and 10 will be used to cover conditions generally found in the Red River Basin.

1. Pre-rinse the calibration cup and sonde sensors with the pH 7 buffer to eliminate contamination. Discard and then place approximately the correct amount of the pH 7 buffer into the pre-rinsed calibration cup.
2. Immerse the probe end of the sonde into the calibration cup. Gently rotate and/or move the sonde up and down to remove any bubbles from the sensors. Ensure that the pH reference and glass sensors as well as the temperature sensor are completely submerged in standard.
3. With the YSI 650 MDS Handheld on, scroll to “**Sonde menu**” and press the **Enter** key.
4. From the displayed “Main” menu screen, scroll to “**Calibrate**” and press **Enter**.
5. Scroll to “**ISE1 pH**” and press **Enter** to access the pH calibration menu.
6. From the “pH calibration” screen scroll to **2 point** and press **Enter** to access the screen to enter your first pH buffer value. Enter **7.00** (or the proper pH value adjusted to the temperature of the calibration standard if other than 25°C) and press **Enter**. Record the temperature and pH value of the pH Buffer 7 that you entered on the calibration worksheet in the “Cal. Standard” section.
7. Watch for the pH value and temperature to stabilize. When stable, record the pH and mV meter readings as the pH Buffer 7 “Pre-Calibration” values on the calibration worksheet.

8. Press **Enter** and record the pH and mV meter readings as the pH Buffer 7 “Post-Calibration” values on the calibration worksheet.. Press **Enter** again and screen will prompt you to “Enter 2nd pH.” At this time, remove sonde from calibration cup and pour out the pH 7 buffer. [Note: Consider pouring into a container marked “used pH 7 buffer” which can be used as the pre-rinse for the next time pH calibration is done.]
9. Pre-rinse the calibration cup and sonde sensors with pH 10 buffer. Discard and then place approximately the correct amount of the pH 10 buffer into the pre-rinsed calibration cup.
10. Immerse the probe end of the sonde into the calibration cup. Gently rotate and/or move the sonde up and down to remove any bubbles from the sensors. Insure that the pH reference and glass sensors as well as the temperature sensor are completely submerged in standard.
11. Enter **10.00** for the 2nd pH value (or the proper pH value adjusted to the temperature of the calibration standard if other than 25°C) and press **Enter**. Record the temperature and pH value of the pH Buffer 10 that you entered on the calibration worksheet in the “Cal. Standard” section.
12. Watch for the pH value and temperature to stabilize. When stable, record the pH and mV meter readings as the pH Buffer 10 “Pre-Calibration” values on the calibration worksheet.
13. Press **Enter** and record the pH and mV meter readings as the pH Buffer 10 “Post-Calibration” values on the calibration worksheet.
14. Remove sonde from calibration cup and pour out pH 10 buffer. [Note: Consider pouring into a container marked “used pH 10 buffer” which can be used as the pre-rinse for the next time pH calibration is done.] Rinse calibration cup and sonde with tap water and store sonde in cup with wet sponge or place sonde in wet towel for short-term storage and transport. Assess slope as per discussion below.

After recording the pH millivolts for the calibration points, you must determine the slope of the sensor. This is done by determining the difference between the two calibration points that were used, for example, if buffer 7 was +3 mV and buffer 10 was -177mV, the slope would be 180.

The millivolts help tell us the present status of the probe; a good set of numbers to use are as follows:

Buffer 4 = + 180 +/- 50 mv

Buffer 7 = 0 +/- 50 mv

Buffer 10 = - 180 +/- 50 mv

The ideal numbers when a probe is new are between 0 and 180, but as the probe begins to age, the numbers will move and shift to the higher side of the tolerance. The acceptable range for the slope is 165 to 180. Once the slope drops below a span of 165, the sensor should be taken out of service.

Recondition the probe if a slow response in the field has been reported. The procedure can be found in the YSI sonde manual under the “**Sonde Care and Maintenance Section**”.

Never override any calibration errors or warnings without fully understanding the reason for the message. Proper storage of the sensor when not in service will greatly extend the life of the probe.

CALIBRATION TIPS - DISSOLVED OXYGEN

DISCRETE MONITORING (Spot Sampling) PREPARATION

Preparing to calibrate Dissolved Oxygen:

Inspect the DO probe anodes, recondition using the 6035 reconditioning kit if they are darkened or gray in color. (see instructions on pg. 90 of YSI Environmental Operations Manual).

It is recommended to change DO membranes every 30 days. Also inspect O-ring and replace if not providing a tight seal. (See DO membrane installation procedure) After installing a new membrane, make sure that it is tightly stretched and wrinkle free. Note: DO membranes will be slightly unstable during the first 3 to 6 hours after they are installed; it is suggested that the final calibration of the DO sensor take place after this time period.

NOTE: If you have resurfaced your DO sensor, it is recommended to run the probe continuously for 15-30 minutes or until good stability is realized. After a membrane change only, run the probe continuously for 3-4 minutes or until good stability is realized.

Dissolved Oxygen Calibration:

- 1. Note:** Calibration should occur on-site in the atmospheric conditions which sampling will occur. Carefully remove the sensor guard and inspect the membrane to ensure that no water droplets are on the membrane—as needed, wash off with wash bottle or gently dab with Kimwipe or other lens tissue to absorb the water droplets. Also dry the silver thermistor (temperature sensor) for accurate temperature measurements. Carefully replace the sensor guard and place the sonde in the calibration cup with the wet sponge and approximately 1/8 inch of water or you may use the wet towel method if you prefer. Do not allow water to touch the membrane and make sure no water droplets are on the membrane. If using the calibration cup, unscrew the cup slightly to relieve pressure, allowing equilibrium to be reached with atmospheric pressure. The sonde must now sit in this saturated environment for at least 10-15 minutes before the DO calibration can begin—both the DO reading and the temperature need to stabilize before starting the calibration sequence. It is suggested to put the sonde in the “Run” mode (see step 2 below) during this time to allow monitoring stabilization of the DO % saturation and temperature. While monitoring stabilization of these readings, the DO sensor output countdown check in step 2 below can be performed and results recorded.
- 2.** From the “Main” menu, select **Sonde run** (you may need to then select **Discrete Sample**, then **Start Sampling** if the meter doesn’t initially start in run mode. The sonde should be in the discrete run mode at a 4 second rate). Immediately watch the DO% display. Observe and/or write down the first 10 DO % numbers. The numbers must start at a high number and drop with each four second sample, example: 110, 105, 102, 101.5, 101.1, 101.0, 100.8, 100.4, 100.3, 100.1. It does not matter if the numbers do not reach 100% or they are below 100%, or that they do not drop each time—it is only important that they have a high to low trend. (**Note:** Initial power-up can make the first two DO % samples read low, disregard low numbers in this position.) Should the output display a negative value or start at a low number and climb up to the calibration point, check Reject on the calibration worksheet and examine the probe anodes, membrane, or other possible errors—do not deploy the probe. If the display declines as it should, check Accept on the calibration worksheet. After this check, while still in the Run mode, allow the sonde to continue

to warm up/run for a total of 10 minutes or longer while the DO% and temperature readings stabilize, then proceed with calibration.

3. When DO % saturation and temperature readings are stable, press **Escape** to get back to the “650 Main Menu.” Scroll to and select **Sonde menu**.
4. From the “Main” menu scroll to and select **Calibrate**.
5. From the “Calibrate” menu scroll to and select **Dissolved Oxy**.
6. The next “DO calibration” menu will offer you the option of calibrating in percent saturation or mg/l—calibrating either of the choices will automatically calibrate the other. Select **DO %** saturation.
7. The next “DO Calibration” menu will require barometric pressure to be entered. If your handheld does not have barometric pressure built into it, be sure to enter your local barometric pressure in mm/hg (inches Hg x 25.4). If your handheld does have barometric pressure built in, it will be displayed. Press **Enter**, then monitor the stabilization of the DO % readings. After no changes occur for approximately 30 seconds, record the Pre-Calibration DO% on the calibration worksheet.
8. Press **Enter** to confirm the calibration. Then record the Post-Calibration DO% value and the DO Charge on the calibration worksheet. Press **Enter** again to return to the “DO calibration” menu. Press **Escape** twice to return to the “Main” menu.
9. From the “Main” menu scroll down to the bottom and press **Advanced**.
10. From the “Advanced” menu press “**Cal constants**” and record the DO Gain on the calibration worksheet. The gain should be 1.0 with a Range of -0.3 to +0.5. The probe should now be successfully calibrated and ready for discrete sampling. Press **Escape** twice to get back to the “Main” menu or turn the power off until ready to use. As with the other parameters any warning messages displayed by the sonde during the calibration are a cause for concern and must be investigated before deploying the sonde.

Dissolved Oxygen Discrete Sampling Tips:

1. Always prepare the equipment the day before the expected field study. Membrane changes should be done the day prior to the study to minimize any drift.
2. The transfer of the sonde from the storage/calibration to the sensor guard puts the sonde and sensors at risk during the process. Usually, this is when most accidents occur, so it is best to avoid removing the protective sensor guard when in the field. A recommended procedure is to carry the sonde in a 5 gallon pail with the sonde wrapped in a wet white towel that covers the entire unit. The towel being wrapped around the sonde will protect it during transport from shock and vibration and will keep the sonde in the perfect saturated environment for pre and post calibration checks as needed.
3. When arriving on site, turn on the sonde and allow it to warm up for approximately 4 to 5 minutes. Next, check the DO output. It should measure saturation in your local environment or barometric pressure setting, plus or minus the instrument's tolerance of 2 percent. If you should find that the DO has drifted, then simply recalibrate on the spot and record the amount of drift that was witnessed.
4. The sonde will then be deployed and the measurements automatically taken. Remember to allow the sonde a few minutes to equilibrate to the water temperature before taking the reading. Once the data has been collected, wrap the sonde again in the wet towel and perform a dissolved oxygen post calibration. Again, the sonde should return to saturation, plus or minus the tolerance of 2 percent, within a few minutes.
5. If you are logging the information, it is recommended that you store this pre- and post-calibration data in the actual site datafile. Otherwise, if you are manually recording the data, record the information in your log sheet. This assures anyone who might look at the records at a later time that the sonde was indeed calibrated and working correctly. The additions of these steps add very little time to the collection process and can actually save time when unexpected results are witnessed.

CALIBRATION WORK SHEET

Date of Calibration: _____ Sonde ID: _____ Technician: _____

Conductivity Calibration Record: Date: _____ Sonde ID: _____ Technician: _____				
	Conductivity Standard	Pre-Calibration Conductivity	Post-Calibration Conductivity	Conductivity Cell Constant
<u>Conductivity Std.</u>	°C	(µS/cm)	(µS/cm)	(Range 5.0 +.45)
1.000 µS/cm _____				
NOTES: (when calibrating for "specific conductance," no temperature adjustments for the conductivity standard are needed)				

PH Calibration Record: Date: _____ Sonde ID: _____ Technician: _____						
	<u>Cal. Standard</u>		<u>Pre-Calibration</u>		<u>Post-Calibration</u>	
	°C	Adj. pH	pH	mV	pH	mV
pH Buffer 7	_____	_____	_____	_____	_____	_____
pH Buffer 10	_____	_____	_____	_____	_____	_____
Range 0 MV ± 50 MV						
Range -180 ± 50 MV						
Milli-volt span between pH 7 and 10 should be ≈ 165 to 180 MV _____						
The ideal numbers when a probe is new are between 0 and 180, but as the probe begins to age, the numbers will move and shift to the higher side of the tolerance. The acceptable range for the slope is a span of 165 to 180. Once the slope drops below a span of 165, the sensor should be taken out of service if maintenance cannot bring it back into range.						
NOTES:						

Dissolved Oxygen Calib. Record: Date: _____ Sonde ID: _____ Technician: _____						
DO membrane changed? Y N Note: After membrane change, should wait 6 to 8 hours before final DO calibration, run sensor for 15 minutes in Discrete Run to accelerate burn-in.						
Barometric Pressure Bar. Pres. Pre-Calib Post-Calib D.O. Charge D.O. Gain						
(Inches/Hg) x 25.4 = mm/Hg <u>D.O. %</u> <u>D.O. %</u> (Range 50 + 25) (Range 1.0 -.3 to +.5)						
_____ x 25.4 = _____ _____ _____ _____ _____						
DISSOLVED OXYGEN SENSOR OUTPUT TEST						
Does the DO % output display the proper declining high to low trend? If so, check ACCEPT. _____ ACCEPT						
Should the output display a negative number or start at a low number and climb up to the calibration point, check REJECT and do not deploy the probe. _____ REJECT						
NOTES:						

CALIBRATION WORK SHEET – DISSOLVED OXYGEN

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 (Inches/Hg) x 25.4 = mm/Hg D.O. % D.O.% (Range 50 + 25) (Range 1.0 -.3 to +.5)

_____ x 25.4 = _____ _____ _____ _____ _____

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