

SOP 1.4: Use of YSI ProPlus: Calibration, Sensor Checks, and Maintenance.

This document provides the guidelines for the operation of the YSI ProPlus water quality meter. For additional guidance and troubleshooting please refer to the [YSI ProPlus user manual](#).

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I. Equipment and Supplies

Equipment:

- YSI ProPlus
- Calibration cup for YSI ProPlus
- Field sensor guard for YSI ProPlus
- Rinse bottle for DI water
- Rinse containers for calibration fluids
- Reference Thermometer

Supplies:

- Calibration standards
 - pH (4, 7, 10)
 - Conductivity (typically 1412)
 - Calibration check solutions (pH, conductivity)
- Deionized (DI) or distilled water
- 5-gallon bucket (for waste fluids)
- Lint-free wipes (e.g. Kimwipes)
- 2 C-batteries
- Multiple soft bristled toothbrushes
- Cotton swabs and balls
- Data Sheets (See Appendix A) printed on water resistant paper
- Mechanical pencils



Figure 1. YSI ProPlus Water Quality Instrument.

II. Configure YSI-ProPlus

Prior to use, the YSI ProPlus must be configured to capture the desired water quality parameters. See YSI ProPlus user manual and individual sensor instructions for guidance regarding sensor installation. All constants used as part of the sensor configurations are provided by the manufacturer, contact YSI technical support for questions regarding sensor configuration.

KEYPAD		Number	Key	Description
	1			System Opens System Menu from any screen. Use to adjust system settings.
	2			Sensor Opens Sensor Menu from any screen. Use to enable sensors and display units.
	3			Calibrate Opens Calibrate Menu from any screen. Use to calibrate all parameters except temperature.
	4			File Opens File Menu from any screen. Use to view data and GLP files, set up site and folder lists, and delete data.
	5			Backlight Press to turn the instrument backlight on and off and to adjust the display contrast when pressed with the left or right arrow key.

Figure 2. Diagram of YSI ProPlus keypad.

A. Configure ProPlus

1. Set Date/Time

- (1) Press Power button to turn on ProPlus Instrument
- (2) Press "System" button on ProPlus

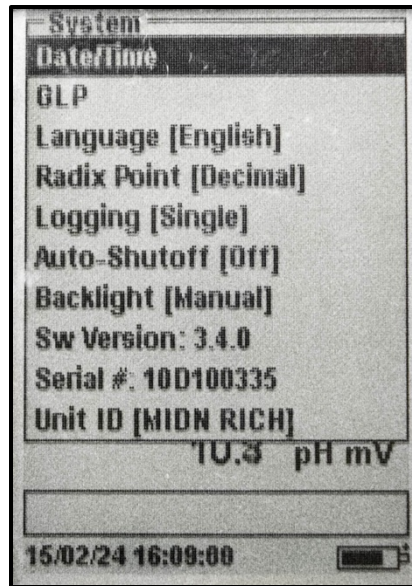


Figure 3. YSI ProPlus system menu.

- (3) Highlight "Date/Time" and press Enter
 1. Highlight "Date format" and press enter
 - i. Select "YY/MM/DD" and press enter
 2. Highlight "Date" and press enter
 - i. Enter the correct date and select enter from screen

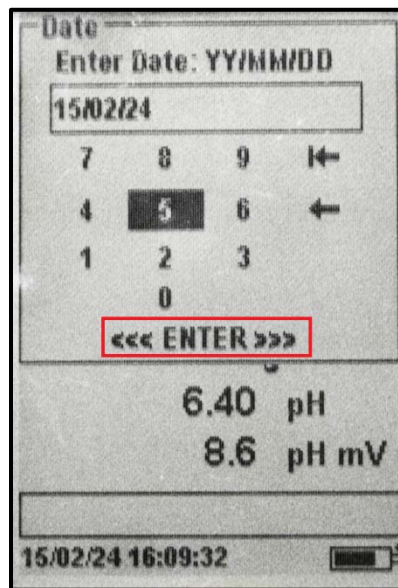


Figure 4. Keypad data entry screen.

3. Highlight "Time Format" and press enter
 - i. Select "24-Hour" and press enter
4. Highlight "Time" and press enter
 - i. Enter the correct time and select enter from screen

2. Set Auto-shutoff

- (1) Press "System" button on ProPlus
- (2) Turn "Auto-shutoff" off
 1. Highlight "Auto-shutoff" and press Enter
 2. Enter "0" with the key pad and select Enter

B. Configure Sensors

1. Dissolved Oxygen

- (1) Press "Probe" button on ProPlus

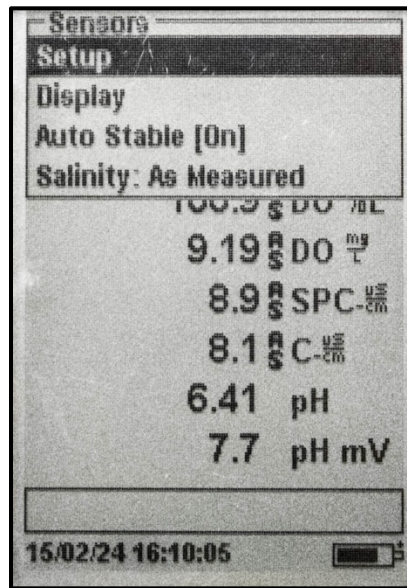


Figure 5. YSI ProPlus probe menu screen.

- (2) Highlight "Setup" and press Enter
 - a. Highlight "DO" and press Enter

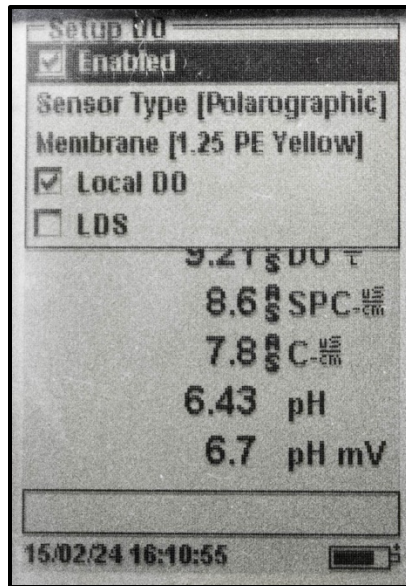


Figure 6. Dissolved Oxygen sensor setup screen.

- i. Highlight "Sensor Type" and press Enter
 1. Select "Polarographic" and press Enter
 - ii. Highlight "Membrane" and press Enter
 1. Select "1.25 PE Yellow" and press Enter
 - iii. Highlight "Local DO" and press Enter
 1. Ensure box is checked next to "Local DO"
 - iv. Ensure sensor is enabled
 1. If box next to "Enabled" does not have a check:
 - a. Highlight "Enabled" and press Enter
- (3) Press "Probe" button on ProPlus
- (4) Highlight "Display" and press Enter

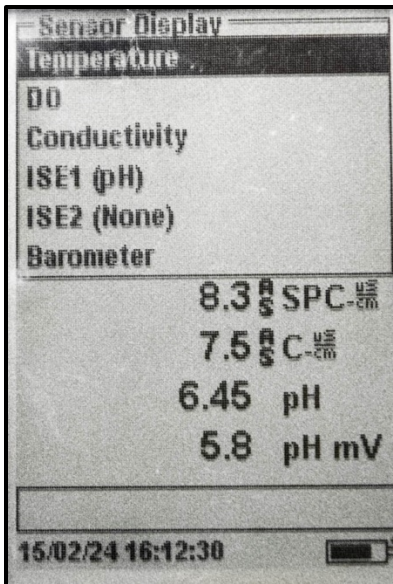


Figure 7. Probe sensor display menu.

- a. Highlight "DO" and press Enter
 - i. Ensure proper reporting units are displayed
 1. If box next to "DO%L" does not have a check:
 - a. Highlight "DO%L" and press Enter
 2. If box next to "DO mg/L" does not have a check:
 - a. Highlight "DO mg/L" and press Enter
- (5) Press "Probe" button on ProPlus
- (6) Highlight "Auto Stable" and press Enter
 - a. Highlight "DO" and press Enter
 - i. Sensitivity should be set at 100%
 - ii. Ensure the Auto Stable in Enabled
 1. If box next to "Enabled" does not a check:
 - a. Highlight "Enabled" and press Enter
- 2. Conductivity (as Specific Conductance)**
 - (1) Press "Probe" button on ProPlus
 - (2) Highlight "Setup" and press Enter
 - a. Highlight "Conductivity" and press Enter
 - i. Highlight "Temp Ref" and press Enter
 1. Enter "25.00" and select Enter from screen
 - ii. Highlight "%/°C" and press Enter
 1. Enter "1.91" and select Enter from screen
 - iii. Highlight "TDS Constant" and press Enter
 1. Enter "0.65" and select Enter from screen
 - iv. Ensure sensor is enabled
 1. If box next to "Enabled" does not have a check:
 - a. Highlight "Enabled" and press Enter

- (3) Press "Probe" button on ProPlus
- (4) Highlight "Display" and press Enter
 - a. Highlight "Conductivity" and press Enter
 - b. Highlight "Sp Conductance" and press Enter
 - i. Highlight "SPC- μ S/cm" and press Enter
- (5) Press "Probe" button on ProPlus
- (6) Highlight "Auto Stable" and press Enter
 - a. Highlight "Conductivity" and press Enter
 - i. Sensitivity should be set at 100%
 - ii. Ensure the Auto Stable in Enabled
 - 1. If box next to "Enabled" does not a check:
 - iii. Highlight "Enabled" and press Enter

3. **pH**

- (1) Press "Probe" button on ProPlus
- (2) Highlight "Setup" and press Enter
 - a. Highlight "ISE1 [pH]"
 - i. Highlight "pH [xxxx]" and press Enter
 - 1. Highlight NIST and press Enter
 - ii. Ensure sensor is enabled
 - 1. If box next to "Enabled" does not have a check:
 - a. Highlight "Enabled" and press Enter
- (3) Press "Probe" button on ProPlus
- (4) Highlight "Display" and press Enter
 - a. Highlight "ISE1 (pH)" and press Enter
 - b. Highlight "pH" and press Enter
 - i. Ensure proper reporting units are displayed
 - 1. If box next to "pH" does not have a check:
 - a. Highlight "pH" and press Enter
 - 2. If box next to "pH mV" does not have a check:
 - a. Highlight "pH mV" and press Enter
- (5) Press "Probe" button on ProPlus
- (6) Highlight "Auto Stable" and press Enter
 - a. Highlight "ISE1 (pH)" and press Enter
 - i. Sensitivity should be set at 75-100%
 - ii. Ensure the Auto Stable in Enabled
 - 1. If box next to "Enabled" does not a check:
 - a. Highlight "Enabled" and press Enter
- (7) Press "Esc" on ProPlus to return to main screen

4. **Temperature**

- (1) Press "Probe" button on YSI ProPlus
- (2) Highlight "Display" and press Enter
 - a. Highlight "Temperature" and press Enter

- b. Highlight “°C” and press Enter
- (3) Press “Esc” on Pro Plus Key Pad to return to main screen

III. Calibrate YSI ProPlus Sensors

To ensure reliable, accurate data is collected the ProPlus meter must be calibrated prior to each sampling event as well as pass quality control sensor checks. The following section will describe the procedures to calibrate the YSI ProPlus water quality meter.

A. General Calibration Procedures

The ProPlus should be clean prior to calibration. Prior to calibration of **each** parameter the user must complete the full rinse procedure:

- (1) Triple rinse calibration cup and sonde sensors thoroughly with distilled or deionized water
- (2) Triple rinse calibration cup and sonde sensors with appropriate calibration fluid

When new calibration fluids are used once they should be retained in a container clearly marked “Rinse” for that particular fluid. This fluid can then be used to complete the initial two rinses called for under this procedure

- a. Fill calibration cup with appropriate calibration fluid from “Rinse” container
 - i. Use enough fluid to thoroughly rinse all surfaces within the calibration cup once attached to sensor housing
 - ii. Attach calibration cup to sensor housing
 - iii. Rinse all surfaces within the cup with the calibration fluid by rotating and shaking the sonde housing
 - iv. Discard fluid in waste container
 - b. Repeat rinse procedure with used (“Rinse”) fluid (when available)
 - c. On the third and final rinse use **only new** calibration fluid and retain the new calibration fluid in the “Rinse” container for that fluid
- (3) Calibration cup and sensors are now primed and ready for actual calibration with **new calibration fluid**

Table 1. Rinse procedures.

Rinse #	Fluid	Source Container
1	Distilled Water	Gallon Jug
2	Distilled Water	Gallon Jug
3	Distilled Water	Gallon Jug
4	Used Calibration Fluid	Rinse Container
5	Used Calibration Fluid	Rinse Container
6	New Calibration Fluid	New Standard Bottle
Calibrate	New Calibration Fluid	New Standard Bottle

*****New calibration fluid used during the actual calibration should also be retained in the appropriate "Rinse" container*****

B. Specific Calibration Procedures

All calibration information is to be recorded on a calibration data sheet. Calibration of individual sensors should follow the order in which they are presented in this section as a best practice.

1. Dissolved Oxygen

Dissolved oxygen (DO) is calibrated in a water-saturated air environment. The cap on the dissolved oxygen sensor must be maintained on a regular basis. This cap should be replaced immediately prior to calibration on every third sampling event (see Maintenance § V.1. below for guidance).

(1) Create water-saturated air environment:

1. Triple rinse sensors with distilled or deionized water
2. Place a small amount of water in the bottom of the calibration cup (several milliliters; water should not contact any sensors)
3. Ensure there are no water droplets on the DO sensor cap
 - i. Water droplets can be dislodged by spraying with rinse bottle or holding sensor bulkhead in your hand and using a flicking motion
 - ii. Use lint free tissue (e.g., kemwipes) to wick away moisture
4. Engage a couple of threads between the calibration cup and the sonde housing; the atmospheric pressure must be allowed to equalize between the inside of the calibration cup and the ambient environment (i.e., do not make an air-tight seal between the calibration cup and sonde housing)

*****i.e., do not make an air-tight seal between the calibration cup and sonde housing*****

5. Allow water-saturated air environment to stabilize for approximately 15 minutes
 - i. stable DO reading is one where temperature values do not change more than 0.1 °C and DO values do not change more than 0.01 mg/L within 10 seconds

*****if temperature values do not stabilize due to changing ambient conditions then alternative methods can be used to create a stable environment, contact MIDN Aquatic Ecologist for guidance*****

- ii. Note time that calibration cup was attached to record on calibration data sheet

(2) Initiate YSI ProPlus Calibration data sheet:

1. Record:
 - i. Sonde serial #
 - ii. Date
 - iii. Contact info (calibrator's name)
 - iv. Park code
 - v. Record if DO sensor was replaced (see Maintenance § V.1. below for guidance)
 - vi. Record pH date stamp code (see Maintenance § V.2. below for guidance)
2. Record the time calibration cup was placed on sensor housing as the start time on the calibration data sheet

(3) Calibrate dissolved oxygen sensor

1. Press “Cal” button on ProPlus

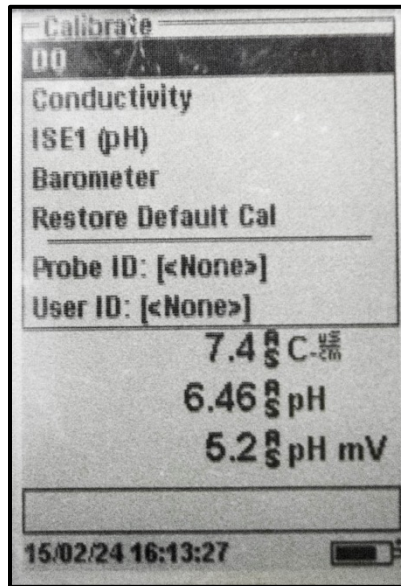


Figure 8. Calibration menu screen.

2. Highlight “DO” and press Enter
 - i. Highlight “DO%L” and press Enter
3. Observe onscreen data and allow the dissolved oxygen values to stabilize

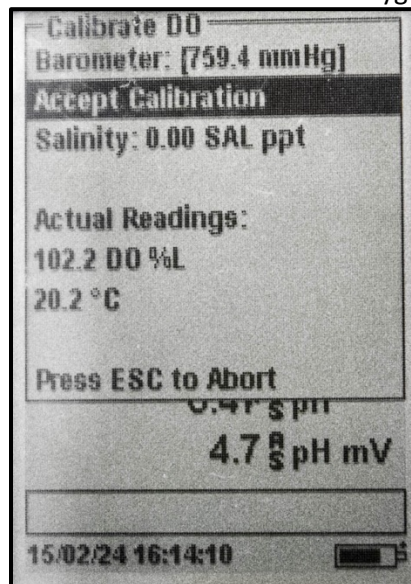


Figure 9. DO calibration screen.

4. On a calibration data sheet in the WQ log book, record all fields related to DO:
 - i. Start time (when sonde entered 100% saturated environment) and time at calibration
 - ii. Barometric pressure value
 - iii. Temperature
 - iv. Pre-Calibration % Saturation Value
5. Highlight “Accept Calibration” and press Enter
6. On a calibration data sheet in the WQ log book record post calibration data:

- i. Post-Calibration % saturation value
 - ii. Post-Calibration mg/l value
7. Ensure post-calibration value is within DO error check limit
 - i. Compare observed post-calibration value to theoretical value
 1. See DO Table in log book or [USGS Calculator](#)
 2. Record theoretical DO values on calibration data sheet
 - ii. If post-calibration value fails the error check, repeat calibration procedure
 - iii. If the calibration fails again consult the user manual or troubleshooting guide and/or contact MIDN aquatic staff or YSI technical support

Table 2. DO error check limit.

Sensor Check Error Limits		
CORE PARAMETER	Sensor Measurement (NPS acceptance/rejection criteria)	Optimum Goal/Target (Range) (USGS criteria)
Dissolved Oxygen	± 0.4 mg/L, ± 5% saturation	± 0.3 mg/L, ± 5% saturation

2. Conductivity

- (1) Rinse calibration cup and all sensors following rinse procedure (see § III.A. above)

Rinse #	Fluid	Source Container
1	Distilled Water	Gallon Jug
2	Distilled Water	Gallon Jug
3	Distilled Water	Gallon Jug
4	Used Calibration Fluid	Rinse Container
5	Used Calibration Fluid	Rinse Container
6	New Calibration Fluid	New Standard Bottle
Calibrate	New Calibration Fluid	New Standard Bottle

1. Fill calibration cup with the specific conductance standard solution so that the conductivity/temperature probe is completely submerged in the calibration solution

2. Note the standard solution value from the bottle on the calibration data sheet (typically a 1412 $\mu\text{S}/\text{cm}$ standard solution is used for calibration)

(2) Calibrate conductivity sensor

1. Press "Cal" button on ProPlus
2. Highlight "Conductivity" and press Enter
3. Highlight "Sp. Conductance" and press Enter
4. Highlight "SPC- $\mu\text{S}/\text{cm}$ " and press Enter

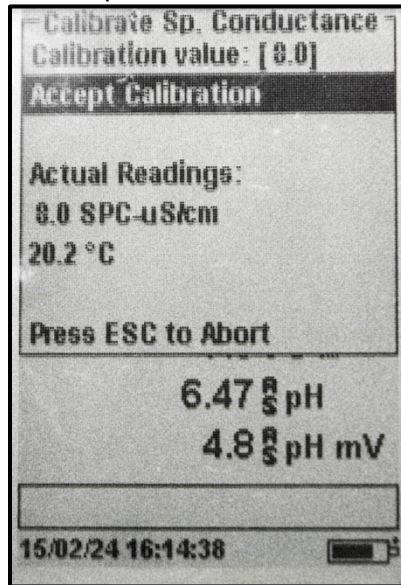


Figure 10. Specific conductance calibration screen.

5. Highlight "Calibration value" and press Enter
6. Use key pad to enter the SpCond standard value printed on the specific conductance standard solution bottle and select Enter from screen
7. Observe onscreen data and wait for conductivity data ($\mu\text{S}/\text{cm}$) to stabilize
 - i. stable reading is where conductivity does not change by 0.1 $\mu\text{S}/\text{cm}$ in 10 seconds
8. On a calibration data sheet in the WQ log book, record:
 - i. Specific Conductance Standard
 - ii. Pre-Calibration value
 - iii. Pre-Calibration temperature
9. Highlight "Accept Calibration" and press Enter
10. On a calibration data sheet in the WQ log book record post calibration data:
 - i. Post-Calibration Specific Conductance value
11. Ensure post-calibration value is within Specific Conductance error check limit
 - i. If post-calibration value fails the error check, repeat calibration procedure
 - ii. If the calibration fails again consult the user manual or troubleshooting guide and/or contact MIDN aquatic staff or YSI technical support

Table 3. Specific conductance error limit.

Sensor Check Error Limits		
CORE PARAMETER	Sensor Measurement (NPS acceptance/rejection criteria)	Optimum Goal/Target (Range) (USGS criteria)
Specific Conductance	$\pm 5 \mu\text{S/cm}$ or $\pm 3\%$ ⁽¹⁾	$\pm 5 \mu\text{S/cm}$ or $\pm 3\%$ ⁽¹⁾

(1) Whichever is greater

3. pH

A three point calibration procedure is used to bracket the expected pH range found in environmental waters. The sensor should be calibrated in order starting with the pH 7, then pH10, and finish with the pH 4. This is a best practice as pH 7 serves as the 0 point for a linearity check and pH 10 is more sensitive to buffer contamination than the pH 4 solution.

(1) Rinse calibration cup and all sensors following rinse procedure (see § III.A. above)

Rinse #	Fluid	Source Container
1	Distilled Water	Gallon Jug
2	Distilled Water	Gallon Jug
3	Distilled Water	Gallon Jug
4	Used Calibration Fluid	Rinse Container
5	Used Calibration Fluid	Rinse Container
6	New Calibration Fluid	New Standard Bottle
Calibrate	New Calibration Fluid	New Standard Bottle

1. Fill calibration cup with enough pH buffer to submerge the pH sensor along with the thermistor
2. Enter the temperature corrected pH value for the **pH 7 buffer** (pH values vary depending on ambient temperatures, temperature corrected values can be found printed on the label of the appropriate buffer solution)

(2) Calibrate pH sensor

1. Press “Cal” button on ProPlus
2. Highlight “ISE1 (pH)” and press Enter

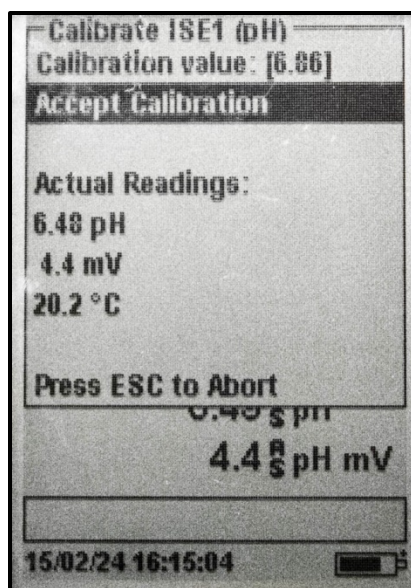


Figure 11. pH calibration screen.

3. Observe onscreen data and wait for pH data to stabilize
 - i. stable reading is where pH does not change by 0.02 pH units in 10 seconds
4. On a calibration data sheet in the WQ log book, record:
 - i. Temperature corrected standard value
 - ii. Pre-Calibration pH value
 - iii. Temperature
 - iv. pH mV
5. Highlight “Accept Calibration” and press Enter

A temporary message will appear at the bottom of the ProPlus screen to alert the user that the ProPlus is ready for the next pH calibration point

6. On a calibration data sheet in the WQ log book, record:
 - i. post calibration value for pH
- (3) Repeat steps (1)-(2) ensuring you complete the full rinse procedure for **pH 10 buffer**
- (4) Repeat steps (1)-(2) ensuring you complete the full rinse procedure for **pH 4 buffer**
- (5) **Press “Cal” button on ProPlus to complete calibration of pH sensor after the third calibration point**
- (6) Ensure post-calibration value is within pH error check limit
 1. If post-calibration value fails the error check, repeat calibration procedure
 2. If the calibration fails again consult the user manual or troubleshooting guide and/or contact MIDN aquatic staff or YSI technical support

Table 4. pH error check limit.

Sensor Check Error Limits		
CORE PARAMETER	Sensor Measurement (NPS acceptance/rejection criteria)	Optimum Goal/Target (Range) (USGS criteria)
pH	± 0.20 S.U.	± 0.20 S.U.

4. Temperature

The thermistor on the YSI sensor cannot be calibrated outside of the factory setting. However, this probe should be checked during each calibration using an alternate NIST-traceable digital thermometer.

- (1) Submerge ProPlus thermistor and alternate thermometer in ambient temperature fluid
- (2) On a **calibration data sheet** (see attached) in the WQ log book, record:
 1. Reference Thermometer Value
 2. ProPlus Thermistor Value
- (3) If sensor check fails, repeat sensor check in alternate fluid
 1. Be sure there is no contact between temperature sensing equipment on container walls, only contact with liquid
- (4) If sensor check continues to fail troubleshoot equipment or replace sensor

Table 5. Temperature error check limit.

Sensor Check Error Limit		
CORE PARAMETER	Sensor Measurement (NPS acceptance/rejection criteria)	Optimum Goal/Target (Range) (USGS criteria)
Temperature	$\pm 0.3^{\circ}\text{C}$	$\pm 0.2^{\circ}\text{C}$

IV. Calibration Check

Following each calibration and **prior to** field sampling, each sensor is checked against known standards for adherence to quality control objectives. Additionally, **after each** field sampling event each sensor is checked again to ensure that the sensors did not drift out of quality control acceptance criteria.

Table 6. Sensor error check limits for water quality parameters.

Sensor Check Error Limits		
CORE PARAMETER	Sensor Measurement (NPS acceptance/rejection criteria)	Optimum Goal/Target (Range) (USGS criteria)
Temperature	$\pm 0.3^{\circ}\text{C}$	$\pm 0.2^{\circ}\text{C}$
Specific Conductance	$\pm 5\ \mu\text{S}/\text{cm}$ or $\pm 3\%$ ⁽¹⁾	$\pm 5\ \mu\text{S}/\text{cm}$ or $\pm 3\%$ ⁽¹⁾
pH	$\pm 0.2\ \text{S.U.}$	$\pm 0.2\ \text{S.U.}$
Dissolved Oxygen	$\pm 0.4\ \text{mg}/\text{L}$, $\pm 5\%$ saturation	$\pm 0.3\ \text{mg}/\text{L}$, $\pm 5\%$ saturation

(1) whichever is greater

1. Dissolved Oxygen

- (1) Create water-saturated air environment:
 1. Triple rinse sensors with distilled or deionized water
 2. Place a small amount of water in the bottom of the calibration cup (several milliliters; water should not contact any sensors)
 3. Ensure there are no water droplets on the DO sensor cap

- i. Water droplets can be dislodged by spraying with rinse bottle or holding sensor bulkhead in your hand and using a flicking motion
4. Engage a couple of threads between the calibration cup and the sonde housing; the atmospheric pressure must be allowed to equalize between the inside of the calibration cup and the ambient environment

***** Do not make an airtight seal between the calibration cup and sonde housing*****
5. Allow water-saturated air environment to stabilize for approximately 15 minutes
 - i. A stable DO reading is one where temperature values do not change more than 0.1 °C and DO values do not change more than 0.01 mg/L within 10 seconds
 - ii. Note time that calibration cup was attached to record on Pre-Sampling data sheet
- (4) Observe onscreen data and allow the dissolved oxygen values to stabilize
- (5) On a Pre(Post)-Sampling data sheet in the WQ log book, record all fields related to DO:
 1. Start time (when sonde entered 100% saturated environment) and time at calibration
 2. Barometric pressure value
 3. Temperature
 4. Observed % Saturation value
- (6) Check observed value against dissolved oxygen sensor check error limits (Table 6)
 1. Compare observed value to theoretical value
 - i. See DO Table in log book or [USGS Calculator](#)
 2. If sensor check fails, repeat entire rinse procedure and repeat sensor check
 3. If this is a pre-deployment check and the sensor continues to fail, repeat calibration procedure.
 4. If the sensor fails again consult the [user manual](#) or [troubleshooting guide](#) and/or contact MIDN aquatic staff or YSI technical support

2. Conductance

(1) Conductivity sensor checks should be performed with either the standard solution which was used to calibrate the sensor (typically 1412 µS/cm) or a lower value which better approximates conditions in environmental waters.

- (1) Rinse calibration cup and all sensors following rinse procedure (see § IV.A.3. above)

Rinse #	Fluid	Source Container
1	Distilled Water	Gallon Jug
2	Distilled Water	Gallon Jug
3	Distilled Water	Gallon Jug
4	Used Calibration Fluid	Rinse Container
5	Used Calibration Fluid	Rinse Container
6	New Calibration Fluid	New Standard Bottle
Calibrate	New Calibration Fluid	New Standard Bottle

- (2) Fill calibration cup with conductivity standard solution to completely submerge the conductivity/thermistor probe
- (3) Observe onscreen data and wait for conductivity data (µS/cm) to stabilize
- (4) On a Pre(Post)-Sampling data sheet in the WQ log book, record:

1. Standard Specific Conductance value
 2. Observed SPC value
 3. Temperature
- (5) Check observed value against Specific Conductance quality control standard to ensure value falls within error limits (Table 6)
1. If sensor check fails, repeat entire rinse procedure and repeat sensor check
 2. If this is a pre-deployment check and the sensor continues to fail, repeat calibration procedure.
 3. If the sensor fails again consult the [user manual](#) or [troubleshooting guide](#) and/or contact MIDN aquatic staff or YSI technical support

3. pH

(1) pH sensor checks should be performed with either the standard solution which was used to calibrate the sensor or an alternate standard solution which better approximates conditions in environmental waters.

(2) Rinse calibration cup and all sensors following rinse procedure (see § IV.A.3. above)

Rinse #	Fluid	Source Container
1	Distilled Water	Gallon Jug
2	Distilled Water	Gallon Jug
3	Distilled Water	Gallon Jug
4	Used Calibration Fluid	Rinse Container
5	Used Calibration Fluid	Rinse Container
6	New Calibration Fluid	New Standard Bottle
Calibrate	New Calibration Fluid	New Standard Bottle

- (3) Fill calibration cup with pH standard to completely submerge the pH/thermistor sensors
- (4) Observe onscreen data and wait for pH data to stabilize
- (5) On a Pre(Post)-Sampling data sheet in the WQ log book, record:
 4. Standard pH value
 5. Observed pH value
 6. Temperature
- (6) Check observed value against pH sensor error limits (Table 6)
 - a. If sensor check fails, repeat entire rinse procedure and repeat sensor check
 - b. If this is a pre-deployment check and the sensor continues to fail, repeat calibration procedure.
 - c. If the sensor fails again consult the [user manual](#) or [troubleshooting guide](#) and/or contact MIDN aquatic staff or YSI technical support

4. Temperature

Check thermistor performance using another NIST-traceable digital thermometer.

- (1) During calibration procedure:
 1. Submerge ProPlus thermistor and alternate thermometer in ambient temperature fluid
 2. On a Pre(Post)-Sampling data sheet (see attached) in the WQ log book, record:

- i. Reference Thermometer Value
 - ii. ProPlus Thermistor Value
- (2) Check observed value against temperature sensor error limits (Table 6)
 1. If sensor check fails, repeat entire rinse procedure and repeat sensor check
 2. If this is a pre-deployment check and the sensor continues to fail, repeat calibration procedure.
 3. If the sensor fails again consult the [user manual](#) or [troubleshooting guide](#) and/or contact MIDN aquatic staff or YSI technical support

4. Barometric Pressure

Barometric pressure should be checked annually at the same time a temperature checks against a locally known, calibrated barometer. This can be found at local airports and through online resources.

V. Obtaining Live Readings

When the YSI ProPlus meter is powered on the main screen displays live reading for each of the sensors which have been enabled.

- (1) Press the Power button on the key pad
 - a. If the batteries were replaced the date and time must be reset before live reading can be observed
- (2) Once the meter boots the “Run” screen will be displayed with all of the enabled sensors displayed

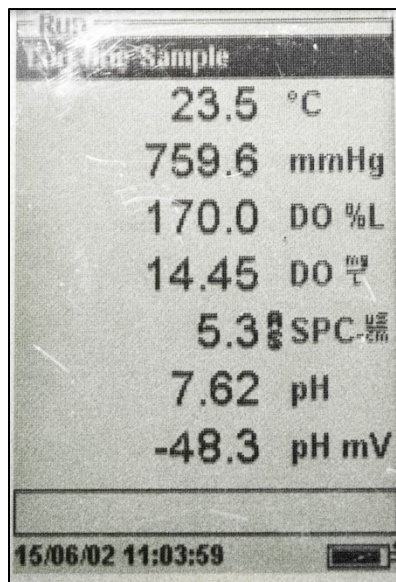


Figure 12. Run screen with live readings.

- (3) Allow the meter to warm up for a period of at least 15 minutes prior to observing any field values

- a. If the meter is powered down accidentally or is off for less than a minute the meter does not need a full 15 minute warm up period
- b. If the meter is powered down for more than a minute then the full warm-up period should occur
 - i. Ensure sensor values have stabilized prior to recording live values (see guidance for sensor stabilization for each parameter in the above sections). Generally, a sensor is considered stabilized when it has not changed more than 1 unit over 10 seconds

VI. Maintenance

YSI ProPlus water quality instruments require periodic maintenance in order to collect high-quality, accurate data. Some sensors require regular maintenance activities while others require no maintenance during the life-span of the sensor. See SOP 1.2 (Acquisition of Supplies, Repair Services, and Maintenance) for guidance regarding replacement sensors and schedules for ordering maintenance supplies.

A. Sensor Maintenance

1. Dissolved Oxygen

The dissolved oxygen sensor consists of a sensor body and membrane cap. The membrane cap surrounds the tip of the sensor body with an electrolyte solution and a Teflon membrane which must be replaced on a regular basis for the sensor to function properly. The membrane cap and electrolyte solution must be replaced approximately every 2nd sampling event (i.e., if a membrane is installed in January it should be replaced again prior to the March sampling event). Membranes should be installed up to 24 hours prior to calibration to ensure proper calibration. Although not required in guidance provided by the manufacturer this is seen as a best practice.

- (1) See guidance provided with membrane replacement kit (YSI #5908)



Figure 13. Membrane replacement kit.

- (2) Unscrew and remove membrane cap from the sensor body and discard the used cap
- (3) Rinse the sensor tip with distilled water
- (4) Fill a new membrane cap with electrolyte solution
 - a. Lightly tap the side of membrane cap and ensure any air bubbles trapped in electrolyte solution are dislodged

*****Electrolyte solution must be free of air bubbles or DO sensor will not calibrate or preform correctly*****

- b. Be careful not to touch Teflon membrane surface during this process
- (5) Thread membrane cap onto sensor body
 - a. a small amount of electrolyte solution should overflow from the threads
- (6) Ensure no air bubbles are trapped between membrane cap and sensor body
- (7) Rinse DO sensor with distilled water
- (8) DO membranes should ideally be allowed to stretch for 4 hours (ideally overnight) after installation to avoid potential calibration errors

2. pH

The pH sensor used in the YSI ProPlus instrument uses a gel based electrolyte solution which becomes depleted over time and requires periodic replacement. The lifespan of the pH sensor is typically 12-18 months. The depletion of the electrolyte is marked by readings becoming unstable in environmental waters (drifting) and larger calibration corrections to the sensor between sampling events. Sensors should be replaced at a minimum of every 18 months and more frequently as sensor performance demands.

- (1) Check pH date stamp code
 - a. Date stamp code is etched on the side of the pH sensor body
 - i. pH sensor codes are stamped with a two digit year and one character month code (e.g., 15A)
- (2) If sensor needs to be replaced follow guidance in ProPlus user manual and/or new sensor package

3. Annual Temperature check

Thermistors accuracy must be validated annually using a NIST calibrated reference thermometer. MIDN maintains a calibrated reference thermometer and will either bring this equipment to park sites or have water quality meters delivered to the MIDN office to perform this sensor check. This check should cover a minimum of two temperatures approximating the natural range found in streams (e.g., water bath stored in chilled refrigerator and ambient room temperature). If sensors do not meet sensor check error limits then the thermistors must be replaced.

B. Storage

1. Short-term storage

Short-term storage procedures should be used if the ProPlus meter is being used at approximately monthly intervals.

- (1) ProPlus meter should be stored in a climate controlled area where it will not be exposed to extreme temperature fluctuations (freezing and excessive heat)
- (2) Sensors should not be allowed to dry out
 - 1. Fill the calibration cup with approximately an 1/8 inch of clean tap water and firmly attach calibration cup to sensor bulkhead

*****The water inside the calibration cup is intended to maintain a 100% humid environment. Direct contact between the water and individual sensor could degrade the sensor performance*****

- (3) Check on ProPlus at two week intervals to ensure there is still adequate water in the calibration cup to maintain a humid environment

2. Long-term storage

Long-term storage should be used if the ProPlus meter is stored for longer than a 1-2 month period.

- (1) Remove batteries
- (2) ProPlus meter should be stored in a climate controlled area where it will not be exposed to extreme temperature fluctuations (freezing and excessive heat)
- (3) Remove pH sensor (see user manual)
 1. Seal port in the cable bulkhead using port plug
 2. Store pH sensor with glass bulb placed in shipping bottle (provided with sensor in its original packaging) with storage solution (e.g., pH 4 buffer solution)
- (4) Remove DO membrane cap and discard
 1. Dry DO sensor housing
- (5) Conductivity sensor requires no special storage
 - (6) Loosely attach a clean, dry calibration cup