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INSTRUMENT OPERATING PROCEDURE

INSTRUMENT:

Multiparameter Water Quality Instrument

MODEL:

- Pro 1020 Meter (6051020)
- Cable (6051020)
- Probes: pH (605101), DO (605203)

MANUFACTURER:

Yellow Springs Instrument Co., Inc. (YSI)

PRECAUTIONS:

POTENTIAL INTERFERENCES

General –

- Greatest accuracy is achieved if the actual samples to be measured are within 10 °C of the calibration solutions.
- Longer cable lengths introduce more error into the readings.

Dissolved oxygen –

- Chlorine, sulfur dioxide, nitric oxide, and nitrous oxide can affect readings by behaving like oxygen at the membrane.
- Static electricity may affect readings.
- Gold Cathode - The gold cathode on the sensor must be textured properly. It may become tarnished or plated with silver after extended periods of use.
- Bubbles under the membrane cap will affect readings.
- Excessive water in calibration/storage sleeve will affect calibration.

pH–

- Do not measure pH in metal containers.
- Water currents in streams can cause unstable readings.
- pH measurements will drift if the sample is not stirred.
- Do not expose the meter or probe to freezing temperatures.
- High humidity and cold temperatures may affect meter operation.
- Be sure that the temperature sensor is immersed in the sample.
- Buffers degrade from exposure to light - change daily

SAFETY

No special precautions

PROCEDURES:

I. Configuration – The YSI Pro 1020 instrument is capable of simultaneous measurement of multiple water chemistry parameters including temperature, pH, and dissolved oxygen.

A. Instrument overview



1. Meter – The YSI Pro 1020 handheld meter includes internal hardware and software for calculation of parameters, a display screen, and a keypad for data entry and screen navigation. The meter includes an internal barometer.
2. Cable – The instrument cable connects the meter to the sensors. The SLCP uses the 6051020 cable with an integrated temperature sensor and two sensor ports.
3. Sensors – two sensors are required to measure all of the water chemistry parameters indicated above. Sensors are installed in the cable bulkhead ports indicated below to ensure proper function. If measurement of one of the parameters is not required, the corresponding sensor(s) may be removed and replaced with a sensor port plug.
 - a. temperature sensor is permanently incorporated into the cable end
 - b. pH sensor (605101) installed in port 1
 - c. polarographic dissolved oxygen sensor (605203) installed in port 2

II. Pro 1020 Key Pad Functions

Key	Description
	Power and Backlight - Press once to turn instrument on. Press a second time to turn backlight on. Press a third time to turn backlight off. Press and hold for 3 seconds to turn instrument off.
	Down Arrow - Use to navigate through menus, to navigate through box options at the bottom of the Run screen and to decrease numerical inputs.
	Enter - Press to confirm selections, including alpha/numeric key selections.
	Up Arrow - Use to navigate through menus, to navigate through box options along the bottom of the Run screen and to increase numerical inputs.
Cal	Calibrate - Press and hold for 3 seconds to calibrate. Opens Calibrate menu from the Run screen.

Menu	Menu - Press to enter the System Setup menu from the Run screen.
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- III. Meter preparation and maintenance
- A. Battery installation and replacement
1. Use a screwdriver to remove the 4 screws securing the battery chamber cover.
 2. Lift off the battery chamber cover.
 3. Install two alkaline C-size batteries according to the inscribed battery symbols on the inside of the battery chamber. Make sure batteries are in correct polarity.
 4. Close the battery chamber cover and secure with the 4 screws.
 5. Press and release the **Power** button (⏻) on the keypad. The LCD will come on; if not, consult the trouble shooting guide in the Pro 1020 User Manual.
 6. Under normal conditions, the average battery life is 425 hours at room temperature without using the back light. A battery symbol will blink in the lower, left corner of the display to indicate low batteries when approximately 1 hour of battery life remains.
- B. Instrument software setup
1. Press the Power key to turn the instrument on. The instrument will briefly display the splash screen with the YSI logo then go directly to the main run screen.
 2. Setup Sensors
 - a. Press *Menu* button.
 - b. **Dissolved oxygen sensor:**
 - 1) Highlight *DO Sensor Type*, Press *enter*.
 - 2) Highlight *Polaro(black)* and press *enter* to confirm.
 - 3) Highlight ESC exit, press enter
 - 4) Highlight *DO Membrane type*, press *enter*.
 - 5) Highlight *1.25 PE Yellow* and press *enter* to confirm.
 - 6) Highlight ESC exit, press enter to return to previous menu
 - 7) Be sure that *Local DO* and *LDS* are not enabled ()
 - c. **pH sensor**
 - 1) Highlight *ISE Sensor Type*, Press *enter*.
 - 2) Highlight *pH* and select it ()
 - 3) Highlight ESC exit, press enter
 - 4) Highlight *ISE Units*, press *enter*
 - 5) Highlight *pH* and select it ()
 - 6) Highlight ESC exit, press enter to return to previous menu
- C. Sensor Installation (This section can be skipped if not installing or replacing any sensors.)
1. Remove/unscrew the metal guard or calibration cup if installed.
 2. Remove the red rubber port caps if the instrument was being stored without sensors installed. Ensure that both the sensor connector and sensor port on the cable are clean and dry and stay that way during this entire procedure.

3. Install the 1001 pH sensor in port 1 as follows:
 - a. If an old sensor is installed, remove it by twisting counter-clockwise.
 - b. Apply a dab of grease to the new sensor o-rings.
 - c. Unscrew the cap from the sensor storage bottle to relieve tension on the o-ring and then remove the bottle. Replace the cap on the storage bottle with the full cap that came with the new sensor to prevent spilling the storage solution. Pat the sensor dry with a kim wipe.
 - d. Push the sensor into the connector on the cable until it is properly seated and only one o-ring is visible. Failure to properly seat the probe may result in damage.
 - e. Twist the sensor clockwise to engage threads and finger tighten. Do not use a tool. This connection is waterproof. Refer to the sensor installation sheet included with each sensor for detailed instructions.

4. Install the 2003 DO sensor in the DO port as follows:
 - a. If an old sensor is installed, remove it by twisting counter-clockwise.
 - b. Apply a dab of grease to the new sensor o-rings.
 - c. Grasp the sensor with one hand and the sensor connection end of the cable (bulkhead) in the other.
 - d. Push the sensor into the connector on the cable until it is properly seated and only one o-ring is visible. Failure to properly seat the probe may result in damage.
 - e. Twist the sensor clockwise to engage threads and finger tighten. Do not use a tool. This connection is waterproof. Refer to the sensor installation sheet included with each sensor for detailed instructions.

5. Install the 2003 DO sensor membrane as follows:
 - a. Change membrane and oxygen probe electrolyte solution every 30 days.
 - b. Remove the metal sensor guard.
 3. If installing a membrane for the first time, remove the protective cap or remove the old membrane cap by unscrewing it with the probe upside down.
 - c. Examine the gold cathode at the tip of the sensor and silver anode along the shaft of the sensor. If either the silver anode is black in color or the gold cathode is dull (tarnished), the sensor needs maintenance or replacement. Refer to the Pro20 Instruction Manual, GENERAL MAINTENANCE, of polarographic sensor (Model # 605203).
 - d. Rinse the sensor with de-ionized water.
 - e. Fill a new membrane cap (5908 Kit - Yellow, 1.25 mil polyethylene) with oxygen probe electrolyte Solution. Do not touch the membrane surface.
 - f. Tap the side of the membrane cap to release air bubbles.
 - g. Thread the membrane cap onto the sensor with the probe upside down.
 - h. Replace the metal sensor guard.

IV. Calibration

- A. **Temperature** – All Pro10 cables have built-in temperature sensors. Temperature calibration is not required nor is it available.

- B. **pH** - The Pro10 pH sensors can be calibrated by performing a 1, 2 or 3-point calibration. A minimum of 2 point calibration is required for quality assurance purposes in the SLCP.

At least one of the calibration points must be done with pH 7 buffer. For auto buffer recognition to work properly with an older or dirty sensor, calibrate in pH 7 buffer first. For highest accuracy, use fresh, traceable pH buffers and ensure the sensor and calibration cup are clean. Most applications in the SLCP use a two point calibration:

1. Place the sensor in pH 7 buffer and allow the temperature and pH readings to stabilize for at least 5 minutes.
2. Press and hold Cal for three seconds.
3. Highlight pH and press enter. If pH is not listed as an option, check the System Setup menu to ensure pH is enabled in the ISE Sensor Type menu.
4. Highlight 2 point and press enter.
5. If necessary, use the up and down arrow keys to adjust the pH buffer value. Note the pH mV reading which ideally should be between -50 and +50 in pH 7 buffer. If the pH mV reading is outside of this range, clean the sensor as described in the maintenance section of this protocol.
6. Press enter to continue to second point.
7. Rinse the sensor and place it in the second pH buffer (4 for alkalinity measurements or 10 for stream pH measurements).
8. If necessary, use the up and down arrow keys to adjust the pH buffer value.
9. Wait at least 5 minutes for the pH sensor to stabilize and for the temperature reading to stabilize. Note the pH mV reading. pH mVs in buffer 4 should be +159 to 180 mV from the previous buffer 7 pH mV value. pH mVs in buffer 10 should be -159 to 180 mV from the previous buffer 7 pH mV value. If the mV readings are outside of these ranges, clean the sensor as described in the maintenance section of this protocol.
10. Press enter to complete the calibration or press Cal to cancel.
11. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
12. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting section of this manual for possible solutions.

C. DO sensor calibration

1. The supplied sensor storage container (a clear sleeve) can be used for DO calibration purposes. Moisten the sponge in the storage sleeve or plastic cup with a small amount of clean water. The sponge should be clean since bacterial growth may consume oxygen and interfere with the calibration. If using the cup and you no longer have the sponge, place a small amount of clean water (1/8 inch) in the sleeve instead. Make sure there are no water droplets on the DO membrane or temperature sensor. Then install the storage sleeve over the sensors, but do not screw on completely. Leaving 2-3 threads disengaged ensures venting to the atmosphere. Make sure that DO and temperature sensors are not immersed in water.
2. Turn the instrument on and wait 15 minutes for the storage container to become

completely saturated and to allow the sensors to stabilize.

3. Press and hold **Cal** for 3 seconds. Highlight **Dissolved Oxygen** and press enter to confirm.
4. The meter will indicate *Calibrating %DO* on the display
5. The instrument will use the internal barometer during calibration and will display this value in the bar at the bottom of the display.
6. Calibration Successful will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
7. If the Calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the error message and to return to the Run screen. See Troubleshooting section of the user manual for possible solutions.

VII. Measurements

- A. Ensure the cable and sensors are tightly connected to the meter.
- B. Be sure the meter has been calibrated.
- C. Place the sensors in the sample to be measured.
- D. Shake the probe in the sample to release air bubbles.
- E. Allow temperature reading to stabilize.
- F. Stir the sample water with the probe at a moderate pace. You must provide 6 inches of water movement per second across the DO sensor membrane to obtain an accurate reading. Be careful not to create a vortex which allows air bubbles to pass against the DO membrane.
- G. After at least 5 minutes and once the values stabilize, record the measurement.

IIIX. Sensor storage

A. Short term storage

The cable assembly is supplied with a sensor storage container, or sleeve, that attaches to the cable. The container is used for short-term storage (less than 7 days). Be sure to keep a small amount of moisture (tap water) in the container during storage. This is done to maintain a 100% saturated air environment which is ideal for short-term sensor storage. The sensors should not be submersed in water. The intent is to create a humid air storage environment.

B. Long term storage

1. Dissolved oxygen sensor - Dissolved oxygen sensors should be stored in a dry state for long term storage. First, remove the membrane cap and thoroughly rinse the sensor with clean water. Next, either blow it dry with compressed air or allow to air dry completely. Install a clean, dry new membrane cap over the sensor to keep it dry and to protect the electrodes. After storing the sensor for a long period of time, it is necessary to “condition” the sensor by putting a new membrane with electrolyte solution on the sensor and then turning the instrument on to allow the sensor sufficient time to stabilize.

2. pH sensor - The key to pH sensor storage, short or long-term, is to make certain that the sensor does not dry out. Sensors which have been allowed to dry out due to improper storage procedures may be irreparably damaged by the dehydration and will require replacement. You can try to rehydrate the sensor by soaking it (preferably overnight) in a potassium chloride solution or a pH 4 buffer before attempting to calibrate. To store the sensor, remove it from the cable and seal the vacant port with a port plug. Fill the original shipping/storage vessel (plastic boot or bottle) with buffer 4 solution and then submerge the sensor into the solution. The sensor should remain submerged in the solution during the storage period; therefore, make certain that the vessel is sealed to prevent evaporation and periodically check the vessel to ensure the sensor does not dry out.

MAINTENANCE:

- I. Routine cleaning of pH sensor at the end of each treatment session or when pH response is slow
 - A. Use clean water and a soft clean cloth, lens cleaning tissue, or cotton swab to remove all foreign material from the glass bulb or platinum button. Then use a moistened cotton swab to carefully remove any material that may be blocking the reference electrode junction of the sensor.
 - B. Soak the sensor for 10-15 minutes in clean water (Not DI water. Soaking in DI water will shorten the life span of the probe) containing a few drops of commercial dish washing liquid. Gently clean the glass bulb and platinum button by rubbing with a cotton swab soaked in the cleaning solution. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then re-rinse with clean water.
- II. Additional cleaning when good pH response is not restored using Step I
 - A. Soak the sensor for 30-60 minutes in one molar hydrochloric acid. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then re-rinse with clean water. To be certain all traces of acid are removed, soak the sensor in clean water (Not DI water. Soaking in DI water will shorten the life span of the probe) for about an hour with occasional stirring.
 - B. If biological contamination of the reference junction is suspected or good response is not restored, soak the sensor for approximately 1 hour in a 1:1 dilution of household chlorine bleach. Rinse the sensor with clean water and then soak for at least 1 hour (more if possible) in clean water (Not DI water. Soaking in DI water will shorten the life span of the probe) with occasional stirring to remove residual bleach from the junction. Then re-rinse the sensor with clean water and retest.
- III. For additional troubleshooting, see user manual.

REFERENCE:

User Manual for YSI Pro 1020
Quick Start Guide for YSI Pro 1020
Calibration Tips for YSI Professional Plus Multiparameter Water Quality Meter

This procedure has been reviewed and approved by the undersigned representatives of the U.S. Fish and Wildlife Service and Fisheries and Oceans Canada.

REVIEWED/APPROVED _____ DATE _____
Field Supervisor (U.S.)

REVIEWED/APPROVED Julie Skewis DATE 05 MAR 2020
Program Manager (Canada)