1.   **Procedure summary**

This procedure describes how to calibrate a PLC pH probe and adjust set points.

Related Procedures

Lock Out Tag Out Policy
Paddlewheel Operation   CB-04-004-002
                                                                                                                          CB-03-006-001

Procedure impacts and concerns

Safety	Standard PPE required plus Nitrile Gloves. Lock out tag out policy must be followed when crossing guard rails at ponds. Ensure paddlewheel is switched OFF and Locked out at pond disconnect prior to beginning procedure. Follow LOTO policy.
Quality	The PLC probe and set points control CO_2 flow into the ponds. CO_2 is necessary to maintain the appropriate pH range in the pond. If the PLC probe is not calibrated and/or the set points are incorrect, the CO_2 will not flow into the pond when necessary and the culture health will be impacted with the potential to decrease productivity.
Delivery	N/A
Environmental	N/A
Cost	N/A
Compliance	Compliance with OSHA's Hazardous Waste Operations and Response, and Hazardous Communication Standard in addition to the Sapphire Energy, Inc. Chemical Hygiene Plan is required where applicable. See 29 CFR 1910.120 and 1200. An AUL list, MSDSs and label information will be available for easy reference in a binder in the administration building.

Responsibilities and owners

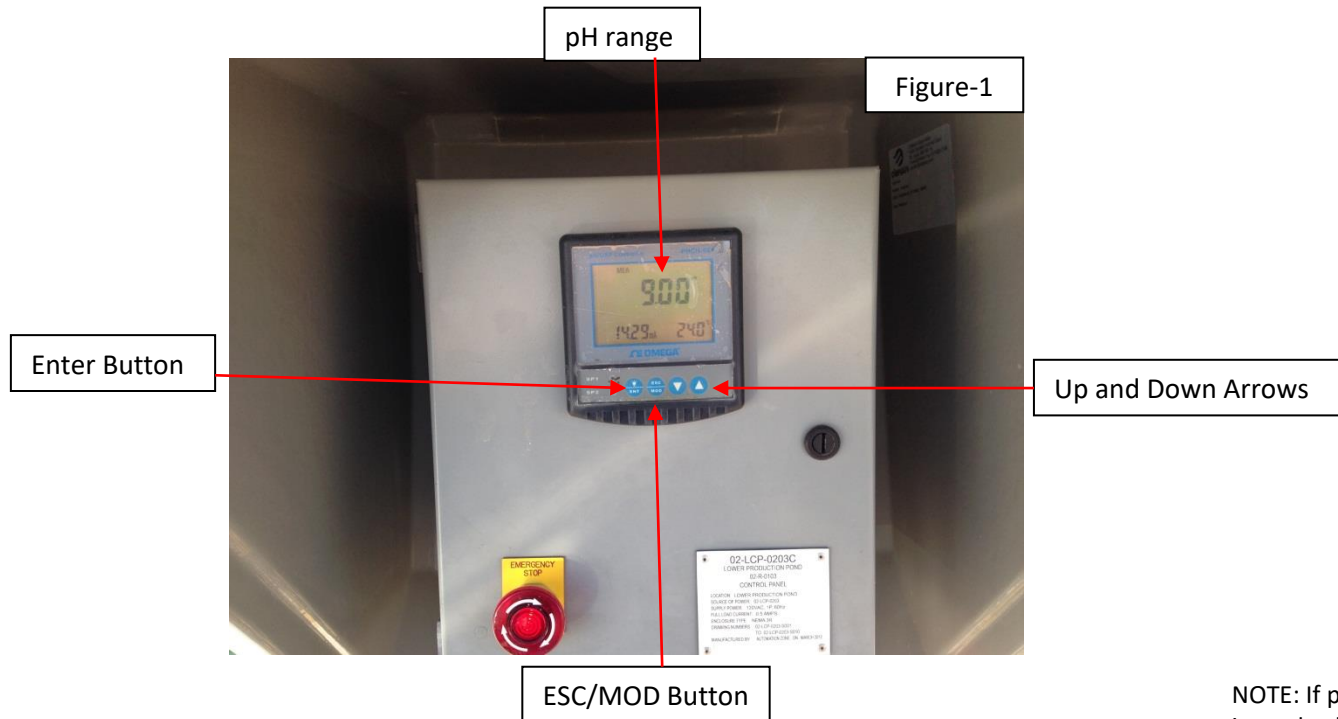|		
Document Owner	Manage content and distribution	Miguel Montoya
Process Owner	Responsible for content and process validation	Dhawal Dhonde
Site Manager	Responsible for implementation and conformance	Dhawal Dhonde

2.   **Process**

Process description

This procedure describes how to calibrate a PLC pH probe, adjust PLC set points and verify pH with handheld probe. PLC pH probe must be calibrated when the PLC reading differs from the handheld reading by 0.2 pH points or more. Two people are required to calibrate PLC's while in the field. The set points must be adjusted according to the operating rage of the algae strain (i.e. 9.8-10.2 for Apollo, 8.8-9.2 for SE0107 and 7.8-8.2 for Nanno 90009).

Process diagram: Work Instruction

Process steps
Before Leaving office handheld pH probes must be calibrated in the lab to ensure there is no temperature interference with calibration
* Remember to take sampling kit to field. Sampling kit is located in designated area in break room.
*Obtain new buffer solution from QA/QC lab, will need buffer solution 7 and 10 for the field.
*Make sure that new pH probe is good and not broken before taking it out in the field.

Note: If buffer solutions look dirty

pH range

Figure-1

Enter Button

Up and Down Arrows

ESC/MOD Button

NOTE: If pH probe is not broken there is no need to replace with new pH probe.

2.3.1. PLC pH probe calibration *Paddlewheel must be OFF and LOCKED OUT before beginning

    2.3.1.1. Press <u>ESC/MOD</u> button once to get to <u>CAL CODE</u> screen.   See Figure-2

    2.3.1.2. Use up arrow (▲) button to scroll to code number <u>28.</u>

Figure-2

Cal Code 28
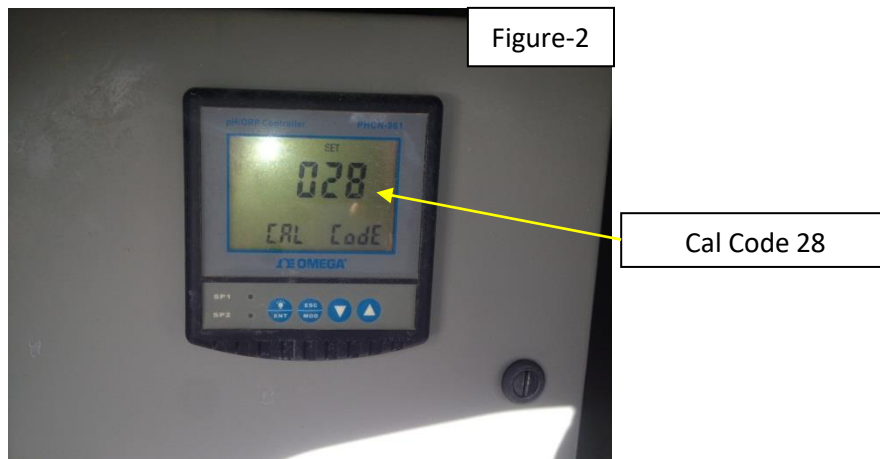
    2.3.1.3. Press 🖫/ENT button once to accept and get to <u>CAL pH</u> screen.

    2.3.1.4. Press 🖫/ENT button twice to get to buffer screen. See Figure-3.
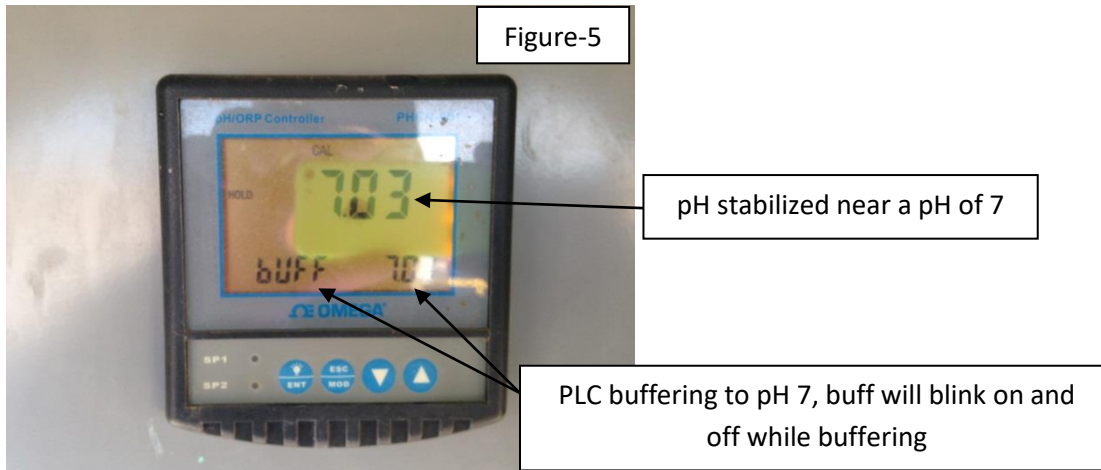
Figure- 3

2.3.1.5. Enter pond
2.3.1.6. Submerge pH probe in pH 7 buffer. See Figure-4. (Can only do a 2 point calibration low to high)


Figure-4

2.3.1.6.1 Watch PLC screen until pH on PLC stabilizes on one number for 30 seconds. See Figure-5 for example.

Figure-5

pH stabilized near a pH of 7

PLC buffering to pH 7, buff will blink on and off while buffering

2.3.1.6.2 After pH has stabilized hit enter on PLC. See Figure-5

Note: If PLC's screen indicates an error on left side of screen (ERR), start troubleshooting alternate problems. For instance pH probe cracked or bad connection from PLC to pH probe. If connection is bad from PLC to probe PLC pH will not stabilize. If probe is cracked will not buffer to correct pH. See Figure-6 for illustration of ERR on PLC

Figure-6

ERR is indicated

Wrong pH
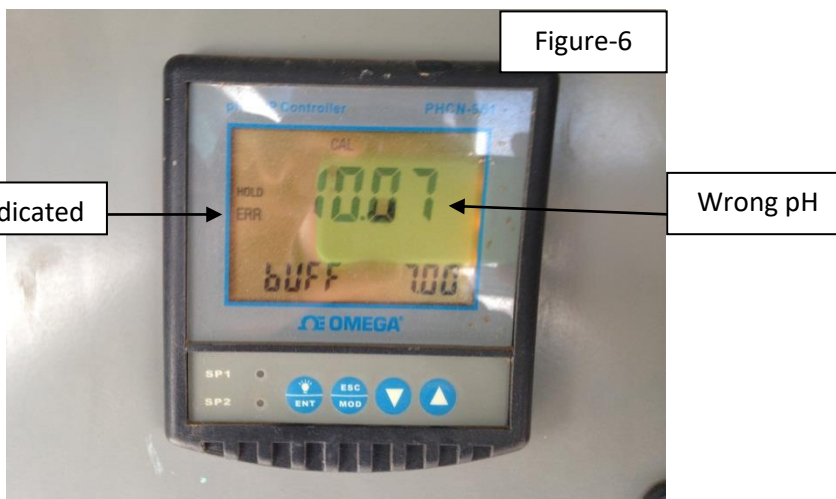
2.3.1.6.3 Submit a facilities ticket if error continues to occur after probe and connection are checked.

2.3.1.6.4 If error doesn't occur take pH probe out of buffer 7 solution and wash with DI water. (Note: DI water is located in sampling kit.) The screen on PLC will change. See Figure-7 below. Bottom of screen will be modified and will read "buff 1.68 when PLC has buffered to pH 7"
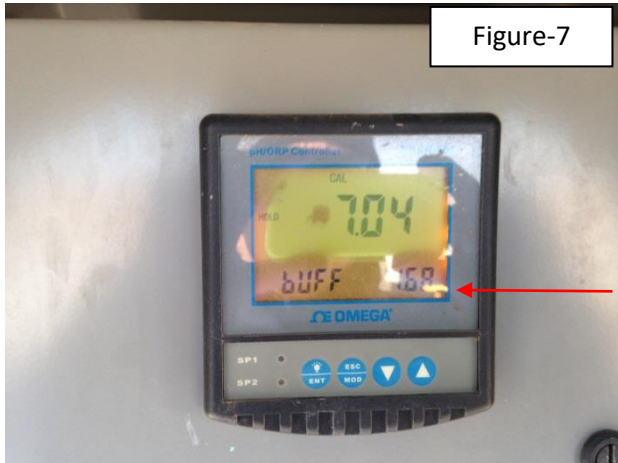
Figure-7

Note: buff 1.68 will appear on bottom of PLC
when PLC has buffered to pH7

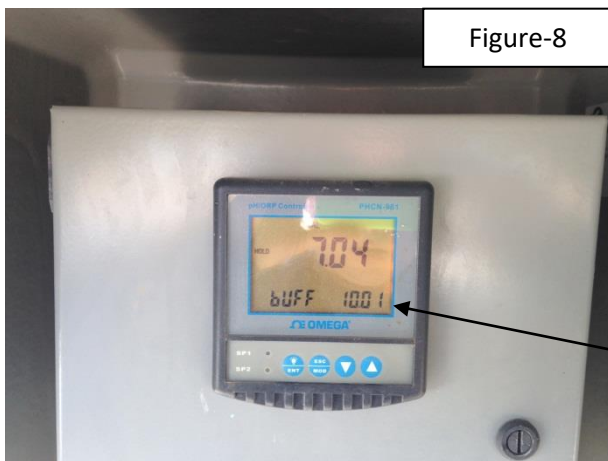2.3.1.7. Use up and down arrows on PLC to select pH 10 buffer. See Figure-8 below

Figure-8

Note: Screen reads buff 10

2.3.1.8. Submerge pH probe in pH 10 buffer. See Figure-9 below.

Figure-9

2.3.1.8.1 Watch PLC screen until pH on PLC stabilizes. Must stay on one number for 30 seconds.

2.3.1.8.2 After pH has stabilized hit enter on PLC. Figure-10 below demonstrates PLC calibrating to buffer 10. If PLC's screen indicates an error (ERR), start troubleshooting alternate problems. See Note on 2.3.1.6.2 for corrective action. See Figure-6 for ERR illustration.
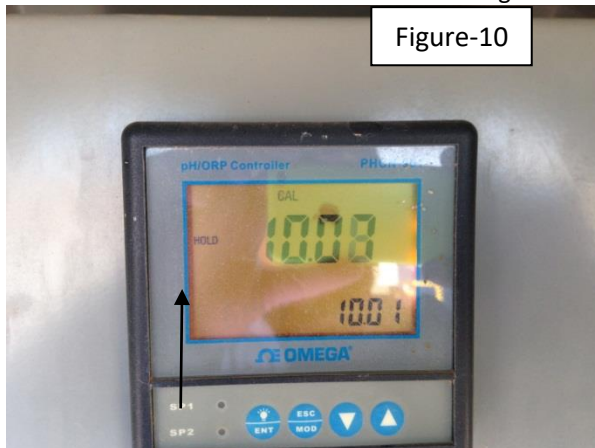
Figure-10

Note: buff is not seen on lower left hand corner of screen because picture was taken while PLC was buffering. buff blinks on and off till PLC calibrates to specific pH

2.3.1.8.3 If error doesn't appear on PLC screen, screen will read "Slope" after PLC has buffered to pH 10. See Figure-11.
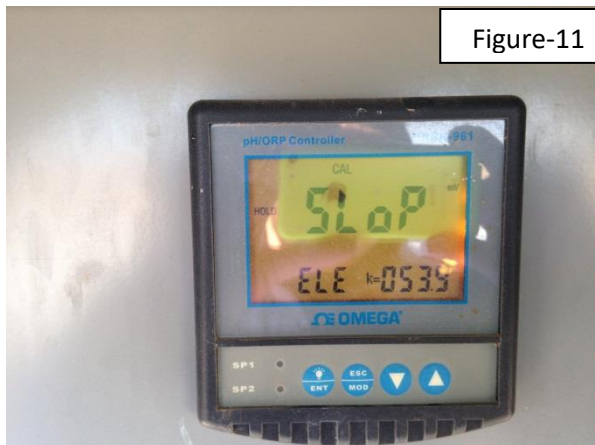
Figure-11

2.3.1.9. Press ESC/MOD to return to main screen. Solenoid near PLC should click on and CO2 to pond should be flowing. CO2 Bubbles will be visible on surface of water where sump is located.

2.3.1.10 Take probe out of buffer 10 solution and wash with DI water and reinsert into pond in designated probe location. Note: Solenoid will turn off and bubbles will

no longer be visible in pond once probe is reinserted into pond

2.3.1.11. Verify calibration with handheld probe.

      2.3.1.11.1 Enter pond

      2.3.1.11.2 Submerge pH handheld probe into pond near PLC probe. See Figure-12 for location.
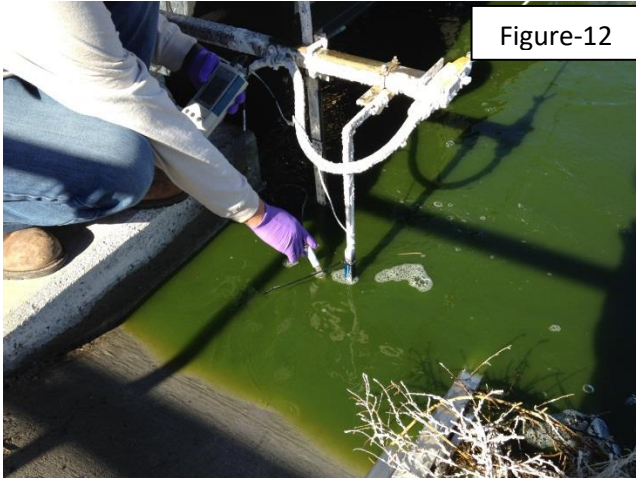

Figure-12

      2.3.1.11.3 After Handheld pH meter has stabilized, pH on PLC should not differ from the handheld reading by 0.2 pH points or more. If it does differ by .2 or more repeat all steps above once more.

      2.3.1.11.4 If calibration cannot be verified with handheld pH meter, submit a facilities ticket.

2.3.1.12. Unlock Paddlewheel and turn ON.

Set point adjustment does not require paddlewheel lock out

2.3.2. PLC set point adjustment

      2.3.2.1. Press ESC/MOD button twice to get to <u>SET CODE</u> screen.
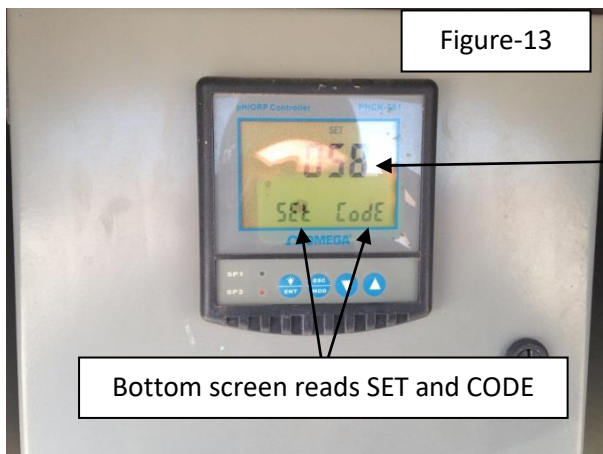

Figure-13

Screen reads 058

Bottom screen reads SET and CODE

      2.3.2.2. Use up arrow (▲) button to scroll to code number 58. See Figure-13 above.

      2.3.2.3. Press ☞ /ENT button once to accept.

2.3.2.4. Use up arrow (▲) button to scroll to code P05. See Figure-14 for an example of PLC screen when at P05.

Figure-14

2.3.2.5. Press ☞/ENT button once to accept.

2.3.2.6. Use up (▲) and down (▼) arrows to select HI. See Figure-15 for illustration of PLC
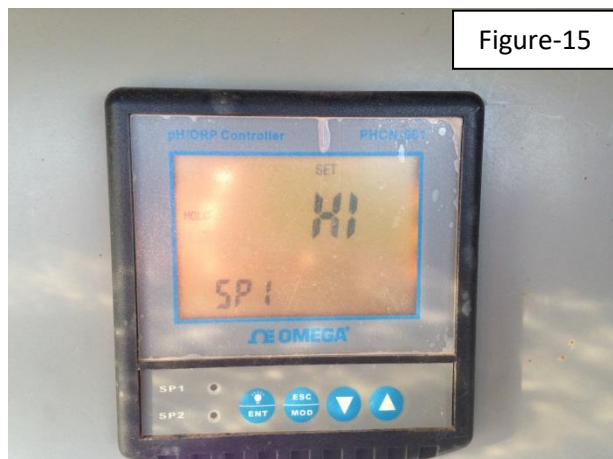

Figure-15

2.3.2.7. Press ☞/ENT to accept.

2.3.2.8. Use up (▲) and down (▼) arrows to set upper pH limit. See Figure-16. (Varies depending on algae strain. Ex. 9.20 for SE0107 and SE70181, 10.2 for Apollo).
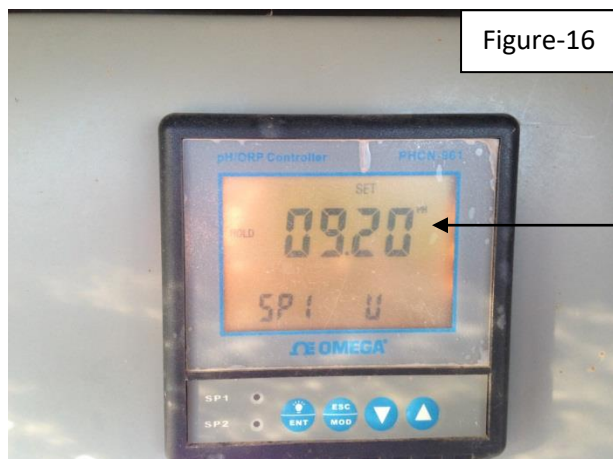
Figure-16

Set Points for SE0107 and SE7181 pH high 9.20

2.3.2.9. Press ☞/ENT to accept.

2.3.2.10. Use up (▲) and down (▼) arrows to set difference point to 0.40.   See Figure-17 for photo of PLC.

Figure-17

2.3.2.11. Press ☞/ENT to accept.

2.3.2.12. Press ESC/MOD to return to main screen.

3. Required documents

Input documents
Daily Data

Output documents
Production Log

4. Document control

Revision history

R0 – Initial Release – Adriana Rascon	11/14/2012
R1 – Adriana Rascon	03/03/2013

| R2- Miguel Montoya | 01/06/2014 |

Document approval

Document reviewers

5. **Risk analysis**