Instructions for operating water clarity sensor

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The following instructions explain how to do an inspection of the sensor, clean the lenses, download data from the SD card, and then reset the sensor.

Definitions:

* Sensor board: the green PCB that the Adafruit is mounted on
* Sensor housing: the grey plastic enclosure with solar panel on
* Sensor head: the part of the sensor under the water that contains the LEDs and photodetectors
* Adafruit feather stack: the black microprocessers that contain the real time clock, LoRa radio and SD card and that the USB connects to to load code
* Arduino IDE: the software that operates the code, and reports data in real time back to the computer via the Serial Monitor (press Ctrl-Shift-M while the IDE is open)

1. When arriving at the site, the time should be noted and a photo taken of the sensor (as close to the sensor as possible without stirring up any sediment.
2. Open the sensor housing with a screwdriver or similar.
3. Connect computer to Adafruit feather via USB cable. Open Arduino IDE and press Ctrl-Shift-M to open the Serial Monitor. Sensor will output information on its operation to the computer
4. If the sensor is performing a measurement (red LED will be on for 6 seconds, off for 2 seconds for a total of 8 measurements), leave sensor to finish measurement.
5. Once sensor is finished taking measurement and goes to sleep, or if it is in sleep mode already (one brief flash every 5 seconds), press the red button and hold until the board wakes up (max 6 seconds). With the serial monitor open, the sensor will report some information, including the site name, time and date and version number. Make a note of the code version in case you have to reload code later.
6. Disconnect USB cable
7. Pull the Adafruit feather stack off the PCB. You should have in your hand the two micro boards, keep these joined together.
8. Remove SD card from the bottom micro by pushing on the card.
9. Insert SD card into card reader / laptop. Open file folder, there should be three files: CalData, CalLog and LogData. Copy the LogData file to your local drive and then close the file folder.
10. Safely eject the SD card using the computer toolbar command.
11. Reinsert SD card into the Adafruit.
12. While Adafruit is not connected to anything, clean the sensor head
13. To clean the sensor head, remove it from the water by loosening the hose clamps on the sunlight shield mount and sliding the sensor head out
14. Take photo of lenses while dirty
15. Using a cotton swab, paper towel or cleaning cloth, splash water onto the sensor head and wipe the lenses clean
16. Take photo of lenses once cleaned.
17. Slide sensor head back into sunlight shield and tighten the hose clamps. Sensor should be in exactly the same position as before it was removed, ensure that pressure sensor is facing downwards
18. Reconnect computer to the Adafruit by plugging in USV cable (don’t plug Adafruit back into sensor board yet)
19. Adafruit will start once power is provided via the USB
20. With the Arduino IDE serial monitor open, watch the information coming back from the sensor. It will report if the LoRa and SD card have been successfully started. If SD is not recognised, disconnect the USB, remove and then reinsert the SD card. This may need to be done several times and the SD card may need to be reinserted into the computer and then safely ejected to ensure correct operation (step 9).
21. If SD card and LoRa successfully start, then note the time that is reported from the sensor. If this does not match the computer time (it probably won’t), reupload the code from the Arduino IDE (right facing arrow at top left).
22. Once code is reuploaded, check that Adafruit time and date match the computer. If it does then Adafruit is ok to be reinserted into the sensor board. USB should be kept connected to the Adafruit until it is reinserted to keep power supply. When the Adafruit is successfully reinserted, a yellow LED will turn on on the Adafruit.
23. Disconnect USB and close up sensor housing
24. All done!

The following instructions set out how to calibrate the sensor. Calibrations should be conducted every 3 months

1. Get a bucket (minimum 10 litres) of clean tap water. Bucket should be cleaned before use and preferably will be black in colour with a lid to prevent as much ambient light as possible.
2. Ensure sensor head is clean and inside sunlight shield, and then put it into the bucket. Cover the bucket with a lid and/or towel to reduce ambient light as much as possible. If doing outside, make sure the bucket is out of direct light.
3. Connect sensor to computer using USB cable.
4. Open Adafruit IDE and Serial Monitor (Ctrl-Shift-M)
5. After the sensor wakes up from sleep, and before it undertakes a measurement, a prompt will appear on the Serial Monitor to do a calibration and it will countdown for 5 seconds. The red LED will flash at one second intervals while this happens.
6. Press the Red button while the countdown is happening.
7. Sensor will automatically do the calibration on all four channels. This may take around 10 – 15 minutes.
8. Sensor will calibrate each channel to an estimated 12 meters of water clarity. The ALS count for each channel will be slightly different.
9. At the end of the calibration process, the sensor will report the ALS count that each path of the sensor has calibrated to. This will be reported in a table and show how close each path is to the ideal 12m value. A warning will prompt if any path is more than 10 counts (1%) that the calibration should be redone.
   1. If a re-calibration is needed, press the reset button on the micro (small black button on the top of the Adafruit). Upload the code again (step 22 from the inspection and download instructions) so that the sensor time and date is correct, as the reset button will reset the time and date to when the Adafruit last had code loaded. After this, wait for the calibration prompt and press the red button again.
   2. If the ALS count readings look good, then nothing more is required. Unit will be calibrated

NOTE: if the sensor temperature is more than 3 or 4 degrees different from the water into which it has been placed, then as the sensor temperature changes it will affect the operation of the LED’s and photodetectors. This may cause large swings in path readings after the calibration process. As the sensor hardware (LED’s) can change brightness with even small temperature changes, this can cause erroneous clarity estimates. The tap water used for calibration should therefore be at a similar temperature to what the sensor will be put in to minimise these errors. Tap water can have ice or hot water added to adjust the temperature as needed.