

Lab Assignment 3. Setting Up A Weather Station

Objective: Program a CR510 datalogger to record observations of wind, moisture, and temperature. Set up the weather station outdoors taking into consideration site and representativeness issues.

Before the Lab Session. YOU MUST TURN YOUR ANSWERS IN TO QUESTIONS 1-8 AT THE BEGINNING OF THE LAB OR YOU WILL NOT BE ALLOWED TO START!!!

1. Refer to the text and read through Section 1 only of the manual about tripod installation:
<http://www.campbellsci.com/documents/manuals/tripod.pdf>.
2. *Question 1.* What are some of the general guidelines for siting discussed in the manual and text?
3. *Question 2.* What are some of the specific guidelines for siting for temperature and relative humidity sensors? What is the recommended height range according to the American Association for State Climatologists (AASC)?
4. *Question 3.* What are some of the specific guidelines for siting for wind sensors? What is the recommended height range according to the American Association for State Climatologists (AASC)?
5. *Question 4.* Use the following web page and the zip code of the University (84105) to determine the magnetic declination here. <http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp> Determine the direction of true north as read by a compass

Declination	Compass Direction for True North

6. *Question 5.* You will be using the CS500 temperature and humidity sensor. It is actually the Vaisala HMP50 sensor, but the wires are colored differently from the HMP50 so be careful to stick to the description and programming for the CS500. Read through the manual:
<http://www.campbellsci.com/documents/manuals/cs500.pdf>. Based on the manual AND the internet (I couldn't find the temperature sensor time response in the manual(s)), complete the following table.

Temp Accuracy 0C	Temp Accuracy 20C	Temp Response time(sec)	RH Accuracy 10-90%	RH Accuracy 0-100%	RH Response Time (sec)

7. *Question 6.* How does the accuracy and time response of the sensors compare to the CS215 temperature and relative humidity sensor used in Lab 2? Would you be more likely to want to use the CS500 mounted on an unmanned plane than the CS215?
8. You will be using the R.M. Young wind sentry anemometer and vane. Read through the manual:
<http://www.campbellsci.com/documents/manuals/03001.pdf> Our wind sentry's are old, so the wiring is different from the manual. See below.
9. *Question 7.* How is wind speed measured? What does the distance constant mean and what is it for the wind sentry? The cups are spinning at a speed of 10 m/s and then you grab them so they no longer spin. How long before the wind speed is 3.7 m/s according to the sensor?
10. *Question 8.* Refer to Appendix B of the manual. How is wind direction measured? Important: the CR510 uses Edlog not CRBasic. So, we are using the EX-DEL-SE command described in Appendix B. The applied excitation voltage is 2500 mv. What is the voltage measured when the wind is from the south?
11. Scout out a location to the east of WBB to set up your weather station. It doesn't need to be a perfect site.

1. Equipment List. You will check out, be responsible for, and return the following:

- a. Laptop
- b. Tripod
- c. Waterproof enclosure
- d. Battery with cable
- e. CR510 datalogger
- f. CS500 temperature and relative humidity sensor
- g. 03001 R.M. Young Wind Sentry anemometer and vane set
- h. 41301 Radiation shield
- i. USB to serial cable adapter
- j. Serial cable and SC32B optical isolator
- k. Level
- l. Small Straight and Phillips screwdriver
- m. R.M. Young baggy with tiny allen wrench

You will share the following and make sure they are returned:

- n. Two Large straight screwdrivers
- o. Two compasses
- p. CR10KD keypad display
- q. Voltmeter
- r. Tape measure

2. Setting up the Logger and Sensors in the Lab

- a. You will need to use a large straight screwdriver to remove carefully the plug in the exterior of the enclosure. NO excessive prying should be necessary.
- b. Check battery voltage. Place battery in enclosure. You will not be mounting the enclosure to the tripod, so keep the door of the enclosure on the upside, and place the battery in the enclosure. Place CR510 in bottom of enclosure near the opening on the bottom. Plug green battery cable plug into CR510.
- c. Attach optical isolator to datalogger. Attach serial cable to optical isolator through hole in bottom of enclosure. Attach USB to serial connector cable to computer.
- d. Reboot the laptop. Use your folder on the netbook. Desktop using your team number (M-T, tables 1-4), e.g., M_1, etc.
- e. Click on LoggerNet and select "Setup" from the "Main" menu. You should be in the EZ View. If you see a CR1000 or CR510 (which you will once someone does the assignment), click on any and delete.
- f. Add a CR510 data logger. You should see DataLogger Name "CR510".
- g. Select "Direct Connect" Connection Type. Be sure the serial cable is connected from the netbook to the CS-IO port on the logger via the optical isolater. Option should be serial port "COM3" or whatever is appropriate for the USB-serial cable.
- h. Leave Datalogger settings alone. Test Communications. If you do not get to the DataLogger Clock option, then something is haywire. Reset the clock. Don't send program, select Finish.

3. Creating a Program and Sending it to the Datalogger. Select Short Cut under Program

- a. Step 1. Select New Program
 - i. Datalogger model (CR510)
 - ii. Scan interval (10 sec)
- b. Step 2. Sensors
 - i. Leave Default measurement of battery voltage (BattV)

ATMOS 5910-2/6910-1 Environmental Instrumentation. Spring 2010

- ii. Add from Meteorological sensors- category Relative Humidity and Temperature. Select Campbell CS500. Click red arrow and should have on right side: AirTC and RH
 - iii. Thread wires through hole in bottom of enclosure. Follow instructions from wiring diagram. You can double up grounds in the same slots.
 - iv. Add from Meteorological sensors- category wind speed and direction. Select 03001 which will bring up the R.M.Young wind sentry. Thread wires through hole in bottom of enclosure. BUT: BLACK wire goes in G or AG and is white in the wiring diagram; GREEN wire goes in E1 and is black in the wiring diagram; RED wire goes in 2H and is red in the wiring diagram; WHITE wire goes in P1 and is black in wiring diagram; BROWN wire goes in G and is white in the wiring diagram.
- c. Step 3. Output
- i. Store every 1 minute. Note that the ARRAY ID is 101.
 - ii. Select average for airTC, sample for RH, average for wind speed, and sample for wind direction
 - iii. Save program to your Team's Desktop folder. YourName_Lab3. You will see files with a csw, fsl, and dld suffix. Do not send the program to the Datalogger yet.
- d. Step 4. Exit out of Short Cut and select the Edlog Editor from the Program Menu
- i. Select Document DLD file. It will pop a window labeled noname.csi. Save the csi file to your folder and call it YourName_Lab3.csi. go ahead and compile the program to see if there are any errors.
 - ii. Scroll through the csi file to see the types of commands used in Edlog. In some respects, it is easier to follow compared to CRBasic but it requires more commands to complete tasks.
 - iii. Also select the FSL Edit option. The Final Storage Label Editor translates storage locations to defined variables.
 - iv. In Loggernet, go to the connect screen, connect, and send your compiled program (the DLD file).
- e. Step 5. Collection and viewing the data in the lab
- i. Select the Custom option and under file mode select overwrite existing file. Select final storage area 1 checkbox. Select the ... and create an output file in your Desktop folder. Then select collect.
 - ii. Now go under Data in Loggernet and select ViewPro.
 - iii. Open the file with a data suffix. It will ask you to associate a FSL file to it. Do so. Your FSL file should be in the same directory.
 - iv. You should now see some data in a text file.
 - v. Highlight the AIRTC column and then select NewLineGraph. You should see your data plotted. Play around briefly with the output options.
- f. Step 6. Setting up outside
- i. Disconnect laptop from CR510. Disconnect battery from CR510. DO NOT DISCONNECT SENSOR WIRES. CAREFULLY carry everything outside to your preferred location. Use common sense, don't set the laptop in the snow.
 - ii. Slide radiation shield onto mast.
 - iii. Slide wind sentry onto top of mast.
 - iv. Set up tripod. Level. Move mast until wind vane cone is facing true north according to the compass. Move radiation shield around until it is on the north side of the mast.
 - v. Plug battery into CR510. Attach serial cable to laptop.
 - vi. Collect data for ~15-30 minutes.
 - vii. Be sure to download the data before disconnecting power to the battery.
 - viii. Disassemble, carry back to lab, and check back in ALL equipment.

4. Synthesizing Questions

- a. *Question 9.* You should have data both from in the lab and from outside. Chop the data file so that you only have observations from outside. Create a table of temperature, relative humidity, wind speed and direction for every minute outside.
- b. *Question 10.* Plot a time series of temperature and relative humidity with temperature on the left axis and relative humidity on the right. The temperature range and spacing of values should make it easy to read but the relative humidity should be on a scale from 0-100%.
- c. *Question 11.* Plot a time series of wind speed and direction as vectors with a north wind pointing down the page. The scale should be set so that any differences in wind speed or direction can be apparent.
- d. *Question 12.* Discuss any obvious environmental changes during the data collection period, but no biggie If there was not much to talk about. Use your tabular and graphical information to discuss whatever you can.
- e. *Question 13.* How did your location reflect proper siting? If not, what were some of the limiting issues associated with the site? How representative would this site be for the campus area as a whole?

5. Final Steps

- a. **Create a lab report with all of your answers to Questions 1-12 and the code. This must be typed.**
- b. **Turn your lab report in by the following lecture.**