

**STANDARD OPERATING PROCEDURE FOR
MEASURING WIND SPEED AND DIRECTION
USING THE
CLIMATRONICS SONIC ANEMOMETER
AND
CAMPBELL SCIENTIFIC CR200W DATALOGGER**



**U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711**

Acknowledgement

This Standard Operating Procedure (SOP) was developed by MACTEC Engineering & Consulting, Inc. for the EPA Office of Air Quality Planning and Standards under EPA contract EP-D-05-096, Work Assignment 4-10.

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I. INTRODUCTION

This procedure describes the installation of the Climatronics Sonimometer™ and the Campbell Scientific CR200W datalogger software. This document also provides instructions on modifying the datalogger to be recharged using a battery or run directly from AC power.

II. METHOD

The Climatronics Sonimometer™ (Figure 1) is designed as a stand-alone sensor to measure the horizontal wind speed and direction. Standard digital outputs are RS-232C, RS485, and SDI-12.



Figure 1. Climatronics Sonimometer

II.1. Instrument Siting

The sensor head should be installed at least two (2) meters above the ground, mounting platform, or rooftop and in an area clear of obstructions.

III. DATA QUALITY OBJECTIVES

No Data Quality Objectives (DQOs) were specifically identified in the Quality Assurance Project Plan (QAPP) for wind speed and direction for the School Air Toxics Monitoring Program (SATMP).

IV. EQUIPMENT AND SUPPLIES

The following equipment and supplies are required for this field program:

- Sonic Anemometer Climatronics Sonimometer™ – Part 102779
- Datalogger Campbell Scientific CR200W
- Datalogger software PC200W
- Copper grounding wire, 7-strand, #8 gauge

The following are optional if other mounting equipment and techniques are available to raise the anemometer at least 2 meters above the surface and clear of obstructions:

- Antenna mount tripod
- Aluminum masts

For the optional electrical box (see Section V), the following is needed:

- Cord lock, weatherproof 12/3 AWG power cord
- Crimpless battery terminal connector side terminals

Various connectors, such as hanging brackets and nuts, are also required but not listed here.

V. HARDWARE MODIFICATIONS

Prior to installing the anemometer, one or more of the following hardware modifications may be performed to recharge the on-board battery.

V.1. Optional Installation of Electrical Box and Power Cord

A small battery charger module has been provided to recharge the internal battery provided with the anemometer (Figure 2). An option to permanently mount the battery charger inside the anemometer console requires modification of the console to allow installation of a power cord and duplex electrical connector. A small hole is drilled through the bottom of the console, large enough to insert a waterproof strain relief fitting suitable for a power cord to enter the console. A receptacle box is attached to the aluminum back plate and a duplex receptacle is inserted and attached to the power cord. The Battery Charger is then plugged into the receptacle. (Note: the Battery Charger will be held in place when the door to the console is closed and locked.)

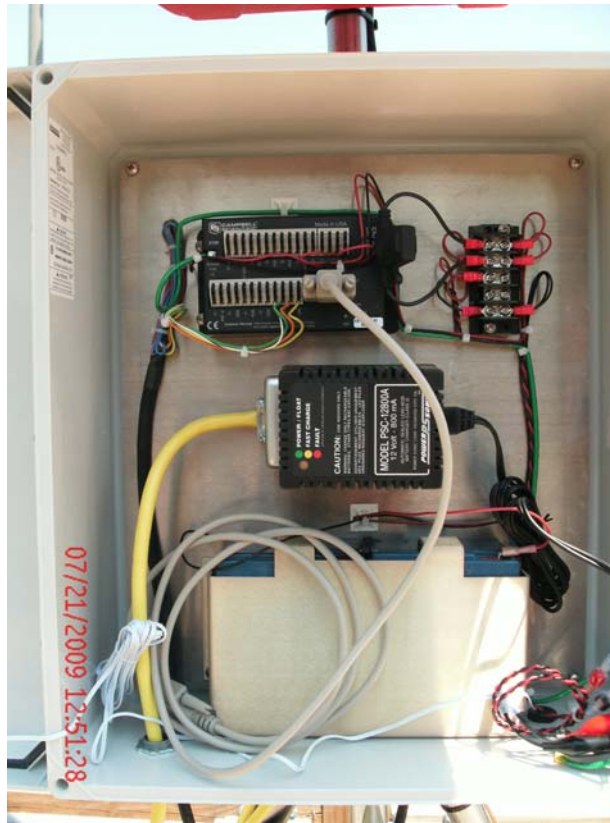


Figure 2. Optional Installation of Electrical Box and Power Cord

The two clamps attached to the low power leads of the battery charger are removed and replaced with terminals compatible with the spare leads provided by Climatronics for external power.

When the battery charger is first turned on the charge indicator should show a solid yellow color (see the indicator legend on the battery charger). Depending on the charge status of the battery, this indicator will turn green to indicate the battery is fully charged.

VI. HARDWARE INSTALLATION

Sufficient cabling is provided with the instrument to locate the sensor head about 7.5 meters (25 feet) from the control unit. The sensor head should be installed at least 2 meters above the ground and in an area clear of obstructions. Proper orientation of the sensor head with True North is required to correctly determine wind direction. A compass (**not supplied by EPA**) should be used to determine magnetic north. The declination can be determined using the online National Geographic Data Center's web site (<http://www.ngdc.noaa.gov/geomag/declination.shtml>). Selecting the link "Compute your declination" allows the user to enter the longitude and latitude of the location to determine the actual declination. For example, for North Birmingham Elementary School, the latitude is 33.56 North and longitude

is 86.82 West. A date of interest is also required with the default being the current day. The calculator returns a result of 2° 35' **West** (Figure 3), which means the instrumentation must be rotated by that amount **clockwise**. See Section 2.5.2.2 in the U.S. EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements* for additional information.

This correction must be applied before securing the sensor head in place.

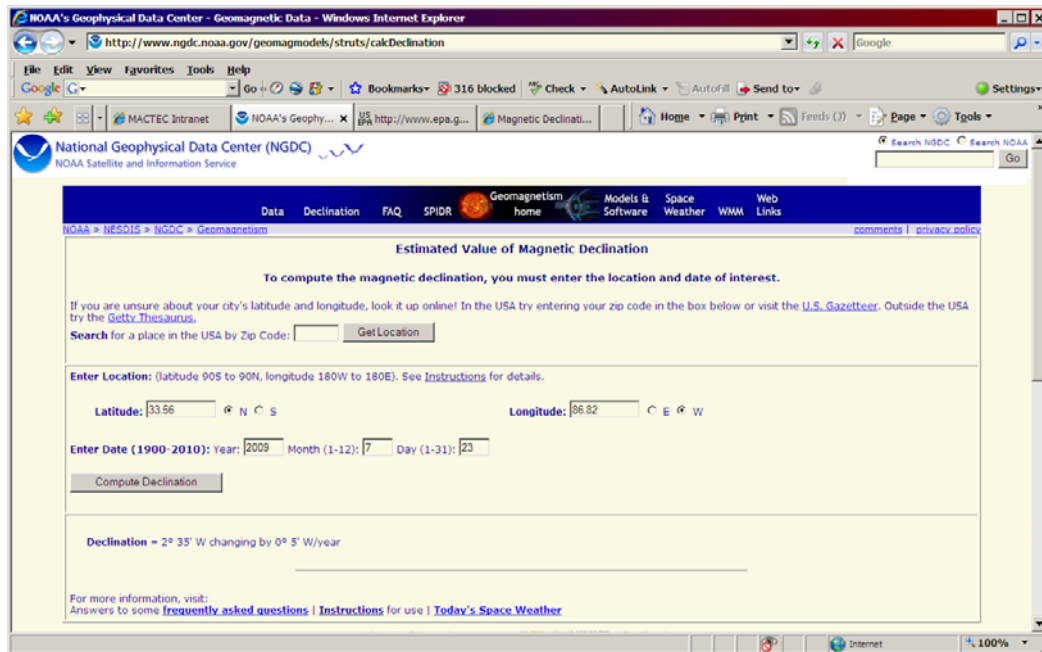


Figure 3. Online Declination Calculation

To be able to download data from the Datalogger to a computer, a 9-pin serial computer cable (**not supplied by EPA**) must be attached to the serial port of the data logger.

Once all connections have been made and verified, connect the two power terminals to the battery. (If the system has been modified to include the battery charger, connect the battery charger at this time.) A red LED on the datalogger will blink periodically to indicate that the datalogger is scanning.

VII. SOFTWARE INSTALLATION AND CONFIGURATION

VII.1. Installing the Campbell Scientific PC200W Software

Once the datalogger and sonic anemometer are connected and power is provided to the datalogger, the system immediately begins recording data. The next step is to install the software to collect the data from the datalogger. The serial cable used to transfer data from the data logger to the personal computer does not need to be connected until the communications test is

performed. However, connecting the RS232 port on the datalogger to the serial port on the computer at this time will not interfere with the software installation.

To start the software installation, insert the Resource CD from Campbell Scientific in the CD/DVD drive on your computer. If the setup wizard does not start automatically, use Windows Explorer to navigate to your CD/DVD drive and double click on the file named "AutoRun.exe".

The following steps will install the software on your computer.

1. At the opening screen, click on "Software" under "Demo and Starter Software" on the right side of the screen.
2. On the second screen, click on "PC200W 3.3" to start the software installation.
3. On the Welcome to the InstallShield Wizard for PC200W, click NEXT.
4. After viewing the license agreement, click the "I accept the terms of the license agreement" radio button and click NEXT.
5. Choose a destination folder in which to install the software. You can accept the default location or use the "Browse" button to change the destination directory. Click NEXT.
6. Enter a working directory. You can accept the default directory, which is different than the default location in Step 5, or use the "Browse" button to change the destination directory. Click NEXT.
7. Select a Program Folder for the software. Click NEXT.
8. A warning will be displayed indicating that all other Campbell Scientific applications must be closed. Click OK when there are no open Campbell Scientific applications.
9. The PC200W software is installed on your system. This process takes less than a minute to complete on newer personal computers.
10. Once the installation is complete, check the box to add PC200W shortcuts to your desktop of you want an icon on the computer's desktop. Two icons are placed on your desktop – an icon to run the software and a device configuration utility. Click FINISH.
11. Close the Resource CD screen and remove the CD from the CD/DVD drive.

VII.2 Configuring the PC200W Software

The following steps configure the software to collect and transfer data.

Double click on the PC200W (or the name you gave it in Step 7 above) icon on your desktop. If a shortcut to the software was not placed on the desktop, select the software program using the Start menu. The first time the software is started, an opening screen is briefly displayed. When the screen closes, the window shown in Figure 4 is displayed, allowing you to add and configure the datalogger.

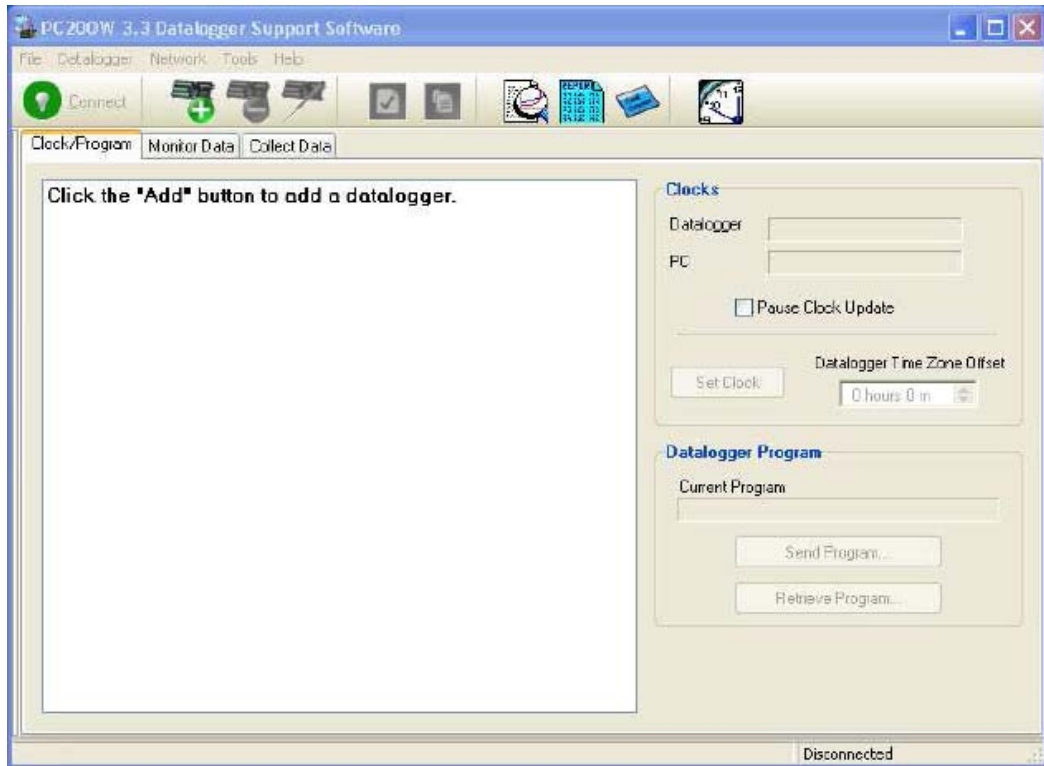


Figure 4. Opening Configuration Screen

Click on the Green Plus Sign to add a datalogger.

The EZ Setup Wizard introductory screen is displayed. Click NEXT to display the Communications Setup (Figure 5). On this screen you select the datalogger type (CR200 Series) and enter a name for your datalogger. **DO NOT ACCEPT THE DEFAULT NAME** if one is provided - **CHANGE THE NAME** following the guidelines provided. If you have multiple dataloggers, using the default name or the same name for all dataloggers will append all data collected into a single file.



Figure 5. Communications Setup – Datalogger Type and Name

Datalogger Naming Convention:

- Use a form of the school name that uniquely identifies it,
- Avoid using periods in the name,

Once the datalogger name is entered, click NEXT.

Before proceeding, connect the serial cable from the data logger to the computer. On the COM Port Selection screen, select the COM port the data logger is connected to and keep the COM Port Communication Delay at 00 seconds (Figure 6). Click NEXT.

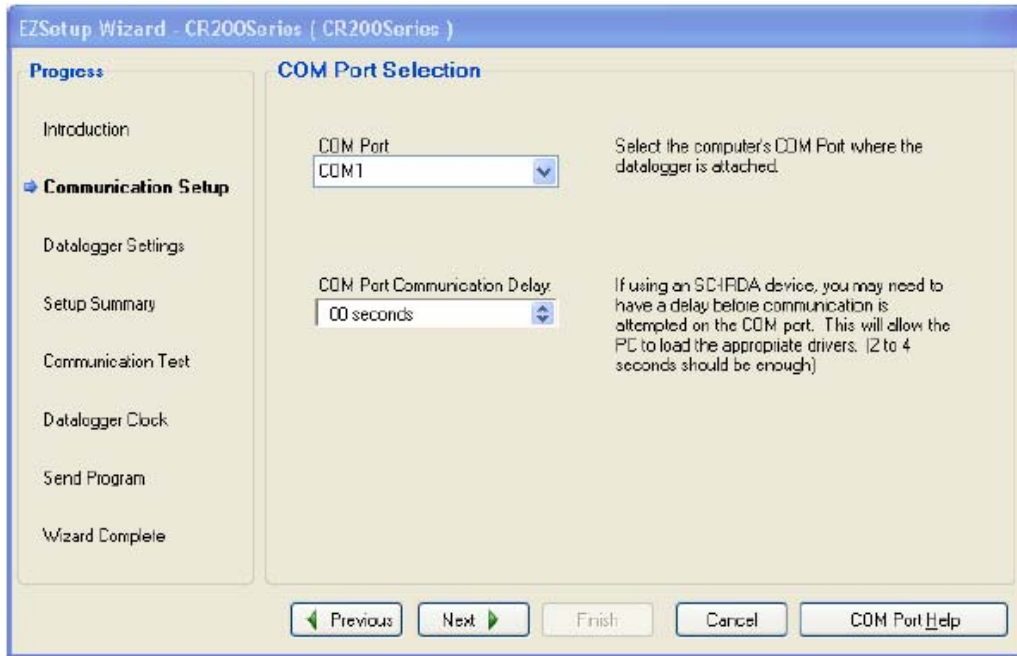


Figure 6. Communications Settings – COM Port Selection

In the Datalogger Settings window (Figure 7), select 9600 baud, PakBus Address is 1, and Extra Response Time is 00 seconds. Click NEXT.

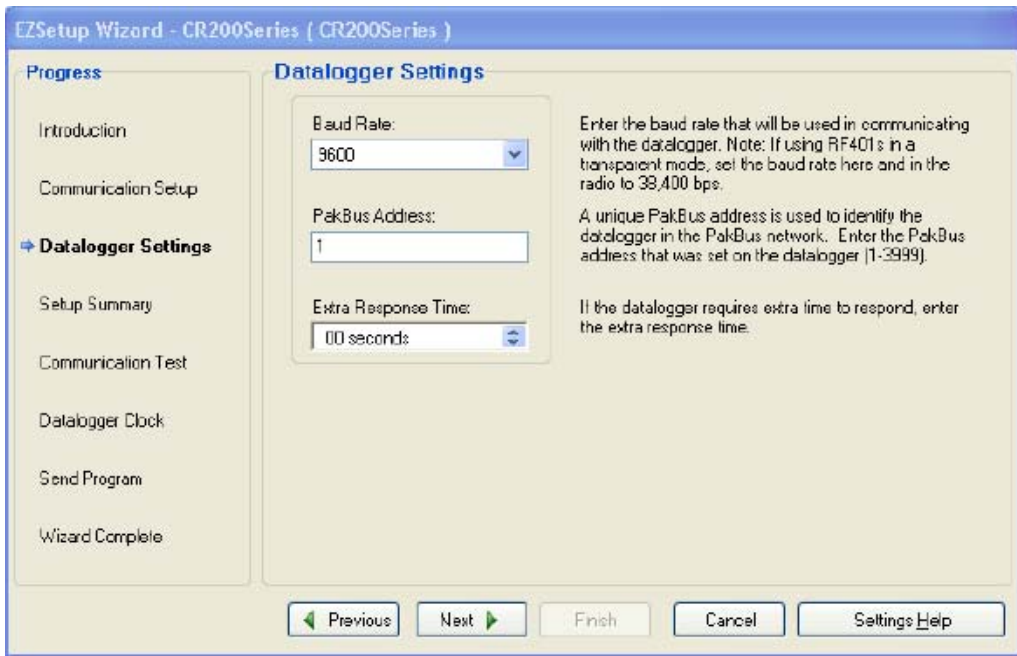


Figure 7. Datalogger Settings

In the Communications Summary window (Figure 8), review your settings. To make changes, click the Previous button to modify your entries on previous screens. Click NEXT if finished.

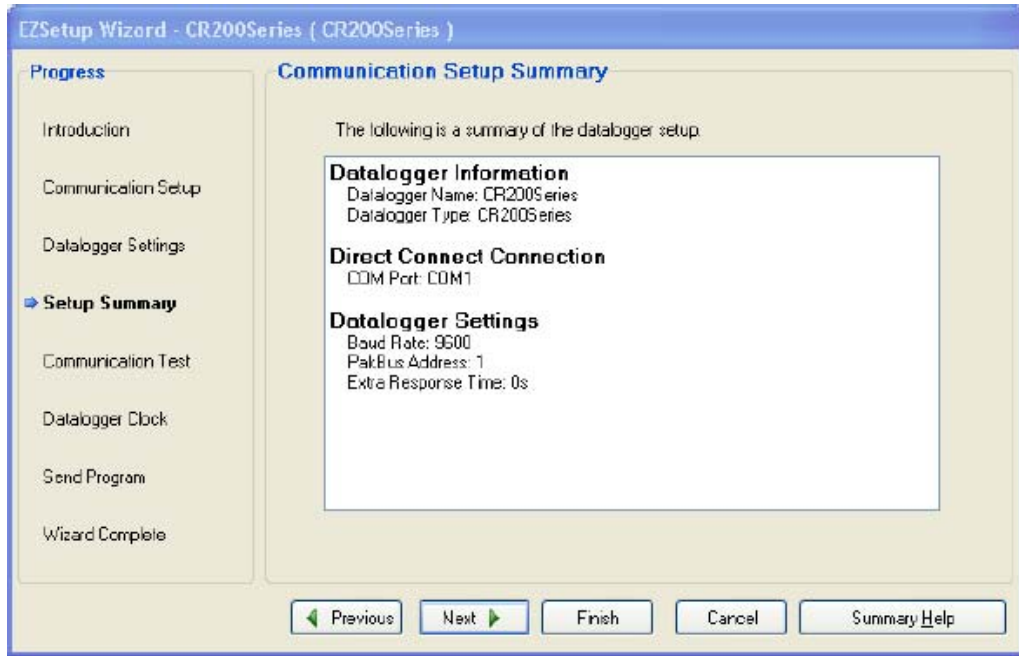


Figure 8. Communications Setup Summary

Perform a communications test (Figure 9). Be sure the 'Yes' radio button is selected and click NEXT to perform the test. The popup shown in Figure 10 is displayed while the test is performed.

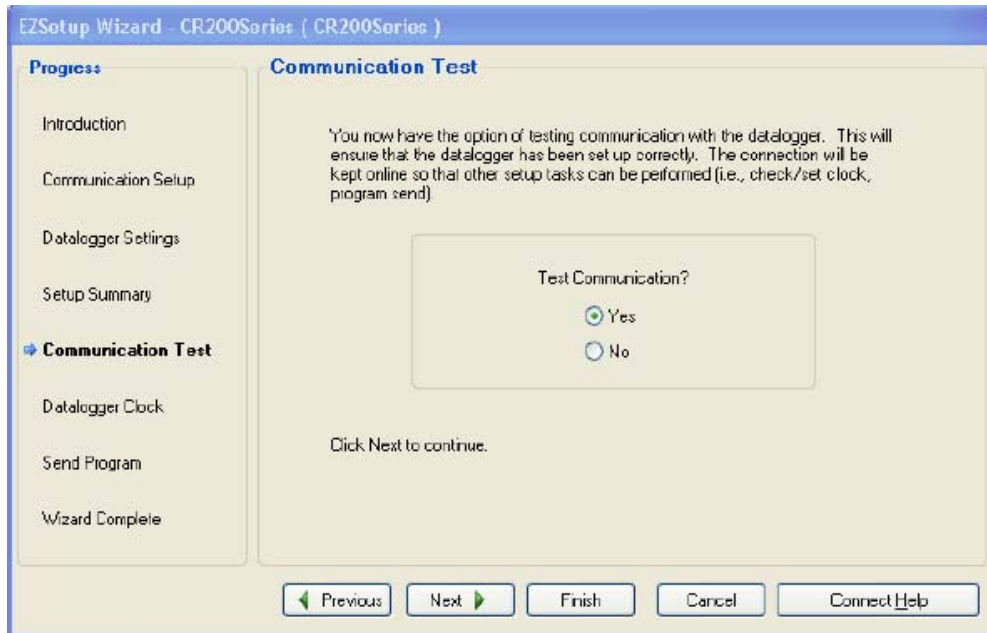


Figure 9. Communications Test

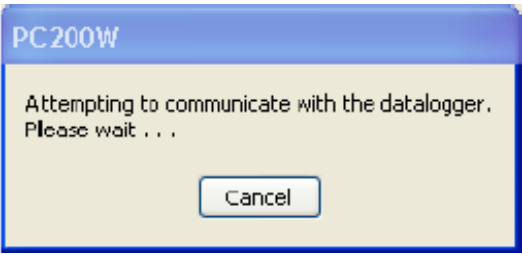


Figure 10. Popup Window When the Communications Test Is Performed.

If the test is successful, the window in Figure 11 is displayed. Click NEXT to continue the installation process. If the test is not successful, check to be sure the serial cable connecting the datalogger and computer is not damaged (e.g., damaged or missing pins), properly connected, and the unit has power.



Figure 11. Communications Test – Window When the Communications Test Is Successful

In the datalogger clock screen (Figure 12), the datalogger date/time must record data in **Local Standard Time**. To account for the time shift associated with daylight savings time, the Time Zone Offset must be set to -1.

Once the values are entered, click on the Set Datalogger Clock button and click NEXT.

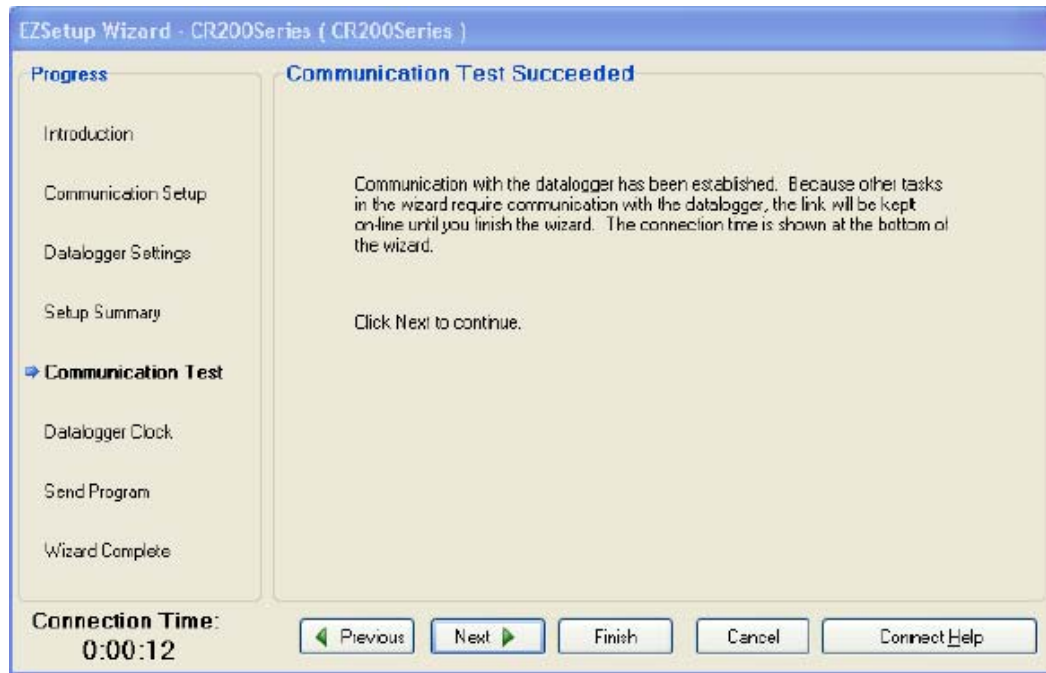


Figure 12. Datalogger Clock

The next screen that appears (Figure 13) is to be skipped. It is used to update the internal program in the datalogger. The program that is running is the current and correct program for this air monitoring system. Click NEXT at the datalogger program screen.

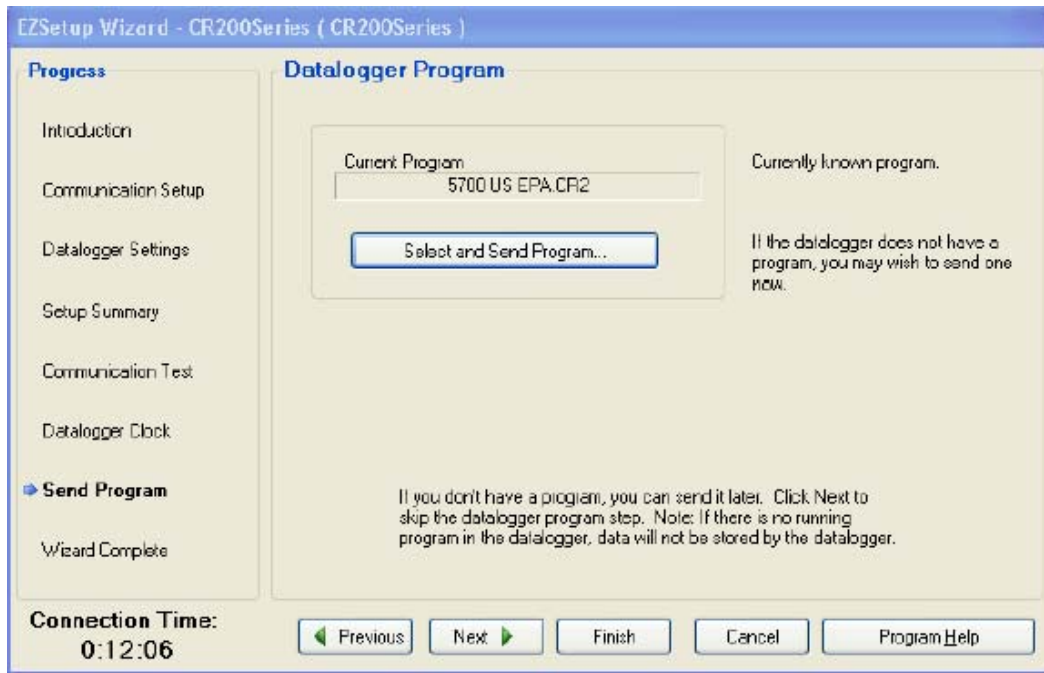


Figure 13. Send Program – Datalogger Program – Skip This Step

Figure 14 shows the final screen displayed for the software configuration. Click FINISH to close the wizard program. Since the serial cable is connected between the datalogger and the computer, a prompt appears asking if you wish to remain connected (Figure 15). Click on “Yes” to continue on to with data collection or “No” to exit. If you choose to exit, unplug the serial cable from the datalogger and the computer and close the datalogger shelter.

You can restart the software and perform data collections by connecting the computer and datalogger with the serial cable and double clicking icon the desktop icon or from the list of Program Files under the Start menu.

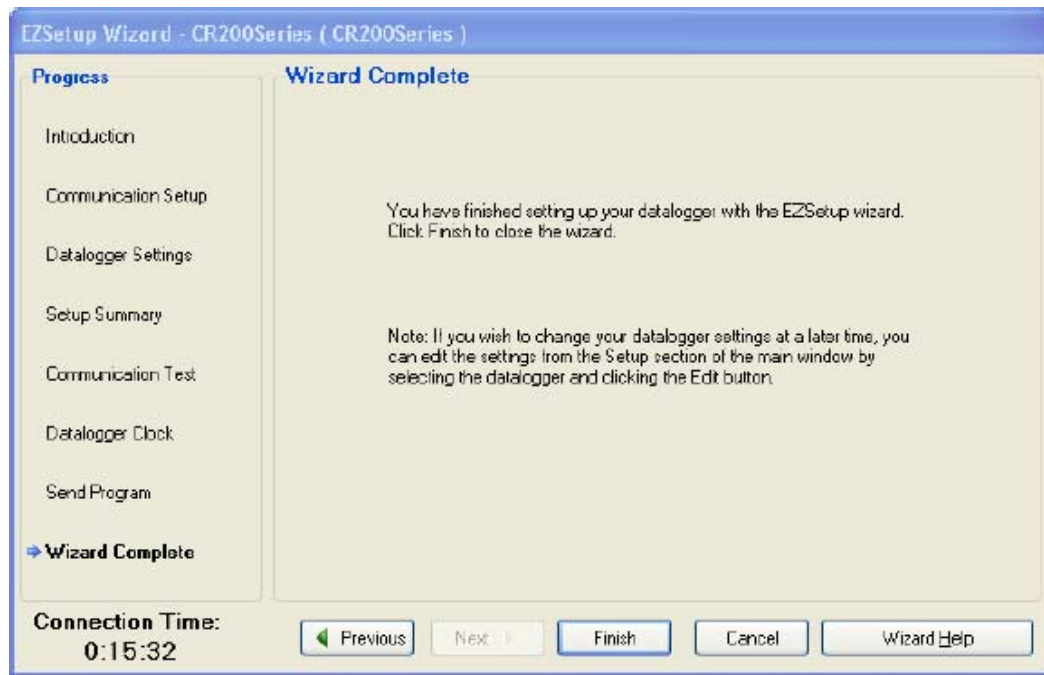


Figure 14. Wizard Complete



Figure 15. Confirmation Prompt

VIII. DATA COLLECTION

Once the software is installed and configured properly and data are being recorded in the datalogger, the data can be transferred from the data logger to the PC at any time. Connect the datalogger to the personal computer using the serial cable. To start the software double click icon the desktop icon (if one is present) or select it from the list of Program Files under the Start menu

Figure 16 shows the opening screen to monitor and collect data. Since the datalogger is already connected to the computer, there is no need to reestablish a connection. For future access and data collection from the datalogger, see the Data Transfer section.

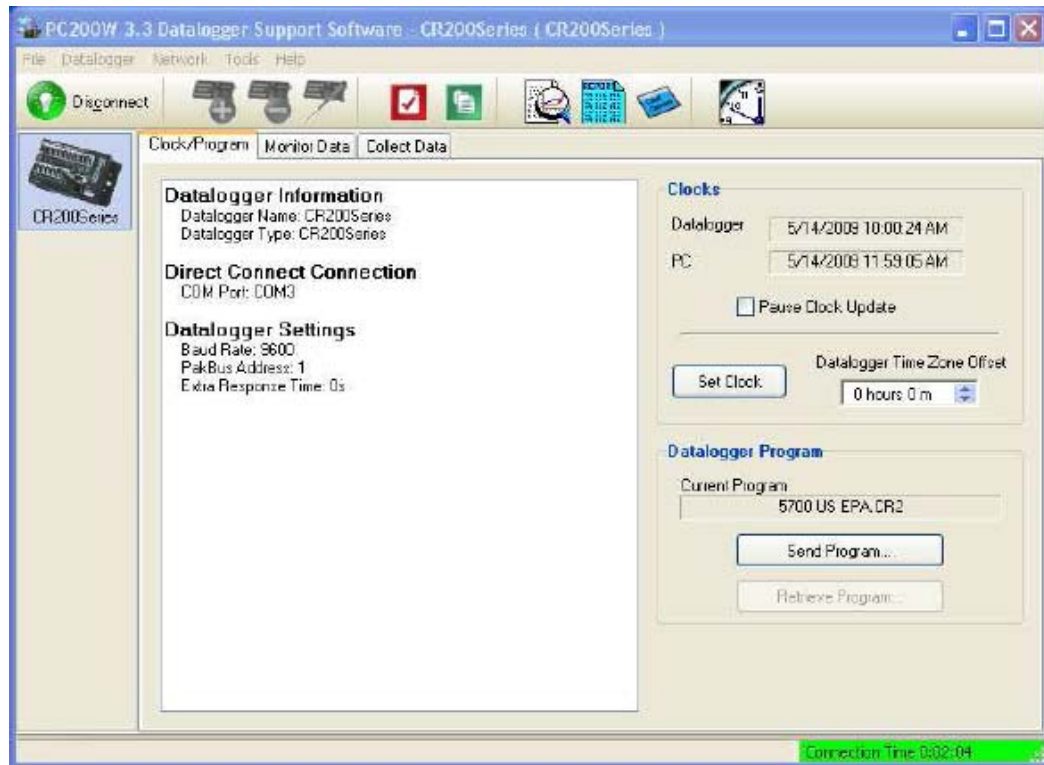


Figure 16. Screen Showing Datalogger Connection

Do **NOT** click the Set Clock or the Send Program buttons.

Select the Monitor Data tab to view real time data (Figure 17). For the first use, the State, County, and Site ID's must be set. To enter those values for your system, double click on the file to be modified. When the field is highlighted in yellow, type in the integer value and press ENTER on the keyboard. The value is not accepted in the datalogger software if ENTER is not pressed. The values to be entered have been provided by the U.S. EPA. Entering a text string results in the letters NAN appearing – Not a Number. Type in a valid value and press ENTER.

NOTE: If power should be interrupted to the datalogger between collections, the site information will be lost (reset to zeroes) and must be re-entered before collecting the data. Be sure to check those values each prior to collecting the data.

Do not alter the default fields displayed since the data being collected will be eventually be uploaded to EPA's Air Quality System (AQS). Any deviation from the default parameters may result in a failed upload to AQS.

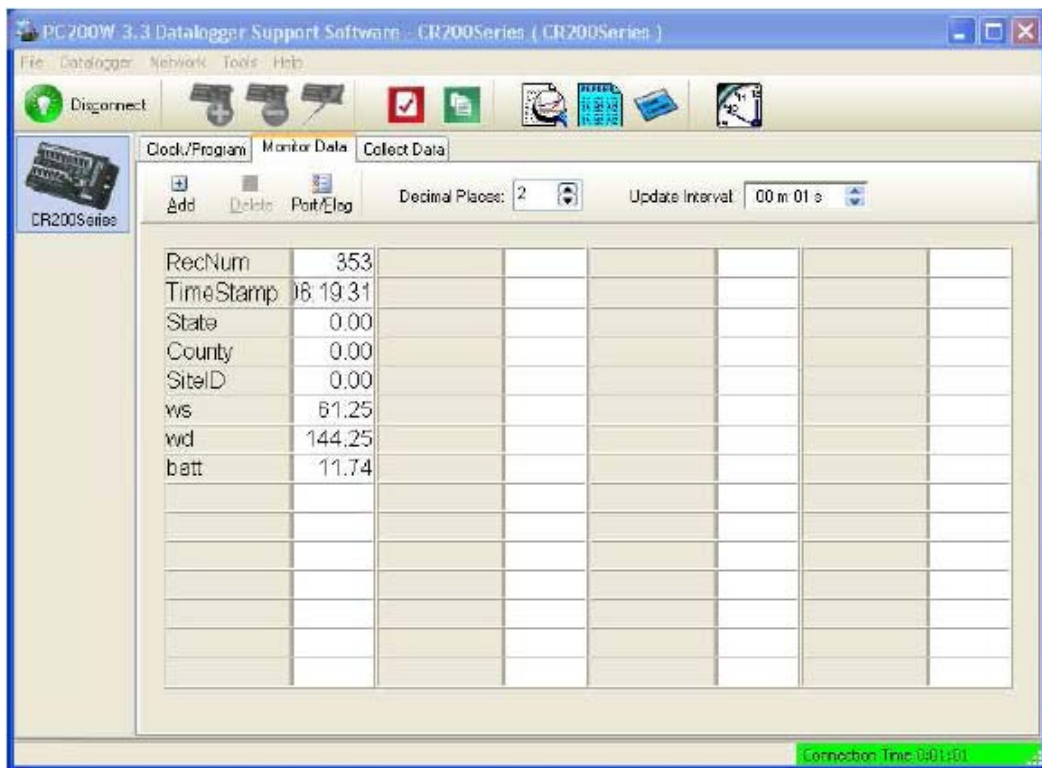


Figure 17. Monitoring Data

Once the system is operational, data can be transferred from the datalogger to the computer. That operation is performed under the Collect Data tab (Figure 18). There are several areas on this tab that affect how much data are collected and where it is stored.

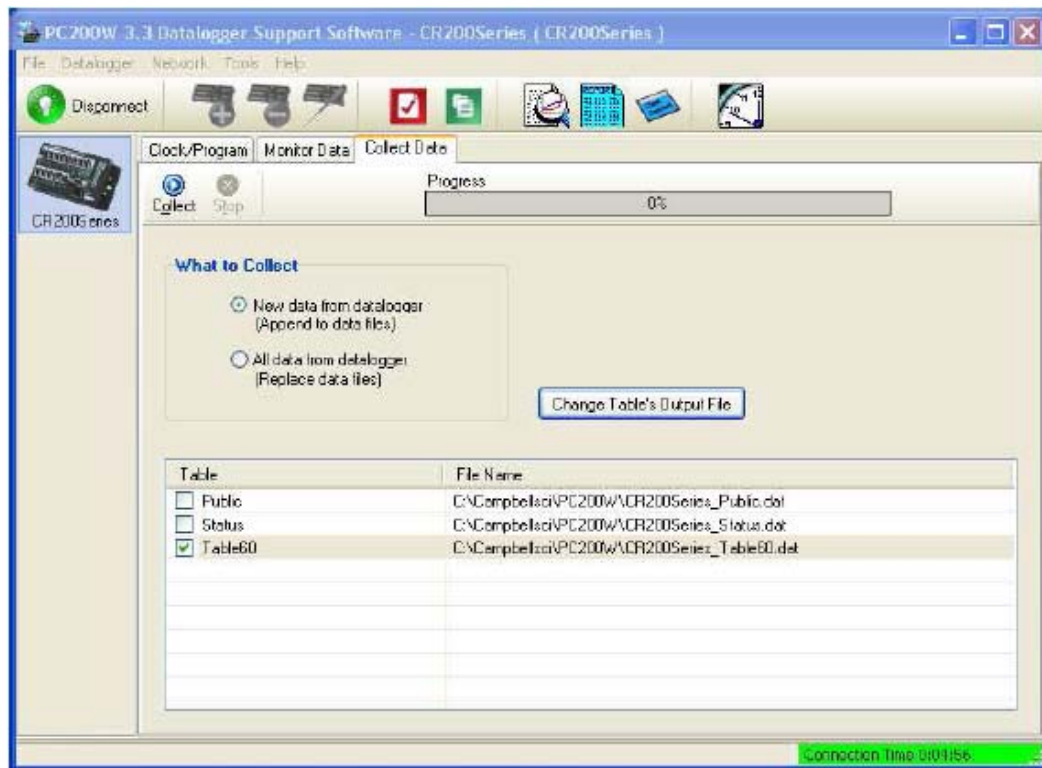


Figure 18. Collect Data

In the box labeled “What to Collect”, there are two choices. Selecting “New data from datalogger” will collect data since the last collection. Selecting “All data from datalogger” will collect all the data on the datalogger. Select the option to collect New data.

For this program, only the data from the table labeled Table60 needs to be collected. Make sure the check box next to table60 is checked. The check boxes next to Public and Status can remain unchecked.

By default the data are saved to files with the extension .DAT for the initial data collection. The data must be saved as .CSV (comma separated values) files. The process is explained below.

The filename needs to be changed each time the data are collected. For the initial collection, the default name will be the datalogger name followed by an underscore and the table type, as shown in Figure 18. If the name of the school was entered for the datalogger name (see Figure 5), then that name appears in place of “CR200Series” shown in Figure 18.

The naming convention that should be used is *dataloggername _mmdd* where datalogger name is the school name and *mm* is the month represented as an integer (e.g., July = 07) and *dd* is the day.

To change the location where the data are to be stored, the file type (extension) and the filename, highlight the row for Table60 (failure to do so will produce a prompt to highlight the file) and click on the Change Table's Output File. The standard Microsoft Windows File Open dialog opens. The first time this button is used, the folder location is the PC200W folder (Figure 19). Change this to a folder of your choosing.

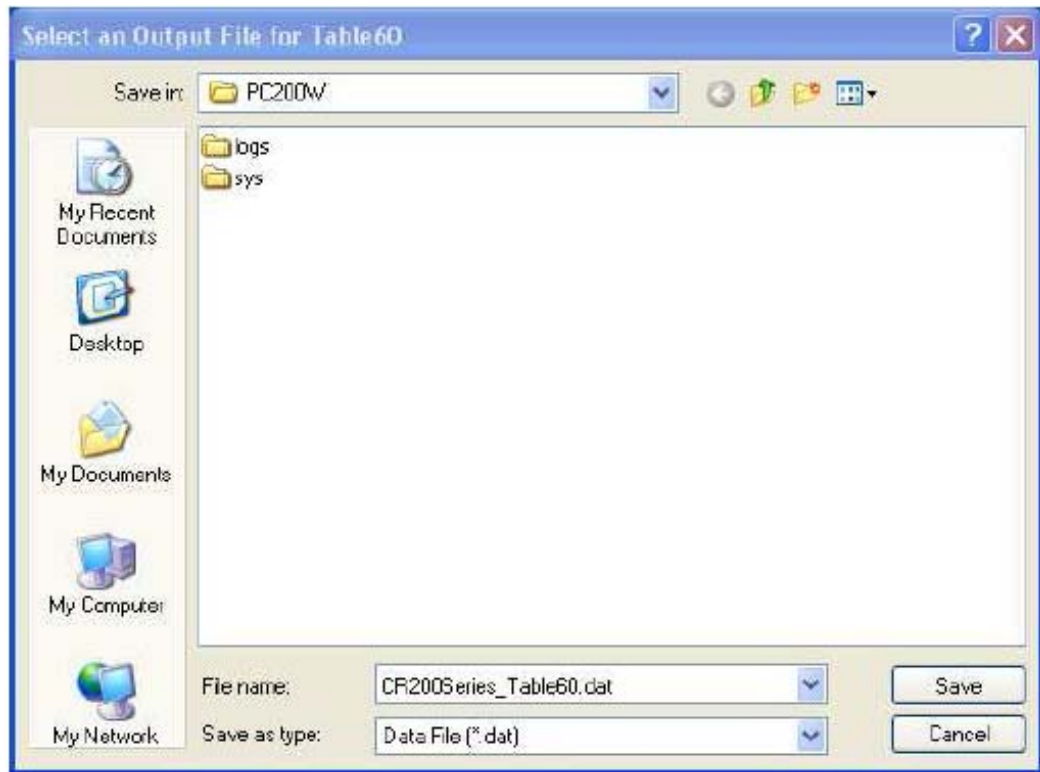


Figure 19. Initial Location to Save Collected Data

Change the extension to .CSV under Save as Type and change the filename to the convention described above in the File Name. Click on the Save button to return to the Collect Data tab (Figure 20). Confirm that the extension was changed to .CSV before proceeding and make changes if necessary.

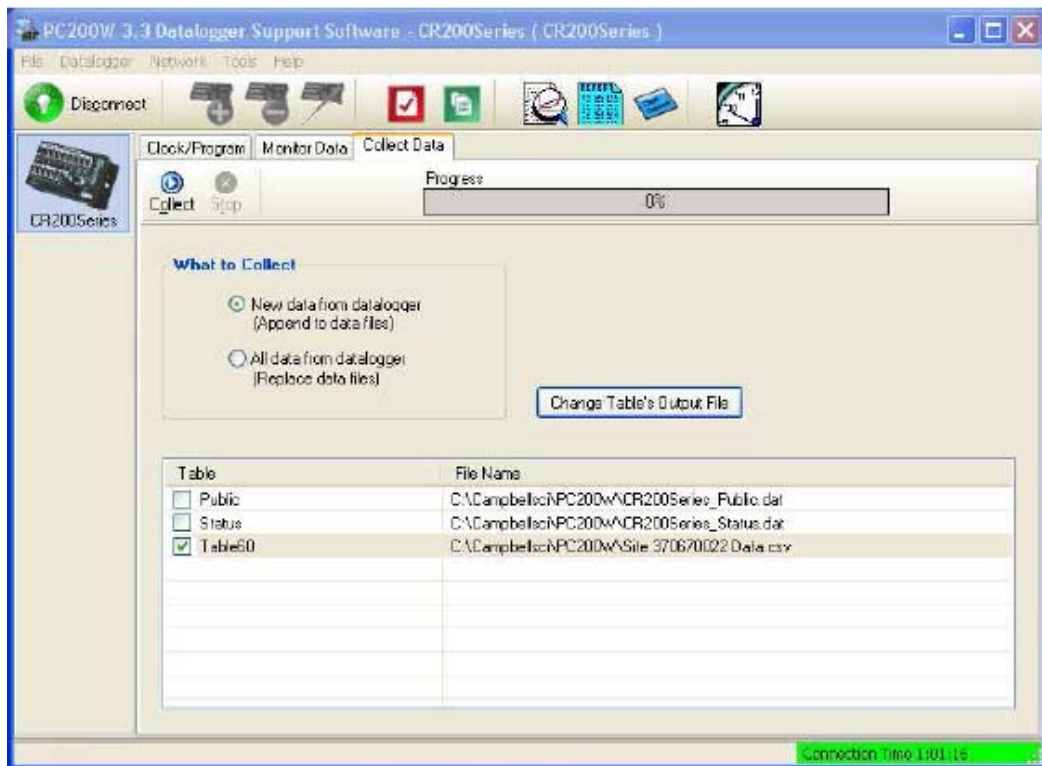


Figure 20. Collect Data Tab with File Extension Changed

To begin the collection process, click on the small blue “Collect” button left of the Progress bar.

Once the data collection is complete, you can disconnect from the datalogger using the Disconnect button in the upper left or close the software window. Doing the latter will generate a message box indicating that the datalogger is still connected and ask if you want to disconnect and ext. Click on Yes.

The next time data are collected, the open file dialog (Figure 20) displays the folder where collected data are stored (and not the default PC200W folder). Also, the extension .CSV should have been retained by the software, but it is best to confirm this.

IX. DATA TRANSFER FROM PC TO EPA

Once the data are collected, the text file (associated with Table60 shown in Figure 20) is to be transmitted each week to EPA for processing. The preferred method is to email the text file to Jonathan Miller. His email address is miller.jonathan@epa.gov. If you do not have access to email or if there are problems transmitting the data, he can be contacted at 919-541-7738 to discuss how to transmit the data to him.

X. AUDITS AND CHECKS

An independent audit will be conducted of the instrumentation at each site once during the field program. See the QAPP for more information regarding the audit of the wind instrumentation.

XI. MAINTENANCE

The anemometer and datalogger unit should be examined for visible damage with each site visit. If damage is noted, EPA should be notified immediately. Contact names are provided in the acknowledgements.

The anemometer has no moving parts therefore, periodic maintenance is not required. There are no adjustable or user replaceable parts located inside the sensor.