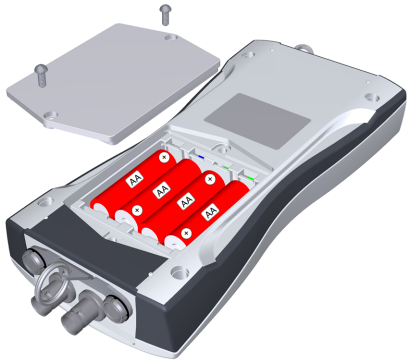
LAI-2200C Plant Canopy Analyzer

Quick Start Guide

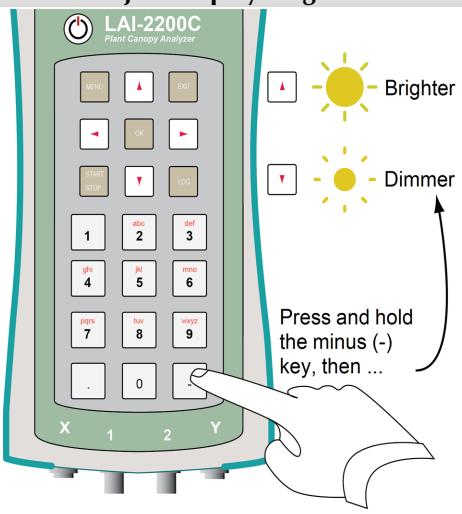
Install Batteries



Control Unit (Console): 4 AA batteries

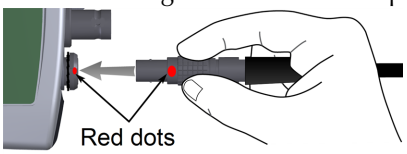
Optical Sensor (Wand): 2 AA batteries, unless attached to console

Adjust Display Brightness

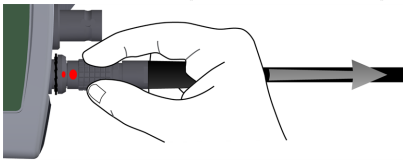


Connect Cable

To attach: Align the red dots and press.



To release: Grasp the collar and pull.



Do not pull directly on the cable.

View Caps

The diffuser cap is used to measure sky radiation properties needed for scattering corrections. It slides over the lens from the front of the wand.

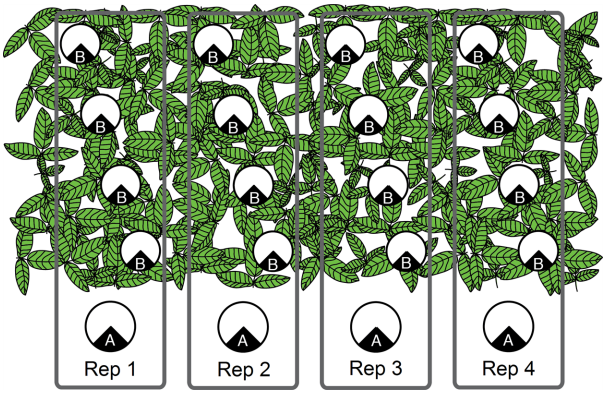
Use the view-restricting caps (10°–270°):

- To block the sun from the sensor's view (usually with 45° cap).
- To block the operator from the sensor's view.
- When there are gaps or clumps in the canopy.
- To reduce the required plot size.
- To make above-canopy measurements in a small forest clearing.

Refer to the manual for more information on choosing and using caps.

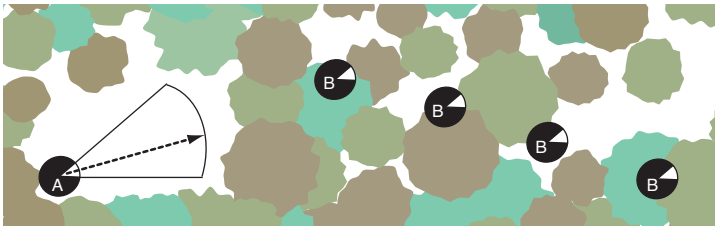
Sampling Canopies

Homogenous Vegetation and Grasslands



A=Above-canopy readings. B=Below-canopy.

Forests and tall Canopies



When direct sun is striking a canopy with large gaps, avoid viewing sunlit canopy by working with the sun to the side or slightly in front of the sensor's view (taking care to keep the sun OUT of the sensor's view). Refer to the manual when sampling small or isolated canopies, rows, and hedges.

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Sky Conditions

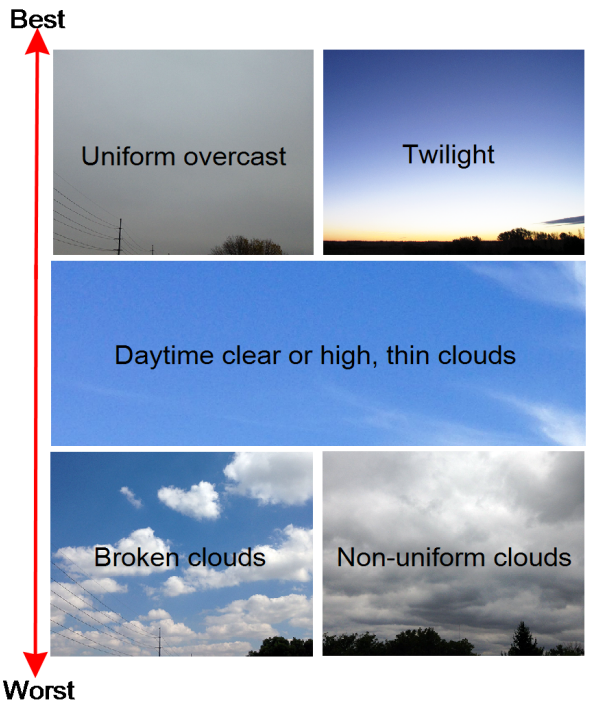
Best:

- Single layer, uniform overcast or
- Clear blue sky (at least in the part of the sky viewed by the sensor) with the sun below the horizon (twilight) or blocked by a convenient cloud.

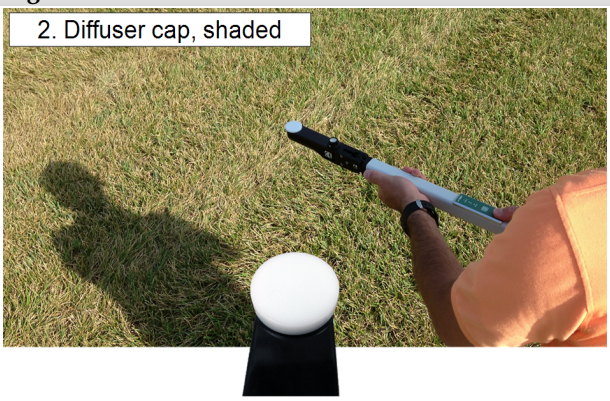
Stable sky conditions allow for longer intervals between above and below readings, and uniformity makes the direction of the readings less important.

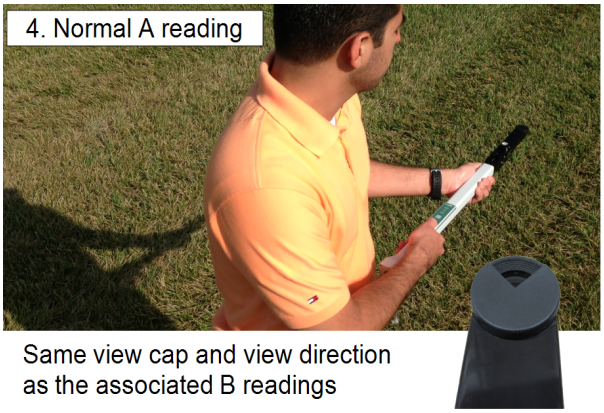
Good: Clear blue sky during sunlight hours. Interpolating above readings over time works well, making tall canopies such as forests easy to measure with a single sensor. Direct sunlight greatly increases scattering error, but this can be mitigated in many circumstances by applying scattering corrections in post processing.

Worst: Most other sky conditions can be problematic, and need to be handled carefully. You will need to minimize time differences between above and below readings, and carefully align above and below readings to view the same section of sky. You will also need to avoid logging B readings when the sun is skirting the edges of clouds, because the fraction of beam is changing very fast and what you capture with a 4A Sequence (below) probably won't coincide with what it is when you do a B reading. **Note:** Refer to the manual for more details on dealing with unstable and non-uniform sky conditions.



4A Sequence for Scattering Corrections





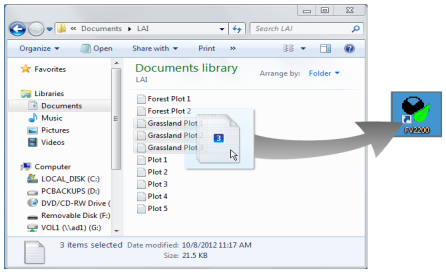
The first 3 readings measure sky radiation properties. The fourth is a normal **A** reading (above-canopy reference for **B** readings).

Note: Step 3 may be omitted if the size of a clearing does not allow a wider view cap than the normal **A** reading.

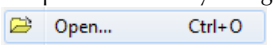
We recommend that you test how well the scattering correction performs at your particular site by doing this simple experiment: Compare the results from a representative transect or plot measured during midday with the results measured without direct sun (e.g. sun below horizon). The scattering corrections can be applied to both, but the midday will have the bigger correction due to the direct beam. The degree to which the two results compare will give you an indication of how well scattering corrections are correcting the midday errors.

Measuring Leaf Area Index with a Single Wand

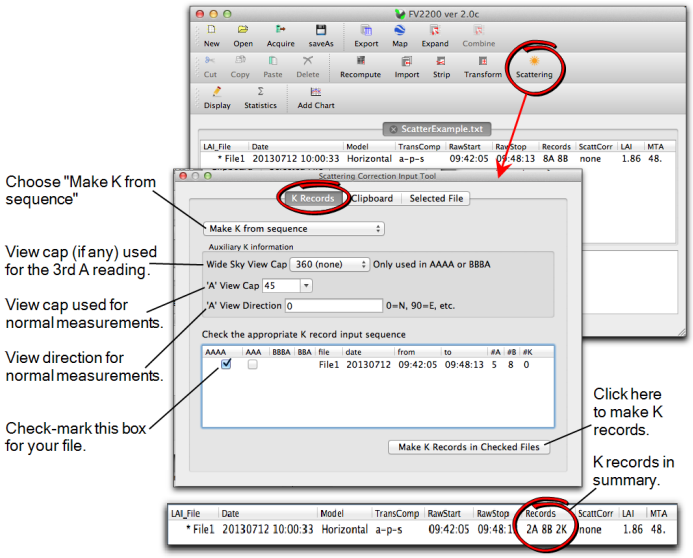
1. **Enable GPS Logging**
   a. Power on the console.
   b. Press **MENU > Log Setup > GPS** (bottom of list).
   c. Select **Active, On** > down arrow key > **Log GPS, Yes** > down arrow > **When, Any**. Press **OK**. (GPS data are recorded with every **A** and **B** reading).
2. **Set Clock and Sync Time**
   a. Connect the cable between wand and console.
   b. Press **MENU > Console Setup**.
   c. Press **OK**, then select **Set Time** (Note: **USE GPS** is an option when GPS is active).
   d. Set the time and press **OK**.
   e. Press **MENU > Wand Setup > Select wand > Clock > Sync Time > Yes > OK**.
3. **Create a New File**
   a. Press the **Start|Stop** button.
   b. Select **New File** and press **OK**.
   c. Enter a file name.
   d. Set Prompts if desired and press **OK**.
4. **Log the Above-Canopy Readings**
   Be sure the blue "Above" LED on the wand is lit. Hold the wand level and Press **LOG** on the wand or console to log each reading.
   a. If in direct sun, log the first 3 steps of the 4A sequence.
   b. Log the normal A reading.
5. **Log the Below-Canopy Readings**
   a. Press the **A|B button** so the "Above" LED is off.
   b. Hold the wand level below the canopy, aimed in the same direction as in step 4b.
   c. Log each below-canopy reading.
6. **Close the File and Compute LAI**
   a. Press the **Start|Stop** button.
   b. View initial LAI results under the **Quick View** or **View Menu** options.
   c. If you did Step 4a, complete the scattering corrections in FV2200 using the following steps.
7. **Transfer your File to a Computer**
   a. Connect the console to your computer with the USB cable. It will appear as a mass storage drive named LAI.
   b. Open the data folder in the LAI drive, locate the LAI file named in step 3, and drag or copy it to a directory on your computer.
8. **Install the File Viewer (FV2200) on your Computer**
   Download the latest FV2200 version at:
   www.licor.com/2200C-software.
9. **Open your File in the File Viewer**
   Drag LAI files(s) over the FV2200 icon to launch FV2200:



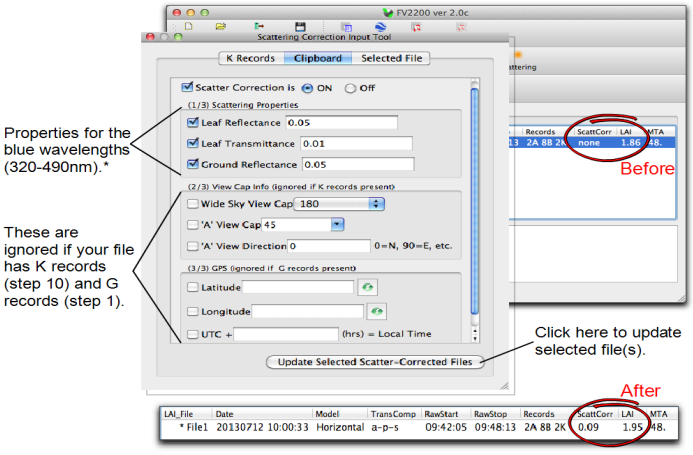
   or open files directly using the Open button in FV2200:



10. **Generate the K Records**
    a. Click **Scattering** to open the scattering correction tool.
    b. Click the **K records** tab
    c. Fill in the form as shown below.
    d. Click **Make K Records in Checked Files**.
    e. Verify the file now has **A** and **K** records.



11. **Add the Rest of the Correction Inputs**
    a. Click the **Clipboard** tab on the scattering correction tool.
    b. Click on the file in the main window to select it.
    c. Fill in the form and check-mark appropriate boxes.
    d. Click **Update Selected Scatter-Corrected Files**.
    e. View the scatter-corrected LAI in the summary view.



* For information on scattering properties, see the instruction manual or Kobayashi H., Y. Ryu, D.B. Baldocchi, J.M.Welles, J.M.Norman. 2013. On the correct estimation of gap fraction: How to remove scattered radiation in gap fraction measurements? Ag. and For. Meteorology, 174-175: 170-183

Global Positioning System (GPS) and Mapping

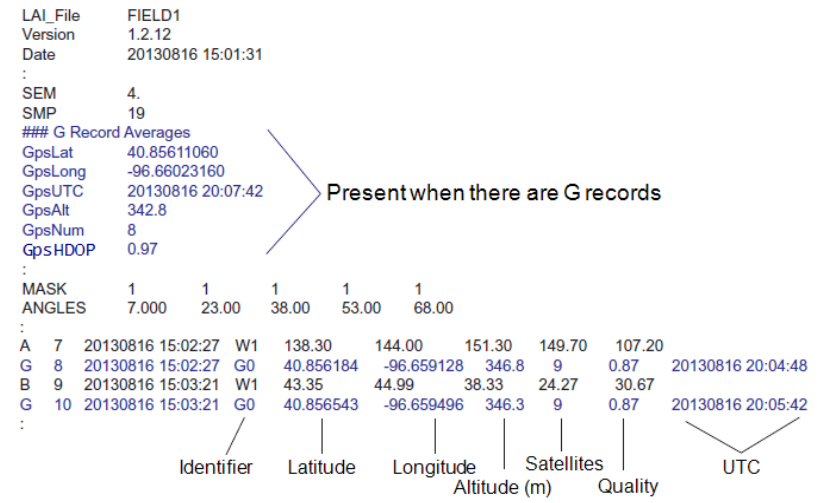
GPS data: LAI files generated by the LAI-2200C (or LAI-2200 with the 2200CLEAR upgrade kit) can include location information. This takes the form of G records in the data set, with summary information in the header. The FV2200 software uses GPS data for scattering corrections and also integrates GPS data with LAI data for tracking LAI changes over time and space.

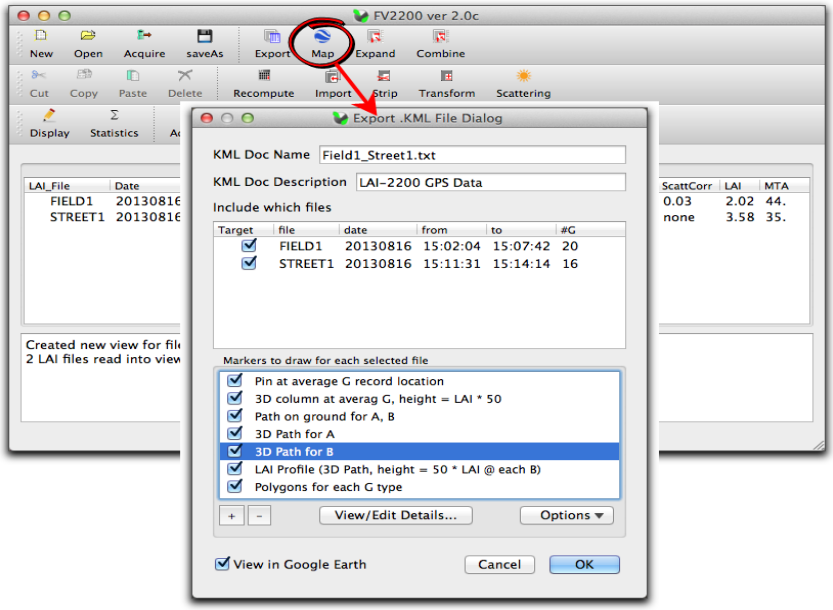
Configuring GPS: Power on the console. Press **MENU**, then select **Log Setup**. Scroll to the bottom of the list and select **GPS**. Press the right arrow key to select **Active–On**. GPS data will now be displayed in monitor mode. Press **OK** to finish, or go on to enable GPS logging by pressing the down arrow key, then the left arrow key to select **Log GPS–Yes**. Press the down arrow and then select **When–A, B,** or **Any**. Press **OK**. GPS data will be now be recorded with every Above reading, every Below reading, or with all readings.

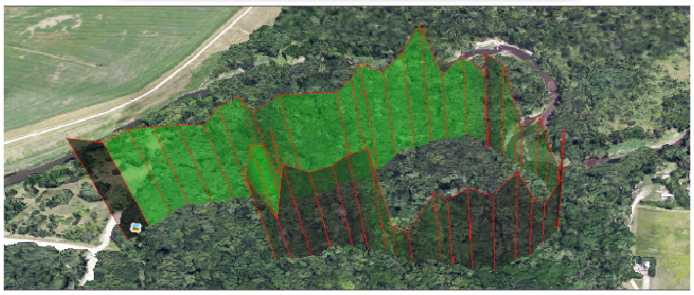
Fix Quality: HDOP stands for Horizontal Dilution of Precision. It is a measure of the geometric quality of the configuration of satellites in the sky. A lower number is better.

G records: The record identifier is usually G0 for GPS records. The number following the G indicates what triggered the G record to be logged. Normally (depending on how the console is configured), logging an A or B record will also trigger a G record to be logged, with the ID = G0. If GPS is Active (see "Configuring GPS" above) and a file is open, you can also log a G record by itself by pressing a numeric key (1-9) on the console. In that case, the G record identifier will be G1 through G9, depending on the key that was pressed. This allows you to mark areas in your plot (the corners, for example) while making measurements without logging spurious sensor readings.

Mapping: The map tool in FV2200 allows the export of location data as a .kml file for Google Earth, with several choices including a 3D representation of LAI along a path (see illustration at right).







LAI profile mapped on Google Earth.

See the FV2200 User Guide (under the Help menu) or the instruction manual for more details on mapping and data processing with FV2200.

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