Solmetric SunEye™ 210 User's Guide

Solar Test and Measurement Equipment

Limited Hardware and Software Warrantry

This Solmetric software and the Solmetric SunEye™ hardware ("Hardware") are warranted against defects in materials and workmanship for a period of two years. During the warranty period, Solmetric will, at its option, either repair or replace products which prove to be defective. The warranty period begins on the date of shipment.
For warranty service or repair, this product must be returned to the appropriate authorized repair center listed in the Solmetric SunEye User's Guide. No returns will be accepted without an RMA (obtain from Technical Support). For products returned for warranty service, the Buyer shall pay for shipping charges to send the product to the repair center, and the repair center shall pay for shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to the repair center from a country outside of the United States.
The forgoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications for the product. Unauthorized modification includes disassembly of the Solmetric SunEye hardware, removal of any part of the Solmetric SunEye hardware, modification to the operating system or operating system settings of the Solmetric SunEye, or the installation of software on the device other than Solmetric SunEye software.
The design and construction of any system or building by the Buyer is the sole responsibility of the Buyer. Solmetric does not warrant the Buyer's system, products, or malfunction of the Buyer's system or products. In addition Solmetric does not warrant any damage that occurs as a result of the Buyer's system, product, or the Buyer's use of Solmetric products.
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Limited Remedy
Our entire liability and your exclusive remedy shall be the replacement or repair of any Solmetric hardware or software not meeting our Limited Hardware And Software Warranty which is returned to an authorized repair center with a copy of your receipt.

IN NO EVENT WILL WE BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING FROM THE USE OF OR THE INABILITY TO USE THE SOLMETRIC SOFTWARE OR HARDWARE (EVEN IF WE OR AN AUTHORIZED DEALER OR DISTRIBUTOR HAS BEEN ADVISED OF THE POSSIBILITY OF THESE DAMAGES), OR FOR ANY CLAIM BY ANY OTHER PARTY.

SOME STATES OR COUNTRIES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PLEASE CONTACT TECHNICAL SUPPORT BEFORE RETURNING ANY PRODUCT.

1
Getting Started

Precautions

Magnetic Fields

Avoid nearby magnetic fields. The Solmetric SunEye is a sensitive measurement device. Magnetic fields from nearby iron can affect measurements and stronger magnetic fields may damage the SunEye. Always store and transport SunEye in the included magnetically shielded case to preserve the compass calibration. Never store magnetized objects, such as hand tools or other magnetized objects, in the case.

Temperature

Do not operate or subject the SunEye to temperatures beyond the published operating and storage temperature specifications found published on the back of the SunEye case.

Moisture

Exposure to rain or condensation may damage the SunEye. Do not expose to rain. Condensation will occur on the case whenever the dew point exceeds the case temperature. This can occur if moving the SunEye from a cold outside environment into a warm office environment. Store the SunEye in its protective case whenever not in use to protect and insulate the instrument.

Dirt and Dust

A precision optical fisheye lens is a key element of the SunEye. Protect from dust and dirt. Keep lens cap on when stored between uses. Clean lens regularly with soft lens cleaning cloth.

Battery

CAUTION	*The SunEye contains a lithium battery and should not be disposed of with general refuse. Dispose of the SunEye in accordance with all local codes and regulations for products containing lithium batteries. Contact your local environmental control or disposal agency for further details.*
WARNING	**Only use the power supply supplied by Solmetric or a UL or certified equivalent with a rated output of 5 Vdc 2.6 A.**

Understanding the SunEye

The Solmetric SunEye™ (patent pending) provides complete solar access and shade analysis in an integrated powerful hand-held tool for the following uses:

• Solar panel system design and installation

• Passive solar house design and green architecture

• Landscape design and landscape architecture

• Home and property inspection

Solar Panel Design and Installation

The Solmetric SunEye™ is an invaluable tool for the professional solar installer, saving time and money and helping to design the highest performance systems. Home and business owners who care about the performance and payback of their systems hire installers that use the Solmetric SunEye™. It's equally useful for photovoltaic (PV), passive hot water, roof mount or ground-mount systems. The Solmetric SunEye™ can help:

• Optimize new systems for maximum production.

• Analyze existing installations to solve problems of under production

• Identify specific shade-causing obstructions and know instantly how much additional energy would be produced if the obstructions were removed.

Passive Solar House Design and Green Architecture

The Solmetric SunEye is the right tool for the job when you need accurate site-specific solar access data for a new home or renovation. Optimize the orientation of a structure by identifying where and when the sun will shine. The Solmetric SunEye™ helps you answer many different questions. For example, "Will there be enough sun in the winter for passive heating of the house given the site-specific shading?", or "How will removing the large oak tree on the south-west

corner affect the warming and cooling of the building?" Furthermore, by collecting data inside an existing structure, you can identify the amount of direct sunlight that will enter a window or skylight or identify the perfect location for a new window or skylight.

Home and Property Inspection

The Solmetric SunEye gives professional home and property inspectors a way to provide their clients with important information about the solar access of a property. This information can be useful for:

- Identifying potential sites for solar panels, gardens, or new windows.
- Determining the amount of passive solar heating or cooling a particular building will experience.
- Determining how much direct sunlight will enter a particular window or skylight.

Installing the Solmetric SunEye and Desktop Companion Software

N O T E   The software on the hand-held unit and the Desktop Companion are simultaneously installed from the same installation file. Refer to "Upgrading or Downgrading Software" on page 5-2 for more information.

1 Before you start using your Solmetric SunEye it is recommended that you install the Solmetric SunEye Desktop Companion software. Although you will not have any data to analyze on the desktop yet, this will allow you to view the user's guide.

2 The Solmetric SunEye will most likely not need to you updated the first time you install the Desktop Companion on your PC. However, it will prompt you to connect the SunEye while it determines if you already have the latest version installed. You will then be given the option to reinstall or skip the Solmetric SunEye install and proceed straight to the Desktop Companion installation.

Minimum System Requirements:

- Operating System: Windows 7, Windows Vista, or Windows XP SP2 (Professional, Home, or Media Center)
- Processor Speed: 1 GHz minimum
- RAM: 1GByte minimum, 2 GByte recommended
- Available Disc Space: 200 MByte or more
- MS Internet Explorer 7.0 or higher
- Display resolution: 1280 x 1024 or greater

Systems that do not meet these requirements may not operate correctly.

Installation Procedure

1 It is important that you are signed on as the Administrator when installing the software. To verify this in Windows, go to Start > Control Panel > User Accounts.

2 Insert the Solmetric SunEye™ DVD into the DVD drive on your Windows desktop computer.

3 If the welcome screen does not automatically open, click **Start** then **My Computer** and double-click on the DVD drive. Then double-click on **setup.exe**. Alternatively, the installation file is available at the solmetric.com website.

4 Follow the instructions in the welcome screen to install the Solmetric SunEye Desktop Companion Software and update the software on the Solmetric SunEye device. If not already installed, the installation will install Microsoft ActiveSync (for Windows XP) or Windows Mobile Device Center (for Windows Vista), which is needed to communicate with the Solmetric SunEye device, and the Microsoft .net framework.

5 You can view the user's guide from the welcome screen by clicking on the "View Solmetric SunEye™ Users Guide" link in the welcome screen.

If at any time the Solmetric welcome screen is not showing, click on the Solmetric installer icon in the task bar at the bottom of your screen. If the welcome screen is accidentally closed, click on setup.exe from the DVD as described in Step 3 or reinsert the DVD to automatically launch.

During the installation, the device connectivity software will try to connect to the Solmetric SunEye device.

6 You can now launch the Solmetric SunEye™ Desktop Companion from the Solmetric SunEye™ icon on your desktop or from the **Start** menu **> All Programs > Solmetric SunEye > Solmetric SunEye**.

If this is the first time launching the Solmetric SunEye™ Desktop Companion, or there has never been data transferred from the Solmetric SunEye hand-held device, then there is nothing that can be done on the desktop at this point other than view the User's Guide. The screen you will see looks like this:
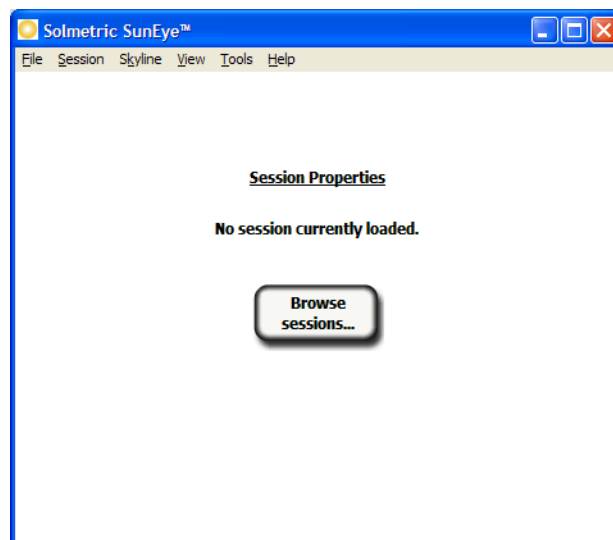
Figure 1-1. Session Properties

7 You can view the user's guide by selecting **Help > Solmetric SunEye User's Guide…**

N O T E   You must have Adobe Reader® installed in order to view the user's guide. Adobe Reader can be installed from the DVD welcome screen (setup.htm). Click on **Click here to install Adobe Reader**.

8 Select **File > Exit** to exit the application.

Charging the Battery

- The battery in the Solmetric SunEye is not removable. It may be recharged by attaching the device to the AC wall-plug or optional car charger via the DC power port on the right side of the device. Alternately, the Solmetric SunEye will trickle charge using the USB data port connected to a PC. However, the trickle charge can take up to 33 hours to fully charge the SunEye. If operating the SunEye while only plugged into a USB port, the SunEye will draw more current than the USB port can supply. Therefore, the he battery may discharge if connected to USB with power on.

- If the battery is completely discharged, you must use the AC charger if you want to operate the device while it is charging. The USB cable and the car charger do not supply enough current to both charge a completely discharged battery and operate the device.

- Charging the battery can take up to 2.5 hours. Once the battery has been charged, the device will operate without the external power connection for approximately 6 hours of continuous operation.

- Power Status LED Indicator:

  - Green = SunEye is turned on under battery power.
  - Red flashing = SunEye is plugged into power and battery is charging.
  - Red solid = SunEye is plugged into power and battery is fully charged.

- To see the current battery level of the SunEye, select the Menu icon, the Tools icon, and then select About Solmetric SunEye.

- It is not harmful to the device to be continuously connected to AC power or to a computer. It is also not harmful to the device or to your data for the battery to fully discharge.

Getting Familiar with the Solmetric SunEye

The Solmetric SunEye includes the following features to make it easy and efficient to use.

- Point-and-click data gathering
- Instant measurement results
  - Plots sunpaths for the latitude and longitude of the site
  - Determines annual, seasonal, monthly, and quarter-hourly shading percentages
  - Automatically adjusts data for magnetic declination for a specific location
- Stores more than 100 site readings on the hand-held unit
- Transfers data to desktop PC for later review
- Automatically generates reports and exported data files using the Desktop Companion software for desktop PC
- Hand-held, all-in-one tool with integrated fish-eye camera and processing software
- Easy-to-use finger-driven touch screen interface

SOLMETRIC SUNEYE™ 210

1	Digital camera with fisheye lens	6	Built-in stylus
2	Touchscreen VGA display	7	Reset button , DC Power, USB Port
3	Standard camera tri-pod mount (backside)	8	Home/Main Menu button
4	Power On/Off button	9	Five-way navigation buttons
5	Wrist/Neck strap attachment points	10	Quick Launch set-up buttons

System Controls and Settings

Power Button

- Pressing the power button switches on or off the Solmetric SunEye device.

- Holding the power button down for 6 seconds will initiate a soft reset. This reboots the device and will preserve any sessions already stored.

Touch Screen

The touch screen is the main interface that you will use to interact with the Solmetric SunEye. Although a stylus has been included, it is not necessary for general operation. The user interface has been carefully designed to allow easy control using your finger alone.

- Touching your finger tip to the screen is similar to moving a mouse cursor or other input device on a personal computer screen.

- Tapping your finger on the screen is similar to clicking a mouse.

NOTE   You will find that your fingernail works better than the fingertip on the touch screen.

Five-Way Navigation Button

The five-way navigation button can also provide input to many of the navigation features displayed on the Solmetric SunEye screen. For example, you can use the five-way navigation button to scroll through menus:

- Pressing the center button brings up the main menu.

- Pressing the left, right, up, or down button changes the selected menu item. The menu selection is highlighted in blue.

- Pressing the center button again selects the highlighted menu option. Small arrows show possible directions that can be pressed on the button to move to the next menu.

There are other specific uses of the five-way navigation button that are described in the following sections and chapters.

Home Button

Displays the Session Properties window.

Star Button

Jumps to Site Survey Mode and prepares the SunEye for a skyline snap.

Orientation Button

Jumps directly to the orientation view. This function is used to measure the direction (azimuth) of the solar array as well as the tilt of the array or pitch of the roof.

Neck Strap

The Solmetric SunEye comes with an optional neck strap and a wrist strap. You may attach the neck strap as follows:

1 The ends of the strap webbing are run twice through buckles on each end of the strap. Open one of the loops by removing the strap webbing from the buckle so that the webbing only passes once through the buckle.

2 Insert the webbing through one of the neck strap attachment points on the base of the Solmetric SunEye.

3 Pass the webbing back through the buckle.

4 Repeat for the other end of the strap.

Wrist Strap

You may choose to use the included wrist strap for an added measure of security with the freedom of easy one-handed operation. Simply thread the looped end of the wrist strap through either attachment point (whether left handed or right handed) and thread the sliding clamp through the open loop.

Resetting

Located on the right side under the I/O door, is a green button. The following table describes SunEye reset functions:

N O T E   In all reset cases, session data is not disturbed and will be available to transfer after the reset.

Table 1-1.

Reset Type	How Invoked	Behavior
Soft Reset	Hold down power button for 6 seconds. Wait 5 seconds. Press power button again normally.	Reboots the device in about 50 seconds. Does not lose date, time or any user data.
Hard Reset	Green side button.	Hardware reset. Reboots device and resets clock. This takes about 50 seconds
Reinstall Reset	Green side button + center navigation button	Performs a hard reset, reinstalls the SunEye application, and deletes SunEye user persistent settings (but does not delete any user data).

2
Using the Solmetric SunEye

This chapter contains step-by-step instructions for the basic use of the Solmetric SunEye 210, including the collection of solar access data.

Power-up the Solmetric SunEye 210

1 If the battery has not been fully charged as described previously, connect the power cable to the DC power port located on the right side, under the rubber I/O door.

2 Press the **Power** button.

Set correct Date and Time

3 Select menu icon at the bottom-left of the screen. You will see the Solmetric SunEye menu.

4 Alternatively, press the center navigation button to bring-up the menu.

5 Select to access the Tools menu

6 Select **Set Date and Time...**

7 Enter correct date, time, and time zone.

About Sessions and Skylines

The Solmetric SunEye organizes the solar access data in Sessions and Skylines.

Session	A "Session" is a *collection* of measurement data that was taken for a particular site visit. You will generally create a new session for each client or site you visit. An example of a session name might be "Roger Smith's House". One session will generally contain multiple skyline data sets and photos.
	You can add notes to the session to help identify the session in the future. For example, you could include client contact information or other information about the particular site being analyzed.
Skyline	A "Skyline" is a *single set* of solar access data captured at a specific location within a site. For example, one skyline might be captured at the north side of the roof of Roger Smith's house. Another skyline might be captured at the center of the roof of Roger Smith's House. A skyline includes a fisheye image, a sunpath diagram, and solar access calculations. Every time a new skyline is captured, the data is stored under the current session. One session can hold many skylines.
	You can add notes to a skyline to help identify the skyline in the future. For example, you could include the location of the captured data such as "north side of roof."

NOTE   The Solmetric SunEye can store more than 100 skylines (the actual number depends on the particular images captured and can store up to 200 in some cases). The number of sessions can vary. You can have one session with 100 skylines or 100 sessions with one skyline each.

Create a Session

A session is like a site visit. You would generally create a new session for each new client. Each session will generally consist of multiple skyline data sets. The Session menu selections are as follows:

- **Weather Properties** – shows the properties for the selected weather model. See "Weather, Air quality and Clouds" on page 4-3.

- **Session Solar Access Averages** – allows you to select the skylines used to compute the monthly

solar access averages. **See "Session Solar Access Averages" on page 2-17.**

- **Session Properties** – displays the current session properties.

- **Browse** – allows you to view and select a previously created session.

- **New** – creates a new session.

1 Select the menu icon then **Session** to view the Session menu.
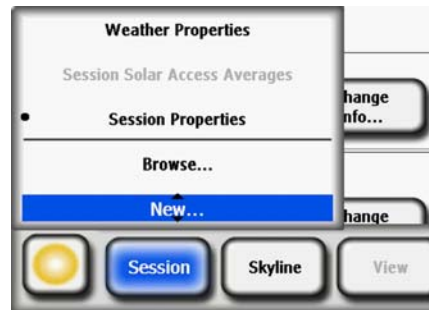
Figure 2-1. Session Properties

2 Select **New**.

You will see the **New session** dialog box**.**
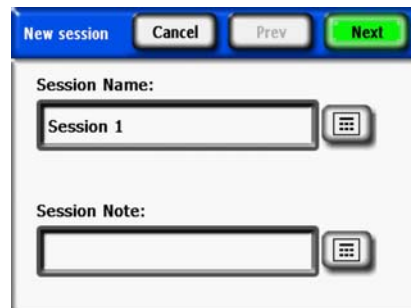
Figure 2-2. New Session

3 You can accept the default session name (for example, Session 1) or you can select the keyboard icon (next to the Session Name text box on the display) and enter a different name.

4 If you pressed the keyboard icon:

a To clear the current Session Name, click in the text box and click Clear Text.

b Select the characters from the keyboard to name the session.

c Press Enter.

For example, if you were creating a session for Roger Smith's house, you could enter the name to appear as shown.
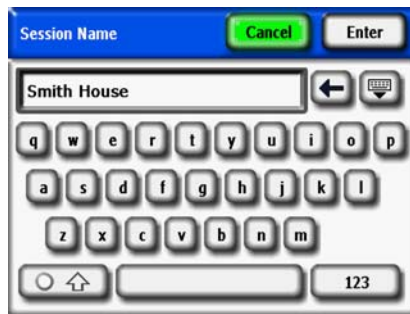
Figure 2-3. Session Name

The keyboard entry dialog has a few features that make entering and modifying text quick and easy. Select the Keyboard button to switch between an alphabetical keyboard and a QWERTY style keyboard. (That is, a conventional keyboard.) Also, as you type text, the Solmetric SunEye™ predicts the words you are typing. To select the predicted word, click on the word where it appears above the text area, as shown in the example below. This feature reduces the amount of typing required to enter text.
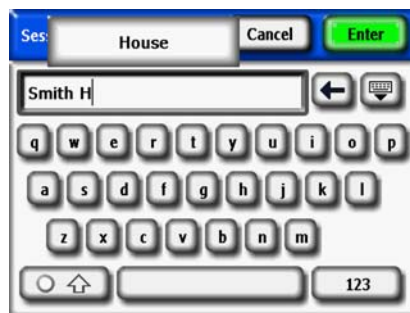
Figure 2-4. Session Name Auto Complete

5 Click inside the text box (where the typed letters appear) to bring up the scroll control. The scroll control (left and right arrows) allows you to move the cursor inside the text box to delete or add letters.

- Use the arrow buttons to move the cursor.

- Press **Clear Text** to clear all text.

- Click anywhere outside the scroll control box to close the scroll control.
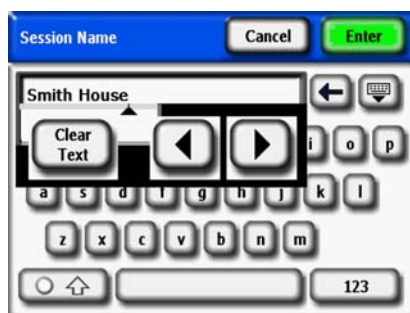
Figure 2-5. Scroll Control Box

Additionally, you can select the keyboard icon next to the **Session Note** text box and enter a description of the session. For example, you could enter the address of the site or the client's contact information.

Figure 2-6. Session Note

6 Select **Next** to advance to the **Location** dialog box to enter the site location information.

Figure 2-7. Location

7 Select the location of the site using one of the following methods.

- List of cities for the current region
- SunEye GPS
- Manual entry

- To select a city from a list of cities.

  a In the **Location** dialog, select **List of cities for the current region**, then **Next.**

  b Select the state where your site is located.

  c Click on **Next** and select the nearest city to the site.

Figure 2-8. City Location

The Solmetric SunEye will automatically determine the correct latitude, longitude, and magnetic declination for the city you select. It is not necessary to select the exact city since the latitude and longitude will be very similar for nearby cities. The lists of states and cities available depend on the currently selected region refer to "Select Locale" on page 2-23. The city latitude and longitude data was obtained from www.geonames.org.

• **Optional:** Use the SunEye GPS to acquire your current location.

    a In the **Location** dialog box, select **SunEye GPS,** then **Next**.

Figure 2-9. Get New GPS Location

    b Click on **Acquire Session Location** and the latitude, longitude and calculated magnetic declination will be acquired. If you would like the GPS to acquire the location for each new skyline, select the **Get new GPS location for each skyline** option.

• Alternatively, enter the location manually.

    a In the **Location** dialog box, select **Manual Entry.**

    b Enter the longitude, latitude, and magnetic declination. (If you have previously selected a city, the corresponding latitude, longitude, and magnetic declination for the selected city appear in the text boxes.) The Calculate button will recompute the magnetic declination for the latitude and longitude that are entered.

8 Select **Done**. You will see the Session Properties which lists the information you entered for the session.
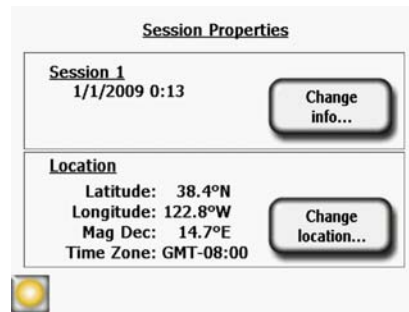
Figure 2-10. Session Properties

9 Change the weather model (United States only). In United States locations, there are two weather models available: NASA and NREL – TMY3 (Typical Meteorological Year). The weather model used by the SunEye may impact the insolation and solar access calculations. To learn more about the weather models, refer to "Weather, Air quality and Clouds" on page 4-5.

10 To select the most appropriate weather model for each session,

a Select *Session* > *Weather Properties > Change Weather Model...* .

b Select *NREL – TMY3* or *NASA – Kt*. If *NREL – TMY3* is selected, then information about the selected NREL weather station is displayed. By default, the SunEye selects the weather station that is closest in geographical distance to the session location that you entered. The name, Weather Bureau Army Navy (WBAN) identification number, and latitude and longitude of the station are displayed, as well as the distance from the session location to the station location. The optimal unshaded tilt and azimuth are also displayed for the specific location.

Figure 2-11. Weather Model

11 To change the weather station, for example, to better match weather patterns at the selected location, select "*Change Weather Model*" > *Next*. Select the US state or territory and then click **Next**, then pick the desired weather station from the list and click **Done**.

12 Change any information, as necessary.

N O T E	The time zone associated with a session is the time zone setting last set (via the **Set Date and Time…** dialog box) at the time the session was created. Changing the time zone (via the **Set Date and Time…** dialog box) does not change the time zone of any existing session or sessions. It is not possible to change the time zone of an existing session.

Site Survey Mode

The Solmetric SunEye 210 includes an operating mode used for initially surveying a site to understand exactly where on a roof or potential array site, the best module locations exist. In this mode a live preview is visible through the fisheye lens and in real-time the calculated sun's path is overlaid on the display. The sunpaths are automatically corrected for tilt and orientation such that you can simply walk the site, keeping the SunEye approximately level and oriented south and observe when and where any obstructions will cause shade any time of the year. Be aware of any nearby magnetic (iron containing) objects that may affect orientation measurements as discussed in the next chapter.

To enter Site Survey Mode press Select > **Skyline > New**

Or, Press the star Quick-setup button.

Capture a Skyline

A skyline is the basic data set representing the solar access for a particular location within a session or site visit. You will generally capture multiple skylines for each session. For example, if you were analyzing a roof site for a new solar installation, you might capture a skyline at each corner and at the center of the roof. A skyline consists of a fisheye image, superimposed sunpaths, and the calculated solar access numbers.

N O T E   The SunEye 210 has a built-in electronic compass. It is important to understand that all magnetic compasses are susceptible to magnetic fields from external magnets or objects containing iron such as a metal roof or chimney. Because the sunpaths in "site-survey mode" are computed relative to the electronic compass reading, it is important to keep away from ferrous objects when surveying a potential array site. Operation is different when capturing a skyline. After snapping a skyline, sunpaths are computed assuming the SunEye is pointed south. If you can't avoid nearby ferrous objects, a work-around is to site a reference point directly south using a distant object and using that reference when orienting the SunEye during skyline snaps.

1 Select **> Skyline > New**

Before capturing the first skyline in a new session, you will need to set the default skyline panel orientation for the session from the Panel Orientation dialog box.

Figure 2-12. Panel Orientation

You can change the default skyline panel orientation by tapping on the **Panel Azimuth** and **Panel Tilt** numeric boxes. If **True azimuth** is selected, then the panel azimuth entered is the true azimuth. If the **Magnetic azimuth** is selected, the panel azimuth entered is magnetic.

N O T E   For panel azimuth; 0° is north, 90° is east, 180° is south, and 270° is west. For panel tilt, 0° is flat, 90° is vertical.

Tap the **Set Tilt = latitude, Azim = 180°(S)** button to set the orientation to the default, which is tilt = latitude, azimuth = 180° (in northern hemisphere) or 0° (in southern hemisphere).

N O T E	When the first skyline in a new session is created, the skyline's panel orientation is set to the default skyline panel orientation. The panel azimuth and panel tilt of a skyline can later be changed from **Skyline > Properties**. When a new skyline is created, the panel orientation always defaults to the orientation of the last skyline. To measure orientation and tilt with the SunEye built-in inclinometer and electronic compass, See "Orientation" on page 2-23.

2 Set the default skyline panel azimuth and panel tilt, then select **OK**.

You will now see a live preview of the skyline through the fisheye lens with the correct sunpaths for that location superimposed on top.

Figure 2-13. Preview Mode

For northern hemisphere orient the Solmetric SunEye toward the south by lining up the compass needle with **S**. This orientation is for a location in the northern hemisphere. For a location in the southern hemisphere, line up the compass needle with **N** to orient the device true north.

N O T E	The Solmetric SunEye automatically accounts for the magnetic declination based on the location you entered for the session.

3 Hold the instrument level by adjusting the position and observing the electronic bubble level. It is level when the green dot is inside the center circle

4 Click the Camera icon or press the center navigation button (thumb works best).

The Solmetric SunEye performs the following tasks:

- Captures the entire horizon with the built-in fisheye lens and digital camera.

- Plots the sunpaths on top of the captured digital image of the skyline.

- Acquires the location using the GPS if this property is set.

- Analyzes the image and attempts to identify unobstructed open sky and shade-causing obstructions.

- Calculates the monthly, seasonal, and annual solar access percentages.

- Calculates the annual solar resource percentages.

|	
N O T E	The accuracy of the measurement is directly related to how close to true south (or north in the southern hemisphere) the compass needle points and to how level the unit is held at the time the skyline is captured. Care should be used during this critical step. If the orientation is not within 3° of true south (or north in the southern hemisphere) during the picture snap and within 3° of

level, a warning message will be displayed indicating the issue. It is strongly recommended that you delete this skyline and start again if this occurs. To do this, press **OK**. After the current calculation is complete, press the left Navigation button to delete and simply try again.
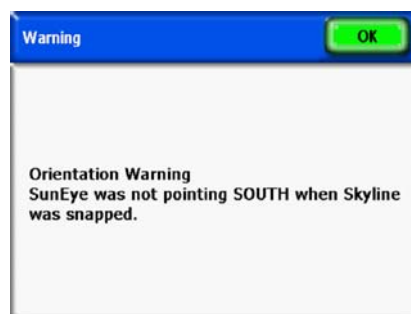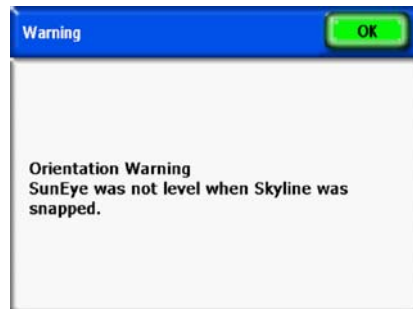
5 Verify that the software has correctly identified the open sky and obstructions. You can verify that the yellow and green shading is correct by looking at the image through the shaded colors. Make sure obstructions are green and open sky is yellow. Incorrect identification will affect the accuracy of the calculations. Correct the shading if needed with the Edit tool as described below.

Skylines are automatically saved every time they are captured. To delete the skyline data that you just captured, press the navigation button to the left. Alternatively, to immediately capture another skyline, press the **Star** button.

6 Tap your finger on the top-right corner of the screen to enter a note for the captured skyline. The note could include a description of where the skyline was captured. For example, you could enter "Southeast corner of roof." You can also enter a skyline note via the **Skyline Properties** dialog box, described in the next step.

7 You can view and change the properties of a skyline by selecting **> Skyline > Skyline Properties….**

The **Skyline Properties** dialog box had two tabs, Panel and General. The panel orientation for a skyline can be modified in the Panel tab. Other skyline properties can be accessed in the General tab.
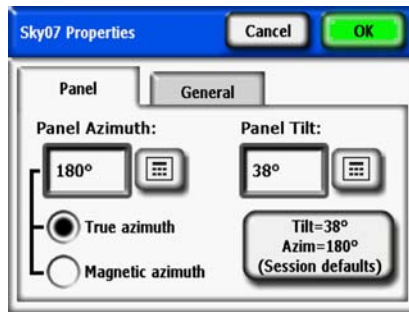
Figure 2-14. Skyline Properties

The panel orientation is changed in a method similar to setting the default skyline panel orientation in the **Panel Orientation** dialog box, refer to "Capture a Skyline" on page 2-9 for details.
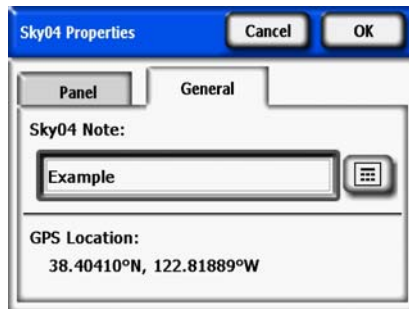
Figure 2-15. Skyline Note

You can enter or change the note for the skyline by tapping on the **SkyXX Note** text box located under the General tab.

If a GPS was used to make a measurement at the time the skyline was created, then the GPS location will be displayed.

View the Skyline Measurement Data

You can choose from four main views of your skyline data, and one average data view of all skylines in your session:. The view are:

- Annual sunpaths view

- Monthly solar access view

- Obstruction elevation view

- Full fisheye view

- Session solar access averages

Annual Sunpaths View

The first display that you see after you capture a new skyline is the annual sunpath view. You can also access this view by selecting > **View** > **Annual sunpaths**. This view shows the annual sunpaths drawn on top of the captured skyline. The detected open sky is shown in yellow. The detected shade-causing obstructions are shown in green.

The Results panel in the lower center portion of the display can be configured to show solar access percentages or solar resource percentages.

Solar Access: The annual and seasonal solar access is shown in the Results panel. The seasonal month ranges, May-Oct and Nov-Apr, represent the common peak and off-peak rate seasons. Your local utility may use a different set of months.

Solar Resource: Tilt Orientation Factor (TOF) and Total Solar Resource Fraction (TSRF) are used to compare the actual site characteristics to the optimal characteristics at that site. TOF and TSRF can only be displayed when the NREL – TMY3 weather model is selected (US only). Refer to "Weather, Air quality and Clouds" on page 4-5 for more information.

- To toggle between Solar Access and Solar Resource, select > **View>Configure Current View**, and select Solar Access or TOS/TSRF.
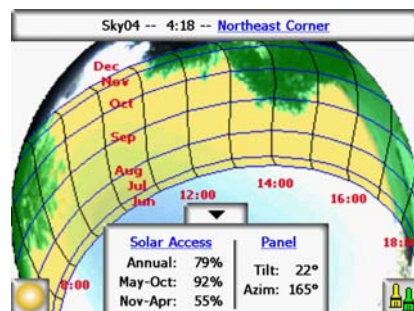
Figure 2-16. Sunpaths View

NOTE	You can magnify the screen using the zoom tool. See "Zoom and Pan Tools" on page 2-20.

The results panel with the solar access/solar resource numbers and edit button can be lowered to see the image behind it by pressing the down arrow. It can be raised again by pressing the up arrow.

NOTE	The sunpaths are shown in clock time, meaning the hour lines represent actual clock time. This is in contrast to solar time. Solar time is based solely on the location of the sun in the sky and can differ from clock time by approximately 30 minutes. You may notice that the image is a mirror image. This is done purposely to provide a display that is consistent with user orientation. The fisheye camera perspective is shot from the ground looking up while the user perspective is looking down at the display. By reversing the image, the sunpaths will go from left (morning) to right (evening) when overlaid on the fisheye image.

NOTE	The sunpath hour lines do not take into account daylight savings adjustments.

Month labels The month lines represent the path of the sun on the 21st day of that month. Because the sunpaths show clock time, it is not possible to clearly display all 12 months of the year. The sunpaths will always display the summer and winter solstices (June 21st and December 21st). To select which months are shown in between the solstices, select:

> **View** > **Configure current view...** and select Jun-Dec or Dec-Jun for the month labels.
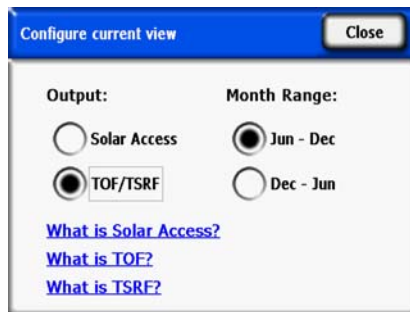
Figure 2-17. Configure View

Monthly Solar Access View

Select > **View** > **Monthly solar access**. You will see the bar chart of the monthly solar access for the location where you captured data.
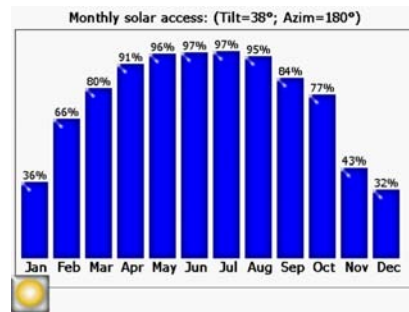
Figure 2-18. Monthly Solar Access

The height of the bars and the numbers at the top of each bar indicate the percentage of solar energy available each month for the site-specific shade conditions. If there were no shade obstructions, the bars would all indicate 100%. If the location was shaded all year round the bars would all indicate 0%.

Obstruction Elevation View

Select > **View > Obstruction Elevation**. You will see the graph showing elevation angle of the highest obstruction at each azimuth. The Obstruction Elevation view can be configured for a range of azimuth values to display the elevation data trace every one degree, bars showing maximum (or average) data within specified azimuth windows, and sunpaths.
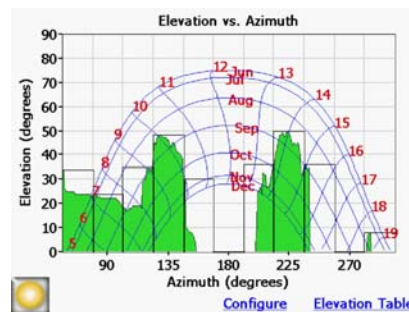
Figure 2-19. Obstruction Elevation Angle View

NOTE

Some information from the SunEye may be lost in Obstruction Elevation view. The elevation data shows the highest obstruction elevation data. Open sky that is below an obstruction will not be visible in the Horizon view. This is common when there are overhanging obstructions, such as a tree branch or light post.

To configure the display for Horizon view, select > **View > Configure current view...**. The Obstruction Elevation Properties dialog is displayed.

NOTE	The obstruction elevation view may show spikes or unusual results. Check that there are no obstruction (green) artifacts and if so remove them in edit mode (from the annual sunpath view).
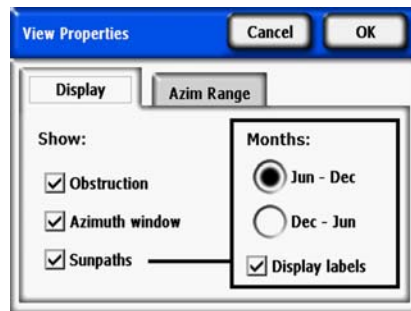
Figure 2-20. View Properties

In the Display tab, select what data will be displayed on the graph:

• Obstruction is the elevation data with one degree resolution

• Azimuth window is the overlaid bar graph of azimuth values for which the maximum (or average) data will be displayed

• Sunpaths.

Also select which month label will be displayed on the sunpaths, Jun-Dec or Dec-Jun.
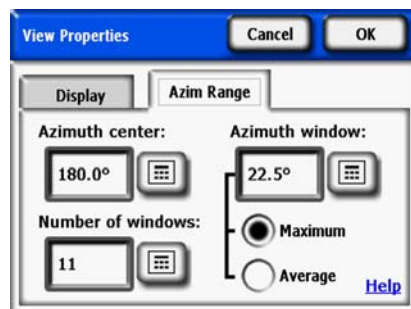
Figure 2-21. Azimuth Range

In the **Azim Range** tab, select the **Azimuth center**, in degrees, for example, 180 for south, This value is the center of the x-axis in the graph. Next, select the **Number of windows** that will be displayed and the **Azimuth window** size in degrees. Note that there must be an odd number of Azimuth windows, since there is one center window centered around the Azimuth center, and an equal number of Azimuth windows on each side of that center window. The Start and Stop azimuth values will be automatically computed from the above values. Lastly, select whether the **Maximum** or **Average** elevation value will be displayed for each Azimuth window. Press **OK**, and the graph will be modified with the new settings.

Select > **View** > **Obstruction Elevation** > **Elevation Table** to show a table of the specified Elevation values in the Azimuth windows. An example, is shown below. Select **OK** to return to the graph.

Figure 2-22. Elevation Table

Full Fisheye View

Select **>View > Full fisheye.** This display option shows the full view of the site captured through the fisheye lens of the camera.

Figure 2-23. Full Fisheye View

You can magnify the screen using the zoom tool. See .

Session Solar Access Averages

Select **> Session > Session Solar Access Averages.** After selecting the skylines in the session you would like to average, the **Session Solar Access Averages** will be displayed. This view calculates the average annual, seasonal, and monthly solar access values for the selected skylines in the currently opened session.
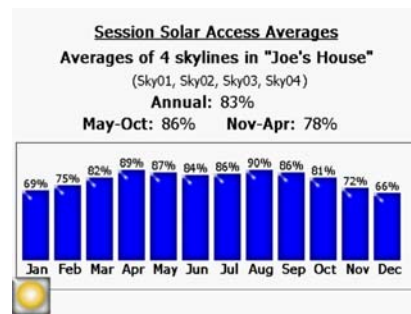
Figure 2-24. Session Solar Access Averages

Tools

This section describes the Edit Tool and Zoom and Pan Tools.

Edit Tool

The Edit tool allows you to modify the open sky (yellow) and shade-causing (green) obstructions for the following uses:

• See the effects of adding or removing shade-causing obstructions. For example, a tree or part of a tree can be removed to see the effect of cutting down or trimming the tree. Or, the area in between story poles can be filled-in to see the effect of a new proposed building.

• Correct the open sky (that is, the yellow shaded area) if the software incorrectly detects the open sky or obstructions.

When your edits to the open sky and obstructions are applied, the Solmetric SunEye recalculates the solar access numbers. The new calculations allow you to see the difference in solar access between current conditions versus hypothetical conditions.

1 Open the edit tool by pressing in the bottom right corner of the results panel in the annual sunpaths view. If you are not already there, you can get to the annual sunpaths view by selecting

 > View > Annual Sunpaths.

2 To add open sky, select the yellow open Sky Paint Brush ( ) to edit the open sky portion of the captured image:

  a Click in the image where you want to add open sky.

  b Paint by moving your finger around in the image.

Your finger nail provides the best control for painting. Try to maintain contact with the screen when moving the brush around the image. You can hold the paint brush anywhere in the large box that surrounds the small yellow square. Only the yellow square actually paints.
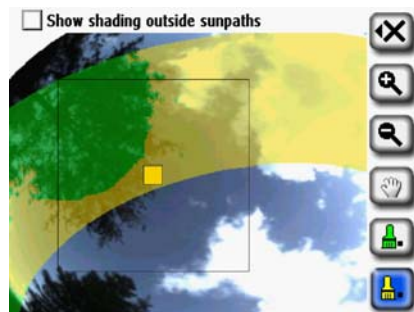
Figure 2-25.

3 To add obstructions, select the green obstruction paint brush to draw in shade-causing obstructions. For example, you may want to determine what the solar access will be when a fast-growing tree is a few feet taller or when a new structure is built. You can do this by painting-in the new obstruction.
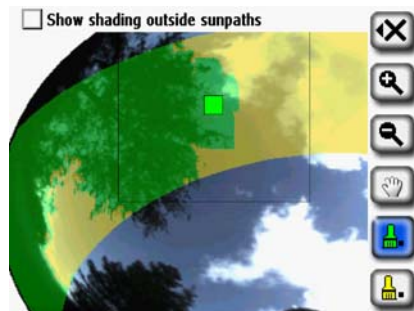
Figure 2-26.

4 To cover a large area on the screen with the paint brush, select the brush icon again to increase the size of the brush. You will see two squares on the tool icon, indicating the large brush:
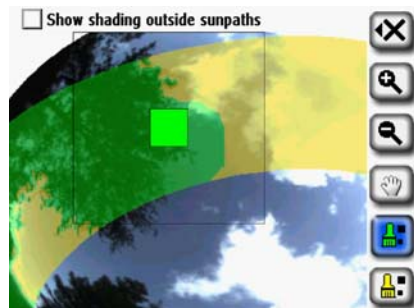
Figure 2-27.

If you want to return to the smaller brush size, select the brush tool again to decrease the size of the brush. You will see one square on the tool icon, indicating the small brush.

5 To enable editing of the outside sun paths, select "Show shading outside sunpaths" (located at the

top of the Edit window. The screen will change to show the entire image as opposed to just in the sunpath region as shown below:

Figure 2-28.

6 Select the **X** icon and then select **New Scenario (SkyXX-N)** to save your edited version as a new scenario. This will create a new skyline scenario with the edits and preserve the original skyline without the edits. With this Scenario feature, multiple skyline scenarios can be viewed for comparison.

Figure 2-29.

7 Select Apply Changes if you wish to keep changes made after editing. This will replace the original and the original without edits will no longer be available.

8 If you want to keep the current shading (that is, the yellow and green shading) of the open sky and obstructions, select **Cancel Changes**.

You can magnify the image using the zoom tool as described in "Zoom and Pan Tools" on page 2-20.

Zoom and Pan Tools

You can magnify the skyline image using the Zoom tool and pan the screen using the Pan tool. These tools are available in the following display modes and views:

• View > Annual Sunpaths View

• Skyline menu

• Full Fisheye View (in desktop only)

• Skyline menu > Edit Open Sky (in desktop only)

While in the Annual Sunpaths or Full Fisheye views, you can access the zoom and pan tools by selecting ![icon] >**View > Zoom**. In Edit mode, the zoom and pan tools are part of the tool bar on the right side of the display.

- Use the zoom-in (![icon]) and zoom-out (![icon]) tools to magnify or demagnify the displayed image.

- Select the Pan tool (![icon]) to pan around the image of skyline data by sliding your finger across the screen. Using your fingernail, as opposed to fingertip, works best.

N O T E   If you are in the Edit tool, you will need to select the pan tool before you can pan the image.

Browsing for Data

You can view previously saved session and skyline data by browsing the stored sessions or skylines.

To Access the Sessions

1 Select ![icon] > **Session > Browse…** to see a list of currently stored sessions. Select a session from the list.

2 Select **Open** to make the selected session the currently open session.

3 Select **Delete** to erase the selected session and all of the associated skylines from memory.

4 Select ![icon] > **Session > Properties** to see the session name, notes, and location information for the currently open session.

To Access the Skylines of the Currently Open Session

1 Select ![icon] > **Skyline > Browse…** to see a list of stored skylines that make up the currently open session. Select a skyline from the list.

2 Select **Open** to make the selected skyline the currently open skyline.

3 Select **Delete** to erase the selected skyline from memory.

4 Select ![icon] > **Skyline > Skyline Note…** to see or change the skyline note.

<table>
<tr><td>**N O T E**</td><td>You can also use the Solmetric SunEye Desktop Companion software to transfer the sessions and skyline data through USB to your PC to store, further analyze the data, or add or modify notes. See Chapter 3, "Using the Solmetric SunEye 210 Desktop Companion Software".</td></tr>
</table>

Tools Menu

Select then to access the Tools menu.

Figure 2-30. Tools Menu

GPS Setup

Use this dialog to set up the SunEye GPS.

Figure 2-31.

1 Click on **Test GPS** to test the GPS by acquiring the current location.

2 Select **Get new GPS location for each skyline** to automatically get the GPS location with each new skyline.

Select Locale

Use this dialog box to specify your language and country of origin.

Figure 2-32.

Orientation

Displays the current azimuth, tilt, and GPS coordinates of the SunEye 210. Use this tool to determine panel orientation. The values can then be entered manually into the Panel Set-up screen as described in "System Controls and Settings" on page 1-8.

By laying the SunEye on the roof or array plane, with the top pointed in the direction the panels will face, both tilt and azimuth can be measured and entered into the Panel Set-up. Note that the orientation meter can display true or magnetic azimuth. Be certain that this selection agrees with that entered in the Panel Set-up dialog.

N O T E   Shortcut Tip: To go straight to the orientation meter, simply press the Orientation button on the front of the SunEye. This is handy whenever you need to measure a roof pitch or roof orientation.
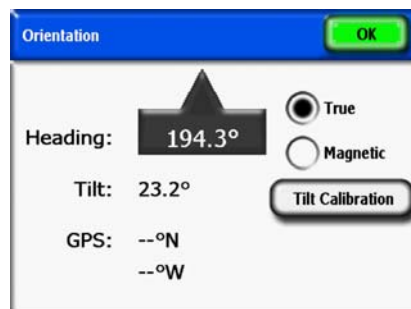
Figure 2-33. Note: GPS coordinates are displayed only if GPS Opt. is present and enabled.

Align Touch Screen

- Use this to realign the touch screen if the touch screen appears to respond to clicks offset from where you touch.

- When performing a touch screen alignment, use the stylus or a pointed (but not sharp) implement. It is important to hit the targets accurately and to not slide off the targets. The procedure will repeat until a set of valid touch points have been recorded.

Set Date and Time

Use this to set the current date, time, and time zone.

N O T E

This is a key set-up parameter. You CAN NOT change this after initiating a session. Location, orientation, and even skyline editing can be changed later. However, the date, time, and time zone must be entered correctly initially.

About Solmetric SunEye

Use this to get information about the Solmetric SunEye, including software version and battery level.

3
Using the Solmetric SunEye 210 Desktop Companion Software

Introduction

The Solmetric SunEye desktop companion software has a similar user interface to the hand-held device. Once your Solmetric SunEye has been synchronized with the companion software through the device/USB cable, you can transfer your data from the Solmetric SunEye to your desktop PC. The data on your desktop PC is archived for later viewing and analysis. The same data views and tools available from the hand-held device are also available from the desktop software. The companion software also allows you to export the measurement data to a single report with a variety of file formats.

This chapter is a reference for the Solmetric SunEye desktop companion software operation and includes the following sections:

- Transferring, storing and viewing data

- Viewing and analyzing data

- Exporting and generating reports

Refer to "Using the Solmetric SunEye" for information about all other function descriptions.

If you have not yet installed the Solmetric SunEye™Desktop Companion software, please refer to the instructions in "Installing the Solmetric SunEye and Desktop Companion Software" on page 1-3.

Launch the Solmetric SunEye™ Desktop Companion from the Solmetric SunEye icon on your desktop or from the Windows **Start** button by selecting, **All Programs** > **Solmetric SunEye** > **Solmetric SunEye**.

N O T E   The Solmetric PV Designer Software is also accessible through the SunEye Desktop Software's Session menu. This software allows Photovoltaic system layout and design using SunEye data. While the SunEye Desktop Software is included with the SunEye, the PV Designer is licensed and sold as a separate product. To activate a trial, or to order the PV Designer Software, select **Session**, **PV Designer**. For additional information, see www.solmetric.com/pvdesigner.html

Transferring and Storing Your Data

Within the Desktop Companion application, select **File > Transfer from Device**.

The data transfer moves all sessions and skylines from your hand-held device to your desktop PC. The data files are no longer available on the hand-held device after the data transfer takes place. The data is stored on your PC in the location My Documents/Solmetric/SunEye/Sessions. The directory name for each transferred session is a combination of the session name and the time and date the session was created. For example, "2009_08_16.222016;Session 1." This way multiple sessions with the same name do not get overwritten.

NOTE

SunEye sessions can be shared among users of the SunEye Desktop Software. To share a session, the entire folder and its contents must be made available in the Sessions folder, normally **My Documents/Solmetric/SunEye/Sessions/**. the folder can be transferred via e-mail or through shared disc access. It is important not to alter the folder contents of the folder or file names.

Viewing and Analyzing your Data

Once you have transferred your data from the hand-held device to the desktop PC, you can:

- Browse sessions

- Browse skylines in the currently open session

- View the data for the currently open skyline

- Modify or add session or skyline notes.

- Edit the open sky regions of a skyline

Browsing Session Data

You can browse sessions by selecting **Session > Browse…** . You will see the following dialog box:
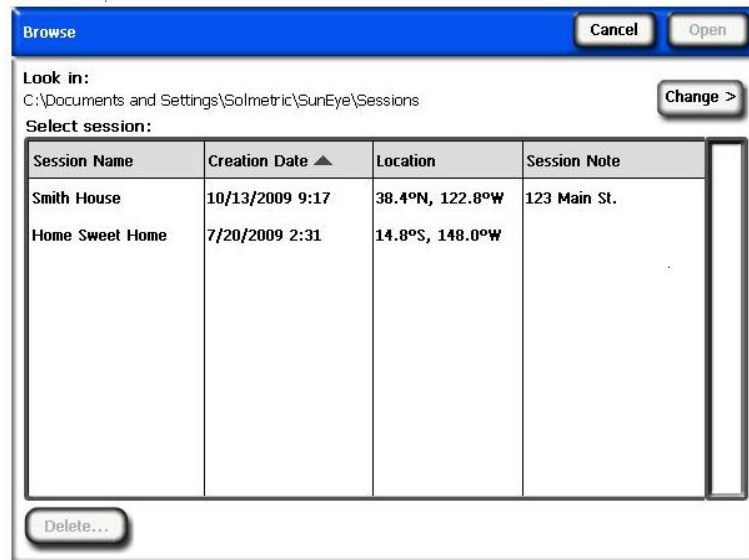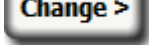
Figure 3-1. Browse Sessions

By default sessions are stored in:

My Documents\Solmetric\SunEye\Sessions

You can display sessions from a different directory by selecting **Change >** , then selecting **Change 'Look In' location…** . If you select **Set 'Look in' location to default** it will automatically display sessions from the default sessions directory.

N O T E   The Session browse dialog box orders sessions with the most recently created session at the top. You can reorder the list of sessions based on other column values by clicking on the column heading that you would like to sort by.

Exporting and Generating Reports

1 Within the Desktop Companion application, click **File > Export Session Report and Data** to export the session data to a report and to generate exported data files.

The export tool combines all of the skyline data for the currently open session into a single, easy-to-read report. It also generates the exported data files described below. The original data remains stored on your computer in the location described in "Browsing Session Data" on page 3-2. Exported reports are in an HTML document format that is viewable with a Web browser such as MS Internet Explorer®. You can quickly jump to data of interest using the hyper links in the file.

At the time the data is exported, you have the opportunity to customize the report.

2 Enter client information that will appear in the report, as shown below.

Figure 3-2. Client Information

Click **Next** to enter information about your company, including name and address.

Figure 3-3.

3 Click **Next** and select the skylines that will be used in session averages and session related output calculations and files.
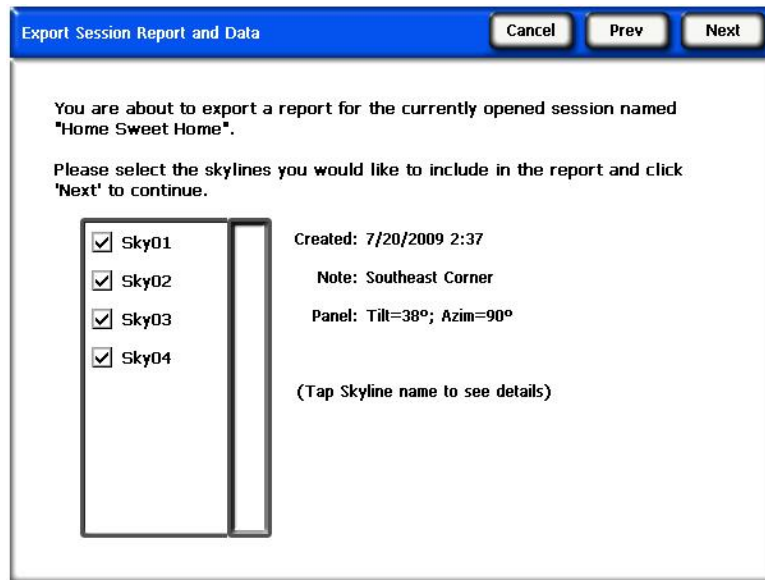
4 Click Next and define the Azimuth scale for the Windowed Obstruction Elevation data file, as shown below. This data is only required for the Windowed Obstruction Elevation data file, and the default values may be acceptable in many situations. If so, just press **Next** to continue the definition of the report.
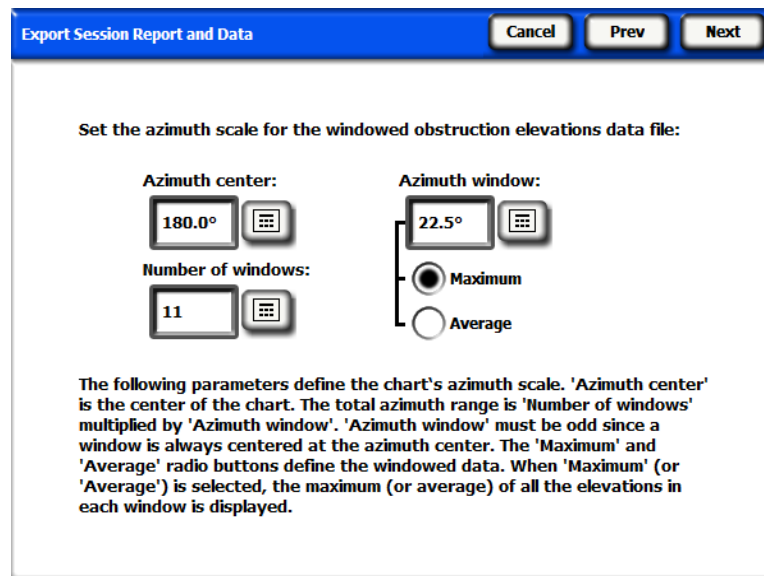
Figure 3-4. Obstruction Elevation Parameters

By default, the values previously entered in the hand-held device's View > Obstruction Elevation are loaded automatically, however they can be changed for the report. For more information about these values, refer to "Obstruction Elevation View" on page 3-14.

5 The Export tool gives you the opportunity to specify a specific location to store the report and the ability to select your company logo which will appear in the report.

Figure 3-5.

An HTML document is automatically created consolidating the data for a single session. The document contains the notes, annual sunpath and bar chart images for each skyline in the session.

6 Click **Export** to export the report.

7 Click **View report now...** to view the report. It can also be viewed later by selecting **File > Browse Exported Session Reports…**, or by navigating with Windows File Explorer to the location where the report was saved. By default, reports are saved in `My Documents\Solmetric\SunEye\Exported Reports`.

Print the Report

The report contains a hyper link under the title, Importable and printable version of the report that does not include the hyper links and can be imported into other software programs such as MS Word® or Adobe Acrobat®, or it can be printed and given to clients. Print the report by selecting "print" from your browser.

Save Images from the Report

Images in the report can be saved for use elsewhere by right clicking on the image and selecting **Save image as…** . Images in the report can also be found in the directory that the report was saved under the sub-directory **Exported Files**. These images can be used to create your own custom report.

Convert Report to Other Formats

The HTML report generated by the desktop companion software can be converted to other formats such as .doc or .pdf by opening it in the appropriate editor (for example MS Word or Adobe Acrobat) and then saving it as the file type you prefer.

In MS Word, there is a specific procedure that must be followed in order to convert HTML documents to .doc documents in which the images show up as permanent elements of the document rather than as links:

MS Word 2003™

1 Open the .htm report in MS Word

2 From the **Edit** menu choose **Select All**. This will select everything in the document.

3 On your keyboard, press the key combination **Ctrl-Shift-F9** together. This will convert all external links to embedded content.

4 Go to **File** and choose **Save As**. Under **Save as type** select **Word Document (*.doc)**, then click **Save**.

Microsoft Word 2007™

When saving a SunEye report to a single file document using Microsoft Word 2007, it is recommended that you save it as PDF. The functionality to save Microsoft Word 2007 documents as PDF documents is not enabled by default within Microsoft Word 2007, however, Microsoft provides a free Add-in that supplies this functionality, which can be downloaded from Microsoft. The name of the Add-in is "Microsoft Save as PDF or XPS". Once this Add-in is installed, follow these instructions to save a SunEye exported report as a PDF document.

1 From Microsoft Word 2007, go to the main menu and select "Open...".

2 Browse to the directory where you exported the .htm report. You will see two versions of the report. Open the version that has "importable and printable" in the name.

3 Select "Save As", and under "Save as Type" select "PDF (*.pdf)".

Exported Data Files

The report also includes a table of hyper links to a number of data files, including comma-separated-value (.csv) files. These .csv files can be opened directly in MS Excel® or other software for further analysis.

Each .csv file has a header section at the beginning of the file that includes information such as the session and skyline names. The end of the header information and beginning of the data is always marked by the text `begin data`. The first line of the file describes the type of data and includes a version number. For example, `Daily Solar Access 1.0` indicates that the file is the daily solar access file and the file format is version 1.0. A description and example of each file type is given below. In each file name the XX would be replaced by the skyline number (for example, 01, 02, and so on for Sky01, Sky02, and so on).

SkyXXDailySolarAccess.csv

This table provides the solar access percentage for every day of the year. It also includes the monthly, seasonal, and annual solar access percentages. An example of the header and part of the data is shown below:

Daily Solar Access 2.1

Session Name:	Session1
Skyline:	Sky01
Creation Date:	11/3/2009 10:43:00 AM
Latitude:	37
Longitude:	-122
Mag Dec:	14
Panel Tilt:	37
Panel Azimuth:	180
Time Zone:	GMT-8:00

			Month											
begin data	Day		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		1	35.16	36.72	38.16	55.61	64.65	85.11	95.29	77.34	54.97	47.97	40.07	29.13
		2	35.16	36.72	38.16	55.61	64.65	85.11	95.29	77.34	54.97	47.97	40.07	29.13
		3	35.16	36.72	38.16	55.61	64.65	85.11	95.29	77.34	54.97	47.97	40.07	29.13
		4	35.16	36.72	38.16	55.61	64.65	85.11	95.29	77.34	54.97	47.97	40.07	29.13
		5	29.36	40.23	41.05	55.11	67.64	85.14	92.22	69.85	54.87	45.17	36.68	29.35
		6	29.36	40.23	41.05	55.11	67.64	85.14	92.22	69.85	54.87	45.17	36.68	29.35
		7	29.36	40.23	41.05	55.11	67.64	85.14	92.22	69.85	54.87	45.17	36.68	29.35

SkyXXShading.csv

The following table shows a 1 or a 0 every 15 minutes of every day of the year. A 1 indicates that time and date is not shaded and a 0 indicates that it is shaded. This table is particularly useful for time-of-use (TOU) analysis.

- This data is in standard time and does not include adjustments for daylight savings.

- This data is not affected by panel tilt or azimuth orientation.

This data file can be imported into different analysis software programs, including OnGrid (see: http://www.ongrid.net), and PVOptimize (see: http://www.PVOptimize.com). An example of the header and part of the shade data is shown below:

Shading 1.1

Session Name:	Session 1
Skyline:	Sky01
Creation Date:	11/3/ 2009 10:43:0 0 AM
Latitude:	37
Longitude:	-122
Mag Dec:	14
Panel Tilt:	37
Panel Azimuth:	180
Time Zone:	GMT- 8:00

A value of "1" implies that the time interval is exposed to open sky. A value of "0" implies that the time interval is shaded.

These values are not affected by panel tilt or azimuth.

begin data	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00
1-Jan											0	0	0	0	0	0	0
2-Jan											0	0	0	0	0	0	0
3-Jan											0	0	0	0	0	0	0
4-Jan											0	0	0	0	0	0	0
5-Jan											0	0	1	1	0	0	0
6-Jan											0	0	1	1	0	0	0
7-Jan											0	0	1	1	0	0	0
8-Jan											0	0	1	1	0	0	0
9-Jan											0	0	1	1	1	0	0
10-Jan											0	0	1	1	1	0	0
11-Jan											0	0	1	1	1	0	0
12-Jan											0	0	1	1	1	0	0

SkyXXInsolation.csv

The following table provides the weather-corrected insolation in Wh/m^2 every 15 minutes for every day of the year for the specific panel tilt and azimuth specified for the skyline. For the NASA weather model, weather corrections are based on historical average monthly clearness indexes from NASA. For the NREL – TMY3 weather model, corrections are based on the hourly NREL data for the weather station specified in the session.

• This data is in standard time and does not include adjustments for daylight savings.

• These values are not affected by shading (that is, they assume no shading).

An example of the header and part of the data is shown below:

Insolation 1.1

Session Name:	Session 1
Skyline:	Sky01
Creation Date:	11/3/2009 10:43:00 AM
Latitude:	37
Longitude:	-122
Mag Dec:	14
Panel Tilt:	37
Panel Azimuth:	180
Time Zone:	GMT-8:00

Numbers along each data row are quarter-hour insolation contributions (Wh/m²) of that time period assuming no shading and the panel tilt and azimuth specified above. Monthly clearness indexes have been applied.

Clearness indexes:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	0.53	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.5					
begin data	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00
1-Jan											20	36	48	59	70	80	90
2-Jan											20	36	48	59	70	80	90
3-Jan											20	36	48	59	70	80	90
4-Jan											20	36	48	59	70	80	90

	19	36	47	58	69	80	90
5-Jan	19	36	47	58	69	80	90
6-Jan	19	36	47	58	69	80	90
7-Jan	19	36	47	58	69	80	90
8-Jan	19	36	47	58	69	80	90
9-Jan	19	35	47	58	69	80	90

SkyXXObstructionElevations.csv

The following table reports the elevation of the highest shade-causing obstruction for every 1°
of azimuth (that is, compass heading). The azimuth is given in two different range formats: 0° to
360° and -180° to +180°. In the -180° to +180° format, 0° is south when in the northern hemi-
sphere and north when in the southern hemisphere. The data includes information about the
entire sky and horizon, including obstructions that appear outside of the sunpath region. The
region outside of the sunpaths may be important for ambient light analysis. The obstruction ele-
vation data in this file is also useful for importing into other design analysis software. An exam-
ple of the header and part of the data is shown below:

Obstruction Elevations 1.1

Session Name:	Session 1
Skyline:	Sky01
Creation Date:	12/12/2009 0:16
Latitude:	39
Longitude:	-123
Mag Dec:	15
Panel Tilt:	37
Panel Azimuth:	180
Time Zone:	GMT-8:00

The elevation given for each azimuth represents the highest point a shade causing obstruction occurs at that
azimuth.

begin data

Compass Heading (0-360deg; North=0; East=90)	Southernly Oriented Azimuth (-180 to +180; south=0; East=-90)	Elevation (0 to 90)
0	-180	55
1	-179	56
2	-178	56

3	-177	56
4	-176	56
5	-175	56
6	-174	56
7	-173	56
8	-172	57
9	-171	57
10	-170	57
11	-169	57

SkyXXObstructionElevation.xml

This file is an XML version of the SkyXXObstructionElevations.csv file described above. This file can be imported into the Clean Power Estimator and Quick Quotes analysis software (go to http://www.clean-power.com).

SkyXX_PV_SOL.hor

This is a shading file that is importable by PV*SOL and T*SOL (Valentin Energy Software).

SkyXX_PVSYST.hor

This is a shading file that is importable by PVSYST (GROUPE ENERGIE (CUEPE), University of Geneva).

SkyXXWindowedObstructionElevations.csv

This file contains elevation values, either average or maximum, within user-specified azimuth windows. It can be considered as a specific view of the data contained in the SkyXXObstructionElevation.csv file described in . An example of the header and data is shown below:

Windowed Obstruction Elevations 1.0	
Session Name:	Session 1
Skyline:	Sky01
Creation Date:	12/1/2009 15:48
Latitude:	38.4
Longitude:	-122.7

Mag Dec:	14.7
Panel Tilt:	0
Panel Azimuth:	180
Time Zone:	GMT-08:00
Azimuth center:	180
Azimuth window size:	22.5
Number of windows:	11
The elevation given for each azimuth window center is the maximum of all of the elevations in that window.	
begin data	
Azimuth Window Center (North=0; East=90)	Maximum Elevation (0-90)
67.5	22
90	19
112.5	27
135	36
157.5	50
180	55
202.5	52
225	51
247.5	51
270	48
292.5	37

AverageSolarAccess.csv

There is only one of these files per session. It contains the solar access averages of all the sky-lines contained in the session. An example of the header and data is shown below:

Average Solar Access 1.0	
Session Name:	Session 1
Creation Date:	2/16/2009 17:02
Latitude:	39

Longitude:	-123
Mag Dec:	15
Time Zone:	GMT-8:00
Number of skylines:	3

The values reported are average percentages of all the skylines(3) contained in this session.

begin data	
Annual:	67
May-Oct:	76
Nov-Apr:	54
Jan:	40
Feb:	48
Mar:	56
Apr:	76
May:	84
Jun:	87
Jul:	84
Aug:	82
Sep:	60
Oct:	56
Nov:	39
Dec:	49

AverageShading.csv

There is only one of these files per session. This file contains the average shading information of all the skylines contained in the session. The format of this file is similar to that of the Sky-XXShading.csv shading files, however each data entry contains the average shading for that time increment for all skylines in the session. The values are in the range of 0 to 1.

ObstructionElevations.csv

There is only one of these files per session. This file contains a session summary of Obstruction Elevations for *all* skylines in the session. Elevation is shown for the highest shade-causing obstruction for every 1° of azimuth (that is, compass heading). The Maximum and Average elevations for all skylines in the session are displayed for every one degree spacing. The azimuth is given in two different range formats: 0° to 360° and -180° to +180°. In the -180° to +180° for-

mat, 0° is south when in the northern hemisphere and north when in the southern hemisphere. The data includes information about the entire sky and horizon, including obstructions that appear outside of the sunpath region. The region outside of the sunpaths may be important for ambient light analysis. The obstruction elevation data in this file is also useful for importing into other design analysis software.

WindowedObstructionElevations.csv

There is only one of these files per session. This file contains a session summary of Windowed Obstruction Elevations for all selected skylines in the session, with the Azimuth window definitions defined by the user. If the maximum elevation is selected for each Azimuth window in a skyline, then it applies to *all* skylines in the session. If the average elevation is selected for each Azimuth window in a skyline, then it applies to *all* skylines in the session.

Tip: To select average or maximum elevation, select the desired setting in the Export Session Report and Data... and ensure the desired setting is selected for Maximum or Average.

GoogleEarthGeotags.kmz

This file will only be created if at least one skyline included in the report was created using the option to get a new GPS location for each skyline. In this event, there will only be one file per session. This is described in the "GPS Setup" on page 3-25. To view this KMZ file it is required that you have Google Earth™ installed. This can be obtained at http://earth.google.com. Each of the skylines in the report with GPS coordinates will show up as interactive place marks within Google Earth. The location of each place mark will be determined by the GPS coordinate of the skyline. Clicking on a skyline place mark will open a window with report information and images about the skyline. The GPS coordinates for a skyline can be edited in the Desktop Companion software in the Skyline Property dialog. A place mark location may also be edited within Google Earth by right clicking on it, selecting Properties, and then dragging the place mark to a new location. You may then save any new locations to a new KMZ file from within Google Earth by going to the File menu and selecting "Save Place As".

4
Solar Access and Interpretation of Data

Introduction

This chapter gives an overview of the different variables involved in solar access and details about how the Solmetric SunEye calculates solar access. Solar access is defined as the amount of available solar energy or insolation in a particular location.

The reported solar access percentages are the amount of site-specific solar insolation available at the location where the data was captured given the shade-causing obstructions, divided by the solar insolation if there were no shading.

- If all trees, buildings, and other obstructions were theoretically removed, the solar access percentages would be 100%.

- If the measured site were completely shaded all year, the solar access percentages would be 0%.

In order to have an accurate estimate of the amount of insolation that will strike a specific surface over time, four variables need to be considered.

- Solar irradiance
- Shading
- Air quality and clouds
- Surface orientation

Solar Irradiance

The sun is a tremendous source of energy for the earth and is, in fact, the only significant net input of energy the earth has. Irradiance is the solar power incident on a surface, and is usually expressed in watts per square meter. Irradiance multiplied by time equals insolation. The average irradiance arriving on the planet after passing through the atmosphere is commonly approximated to be 1000 W/m^2. The irradiance above the atmosphere is 1367 W/m^2.

Due to the tilt of the earth's axis, the sun is higher above the horizon in the summer months and lower in the winter months. The sun will also appear higher in the sky when the observer's latitude is closer to the equator (0° latitude) and it will appear lower in the horizon as the observer's latitude is closer to the north or south poles (±90 ° latitude). The height of the sun in the sky is not affected by the longitude or the east-west location of the observer on earth.

The sun's elevation is the angle formed between the observer, the horizon, and the sun above the horizon. The azimuth is the angle created by the sun's deviation from true north in relation to the observer. The sun follows a predictable path through the sky based on the time-of-day, day-of-year, and latitude of the observer. Therefore, the elevation and azimuth angle of the sun can be calculated for any time, date, and latitude. The collection of sun trajectories for the entire year is called a sunpath diagram. For example, a sunpath for San Francisco, California that was generated by the Solmetric SunEye is shown below:
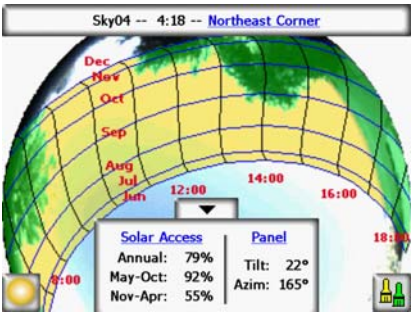

Figure 4-1.

The Solmetric SunEye automatically generates the sunpath diagram for the particular latitude where the data is collected. This sunpath chart is superimposed on top of the captured skyline image.

NOTE   The annual sunpaths are drawn in standard time and the exported *.csv data files are also in standard time. Daylight savings adjustments must be applied manually where appropriate.

Shading

Shading is a serious design parameter to consider with regard to the performance of a solar system, placement of a building, or in landscaping. The *Solar Living Source* book by John Schaeffer, comments on shading of crystalline PV collectors, "Short of outright physical destruction, hard shadows are the worst possible thing you can do to a PV module output."

Shading may be produced by geological formations, vegetation, and human-made structures, such as buildings. Minor shading can result in a significant loss of energy. This is because the solar cell with the lowest illumination determines the operating current of the series string in which it is connected. The voltage output may remain the same, but the current will be significantly reduced.

The Solmetric SunEye automatically gives an accurate analysis of the shading for the specific location.

Weather, Air quality and Clouds

Moisture, pollution, clouds, and particles in the atmosphere block a portion of the sun's energy from reaching the earth. This can impact the insolation and solar access calculations provided by the SunEye. Two weather models are incorporated into the SunEye: NASA and (in the US only) NREL – TMY3.

NASA Weather Model. The Clearness Index (K_T) is a number from 0 to 1 that describes the amount of solar radiation that passes through the atmosphere.

Historical clearness index data by region and solar insolation data is available from NASA at http://earth-www.larc.nasa.gov/cgi-bin/cgiwrap/solar/sse.cgi.

When the NASA weather model is selected, the Solmetric SunEye uses the NASA Clearness Index data. The SunEye contains an internal database of clearness indices by latitude and longitude for the entire world. The Solmetric SunEye software automatically accounts for the approximate average clearness index for the region you specify for your session when calculating the solar access.

NREL – TMY3 Weather Model. The United States National Renewable Energy Laboratory (NREL) publishes weather data for 1,020 locations in the United States. Each station has a Weather Bureau Army Navy (WBAN) identification numbers. This data shows "Typical Meteorological Year" (TMY3) data, and it contains insolation during all hours of the year. For more information, please see http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/. The SunEye uses TMY3 hourly insolation data when the NREL – TMY3 weather model is selected. When using this model, the NREL weather station must be selected, normally the one closest to where the SunEye session is being created.

In addition, when the NREL – TMY3 weather model is used, the SunEye has precomputed values for the optimal panel orientation (tilt and azimuth) for maximum annual insolation for all of the selected weather stations. The optimal orientation is dependent on weather, and allows calculation of TOF and TSRF which are defined as follows:

- Tilt and Orientation Factor (TOF). TOF is the solar insolation at the actual tilt and orientation divided by the insolation at the optimal tilt and orientation, expressed in percent.

- Total Solar Resource Fraction (TSRF). TSRF is the ratio of insolation available accounting for both shading and the specific tilt and orientation of the surface, divided by the total insolation available assuming no shade and assuming the surface is at the optimal tilt and orientation. TRSF is expressed in percent, according to the following equation: TSRF = Solar Access x TOF.

When the NREL – TMY3 weather model is selected, the SunEye can compute and display TOF/TSRF for each skyline. The average TSRF for all selected skylines in a session is also displayed in the exported reports.

To obtain Wh/m^2 or peak-sun-hours, take the solar access percentages from the Solmetric SunEye and multiply them by the average solar insolation for your region.

Surface Orientation

The amount of energy absorbed from the sun depends on the angle and orientation of the surface receiving the irradiation. For example, the magnetic orientation and tilt of solar panels affect the energy collected by those panels.   The difference in solar energy collected by a solar panel at 38.07° North with a 0° tilt versus a tilt of 35° is about 11%.

By default, solar access results in the Solmetric SunEye are based on the following assumed configuration:

- The receiving surface (a solar panel, for example) is oriented south if you are in the northern hemisphere, and oriented north if you are in the southern hemisphere.

- The tilt is equal to the latitude of the site location.

For example, if the latitude of the site that is being evaluated is 37, then by default the solar access calculations performed in the Solmetric SunEye are assuming a surface tilt of 37 from horizontal. This panel tilt and azimuth can be adjusted by the user for optimizing energy production and/or conforming to a roof structure.

The orientation used to calculate solar access can be changed via the **skyline properties** dialog. Refer to "Capture a Skyline" on page 3-9 for more information.

Shading can have a greater effect on energy output than the tilt and orientation of a system. Shifting a panel array in order to avoid shade or orienting panels to optimize collection during the unshaded times of day and year is one of the most important steps in solar system design.

For more information about designing and installing a solar system, see:

http://www.sandia.gov/pv/docs/Design_and_Installation_of_PV_Systems.htm

Numerical Calculations

When using the NREL - TMY3 data, the hourly insolation data is taken directly from the database for the weather station specified. When using the NASA data, the following numerical assumptions are made by the Solmetric SunEye™ software when calculating results:

- Solar constant (above-the-atmosphere solar irradiance): 1367 W/m^2

- Atmospheric pressure: 1013 mBars

- Atmospheric temperature: 15 °C

- Panel orientation: south with tilt equal to latitude

- Clearness index (K_T): NASA historical monthly averages by latitude and longitude

For either weather model, the solar access numbers reported by the Solmetric SunEye are percentages that are calculated by first calculating insolation (Wh/m^2) for every 15 minute time interval, every four days, for the entire year. This insolation value includes either average historical weather data for the latitude and longitude set in the session (NASA model), or hourly TMY3 weather data for the closest NREL station (NREL – TMY3 model, US only). Next, the skyline data is analyzed to determine which 15 minute intervals throughout the year are shaded. The sum of the unshaded 15 minute insolation values for a given period (for example 1 month) divided by the total insolation possible (assuming no shading) for the same period times 100 gives the solar access percentage for that time period.

5
Maintenance and Troubleshooting

Introduction

The Solmetric SunEye is an electronic device, please follow these guidelines to maintain its functionality and performance:

- The Solmetric SunEye device has an operating temperature range of 32°F (0 °C) to 113 °F (45 °C). Do not operate the device outside of this temperature range.

- The Solmetric SunEye device should never be exposed (that is, stored or transported) to a temperature below –4 °F (–20 °C) or above 140 °F (60 °C). Avoid leaving the device in the direct sun for an extended period of time. Even though the ambient temperature may be 80 ºF (27 °C), the temperature of the device left in sun for half an hour can easily reach 130 ºF (54 °C) or more.

- Do not expose to moisture or dust.

- Keep the software up to date by downloading the latest installation software from the Solmetric web site at: www.solmetric.com/support.

- Periodically clean the lens with a lint free lens cleaning cloth.

- Maintain the battery charge level and avoid allowing the battery to go completely dead even when not in use. "Charging the Battery" on page 1-5.

NOTE   Storage in the off state without the AC power or Device/USB cable attached will result in the slow discharge of the battery. It is not harmful to the device to be continuously connected to AC power or to a computer. It is also not harmful to the device or to your data for the battery to fully discharge, however you may be forced to go through a reset.

Magnetic Fields

Avoid nearby magnetic fields. The Solmetric SunEye is a sensitive measurement device. Magnetic fields from nearby iron can affect measurements and stronger magnetic fields may damage the SunEye. Always store and transport SunEye in the included magnetically shielded case to preserve the compass calibration. Never store magnetized objects, such as hand tools or other magnetized objects, in the case

Upgrading or Downgrading Software

Solmetric periodically publishes updates to the software. You can find the latest version of the Solmetric SunEye software at: www.solmetric.com/support. The software on the hand-held unit and the Desktop Companion are simultaneously installed from the same installation file.

- To upgrade your software, simply run the installer by double-clicking on the new setup executable file obtained from the web site. Purchase of additional licenses may be required.

- To downgrade your software version to an earlier version, you must first uninstall the current version as follows:

1 On the desktop computer go to **Start > Control Panel**.

2 Double-click on **Add or Remove Programs**.

3 Locate and select **Solmetric SunEye**.

4 Click **Remove**.

5 Close the **Add or Remove Programs** window.

6 Install the older version as you would any version, by double-clicking on the .msi file for the version you wish to install or inserting the DVD with the old software and install as usual.

NOTE   Upgrading software will not affect your stored session and skyline data. All data will continue to be available. Downgrading software will not affect your stored session and skyline data, however, the sessions or skylines created in the newer software version may not be viewable in the older version.

Reset

If unstable or unexpected performance is observed it may be necessary to perform a reset. Please refer to the reset procedures in the "Resetting" on page 1-10.

Battery

- The battery in the Solmetric SunEye is not removable. It may be recharged by attaching the device to a PC via the USB cable or by using the wall-plug. The USB port supplies enough current

to "trickle charge" the SunEye 210. However, it is insufficient to operate the unit. The trickle charge current is less that the operating current. For proper operation it is important to maintain the charge of the battery. Prolonged storage will result in the slow discharge of the battery. After a prolonged period of storage, connect the wall charger or before powering on the device. It is preferable to leave the device always plugged in to maintain charge when not in use. For more information, refer to "Charging the Battery" on page 1-5 for more information.

Contact Information for Service, Technical Assistance, and Sales

At Solmetric we constantly strive to improve our products. If you have experienced problems with your Solmetric SunEye, we would greatly appreciate your feedback.

For 24 hour self-help technical support, visit our online Knowledge Base at http://www.solmetric.com/knowledgebase.html.

If you experience a software issue please report any messages you received from the software and a list of steps leading up to the problem as well as the battery level of the device and the version number of the software. The version number can be found in the Tools menu > **About Solmetric SunEye…**

If you experience problems with the automatic open sky detection incorrectly identifying the open sky, please send us the original full fisheye image by exporting the session, and locating the image called SkyXXFullFishEye.jpg in the Exported Files subdirectory. XX is the skyline name (for example 01, 02…). Please also report the version number of the software. The version number can be found in the Tools menu > **About Solmetric SunEye…**

Corporate Contact Information:

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e-mail:info@Solmetric.com
Web: http://www.solmetric.com/

Specifications

Temperature

Operating: 32°F(0 °C) to 113 °F(45 °C)

Storage or Transportation: -4 °F(-20 °C) to 140 °F(65 °C)

Weight

1.0 lb

Display Resolution

640 X 480 VGA

Battery Life

6 Hours (typical) with backlight on
120 days (typical) in power off state

Backlight

To preserve power, the SunEye will turn off automatically after five minutes of inactivity by the user. To turn back on press the ON button.

Regulatory Compliance

Electromagnetic Interference

The SunEye contains a wireless transceiver which is FCC approved.

USA-Federal Communications Commission (FCC)
This equipment has been tested and found to comply with the
limits for a Class B digital device, pursuant to Part 15 of FCC
Rules. These limits are designed to provide reasonable protection
against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio
frequency energy. If not installed and used in accordance with
the instructions, it may cause harmful interference to radio
communications. However, there is no guarantee that interference
will not occur in a particular installation.

If this equipment does cause harmful interference to radio or
television reception, which can be determined by tuning the
equipment off and on, the user is encouraged to try and correct
the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.

• Increase the distance between the equipment and the
receiver.

• Connect the equipment to outlet on a circuit different from
that to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician
for help.

Any changes or modifications not expressly approved by the
party responsible for compliance could void the user's authority
to operate the equipment.

Caution: Exposure to Radio Frequency Radiation.

This device must not be co-located or operating in conjunction
with any other antenna or transmitter.

Canada – Industry Canada (IC)

This device complies with RSS 210 of Industry Canada.

Operation is subject to the following two conditions:

(1) this device may not cause interference, and

(2) this device must accept any interference, including interference
that may cause undesired operation of this device."

L ' utilisation de ce dispositif est autorisée seulement aux
conditions suivantes:

(1) il ne doit pas produire d'interference et

(2) l' utilisateur du dispositif doit étre pr?t ? accepter toute
interference radioélectrique reçu, m?me si celle-ci est susceptible
de compromettre le fonctionnement du dispositif.

Caution: Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna
is located or pointed such that it does not emit RF field
in excess of Health Canada limits for the general population;
consult Safety Code 6, obtainable from Health Canada's website
www.hc-sc.gc.ca/rpb.

Safety

Warning: Only use the power supply supplied by Solmetric or a UL or certified equivalent with a rated output of 5 Vdc 2.6 A.