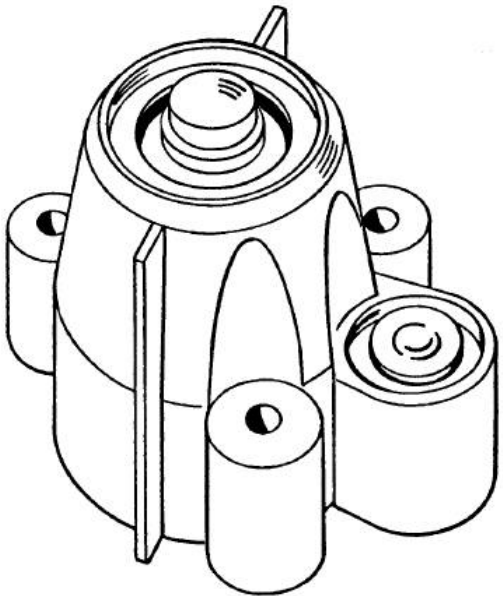
Pace Scientific
Data Loggers and Sensors

# SRS-100 Solar Radiation Sensor

# Installation and Setup Instructions



**Revision 1.08**

**Jan 2010**

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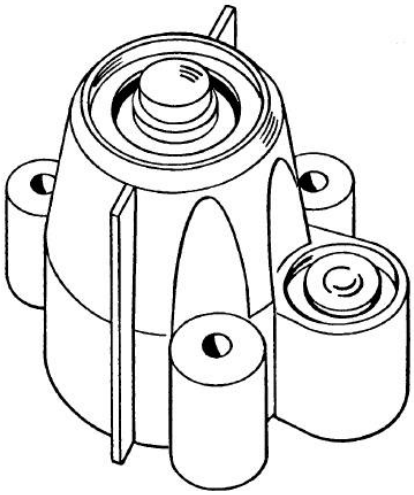


The Pace SRS-100 Solar Radiation Sensor measures solar irradiance from 300 to 1100 nanometers. It may be used with the Pace XR5 Data Logger as part of a solar energy data logging system. It is also suitable for agricultural and botanical applications. *Some assembly is required, as detailed on the following pages.*

****** IMPORTANT! *** Do not touch the small white diffuser at the top of the sensor.***
Any skin oil on the white diffuser will degrade the sensitivity of the sensor. To remove any oil present, clean the diffuser with a clean swab and ethyl (denatured) alcohol. **Do not use rubbing alcohol.**

The SRS-100 Solar Radiation Sensor consists of the following components:

**Shield**
The outer shell shields the sensor body from thermal radiation and provides a path for convection cooling of the body, which minimized heat build-up in the sensor interior. The shield provides a cutoff ring for cosine response, a level indicator, and fins to aid in aligning the sensor with the sun's rays.

**Body**
The body houses the following components:

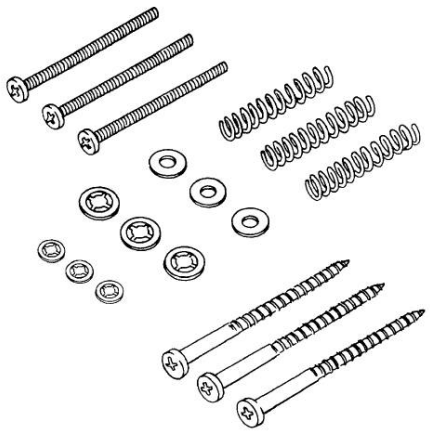
Diffuser
Welded to the body for a weather-tight seal. Provides excellent cosine response.

Detector
An hermetically sealed silicon photodiode.

Amplifier
The amplifier converts detector current into a 0-2.5v signal

**Mounting Hardware**
Please make sure you have all components listed below before continuing.

- ✦ **Shield**
- ✦ **Body with cable attached**
- ✦ **Mounting hardware:**
  (For installing and leveling the sensor)
  - ✦ Three #6-32 x 1-1/2" (38 mm) machine screws
  - ✦ Three springs
  - ✦ Three #6 flat washers
  - ✦ Three #6 screw retainers
  - ✦ Three #4 screw retainers
  - ✦ Three wood screws



**TOOLS AND MATERIALS NEEDED**

- ✦ Medium Phillips screwdriver
- ✦ Center punch or nail (if mounting on wood)
- ✦ Drill with 7/8" (22 mm) drill bit and if mounting on wood:
  Softwood: 1/16" (1.6 mm) drill bit
  Hardwood: 5/64" (2 mm) drill bit

**Will you install the Sensor level or at an angle?**

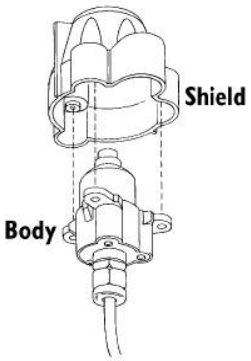
✦ For measurements to monitor the irradiance on a solar voltaic or thermal collection panel the data is probably most relevant if the sensor is tilted to the same angle as the collection panel.

✦ For evapotranspiration (ET) or environmental measurements, the sensor can be mounted on any level surface.

✦ For measurements where the immediate effect on humans is of interest, we suggest that the sensor be mounted so that its axis is aligned with the sun's rays at solar noon. This will maximize the mid-day readings and provide what is probably a more accurate measure of the solar radiation people are exposed to.

## Mounting the Sensor

The Sensor may be mounted on wood or metal.




**For mounting on wood:**

1. Using the drill template on the next page, mark the location of the necessary pilot holes.

2. Using a drill with a 3/32" (2.5 mm) drill bit, drill pilot holes in the marked locations. Bore a 7/8" (22 mm) hole through the mounting surface to provide clearance for the bottom of the sensor.

3. Route the sensor cable through the hole in the wood.

4. Place the shield onto the body as shown.

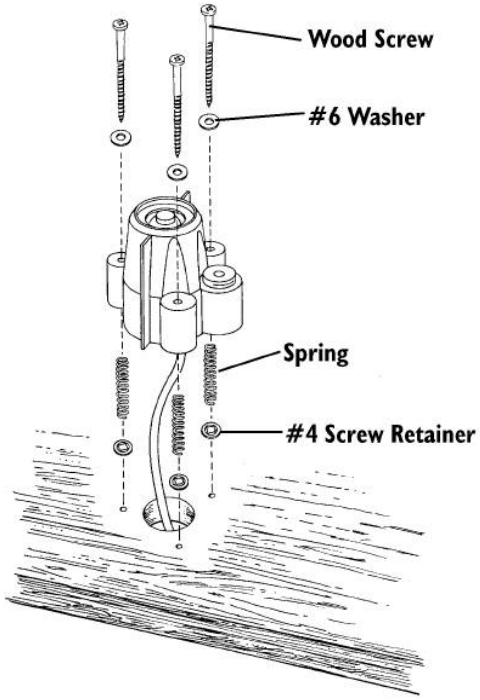
5. Place a flat washer over the end of each wood screw and insert it into the body.

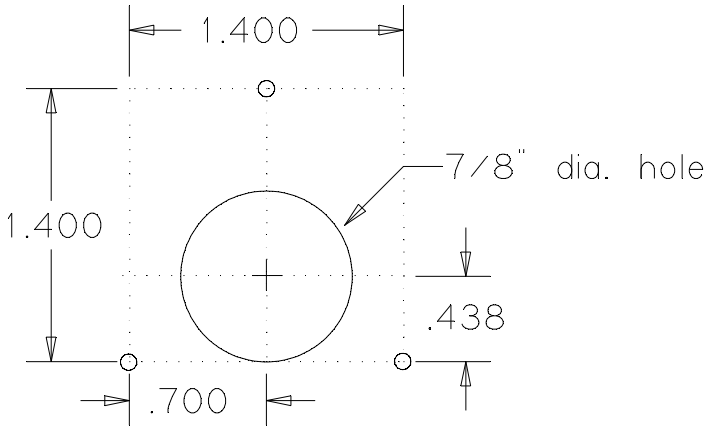
6. Place a spring over the end of each wood screw and hold the springs in place using a #4 screw retainer.

7. Secure the sensor to the mounting surface by driving the wood screws into the appropriate holes as shown below.

8. For mounting the sensor level, use the bubble level on the sensor as a guide, and adjust the sensor until it is level by tightening or loosening the leveling screws as necessary.

9. Secure the sensor cable.






## Drill template

for mounting the SRS-100 Solar Radiation Sensor

If mounting on wood, drill pilot holes for three #6 wood screws as shown above.

Use 1/16" (1.6 mm) drill for softwood

Use 5/64" (2 mm) drill for hardwood

If mounting on metal, drill holes for three #6 machine screws using a #27 (0.144", 3.7 mm) or 5/32" (0.156" or 4 mm) drill bit.

### Extending the Sensor Cable

The SRS-100 has a 2 ft cable terminated with an RJ11 phone plug. In dry environments, this cable can be extended using a phone line coupler and an additional length of phone cable. For non-dry environments, cut the phone plug off the end of the cable and strip off about 1.5" of the black outer sheath (being careful not to cut into the insulation of the internal wires). The four leads can then be spliced to any four conductor extension cable using crimp lugs or any suitable splicing method.

> **Notes:**
> Since the Red and Black leads are both "ground", they can both be connected together and a three conductor cable used for the extension cable.
>
> Pace offers the WE-100 Extension Cable (100 ft / 30 meters) which includes a weatherproof splice kit.

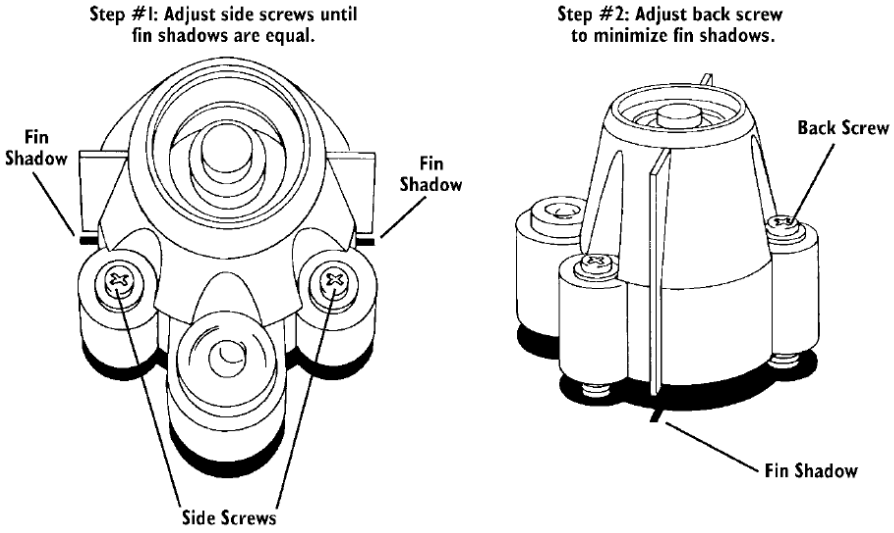
### Routing the Sensor Cable

Secure any extension cable at approximately 4 ft intervals, so that is does not whip about in the wind.

> **Note:** Make sure the sensor cable is not taut where it enters the sensor body. Provide some slack for cable contraction due to seasonal temperature variations.

### Final Adjustments

If it is desirable for the sensor to be oriented to solar noon, wait until solar noon time, and then follow the steps below:



## Wiring Connections

An earlier version of the SRS-100 had a 40 ft cable and a different wiring color code. All SRS-100 models shipped after April of 2008 have a 2 ft cable and are wired as follows:

**SRS-100 with 2 ft cable**

| SRS-100 Cable | XR5 Terminal | Function |
|---|---|---|
| Green | Channel 1 - 8 | Output signal: 1.67 mV per W/m$^2$ |
| Red | C | Ground |
| Black | C | Ground |
| Yellow | E | Power: +5V DC, 1 mA |

**Discontinued SRS-100 with integral 40 ft cable**

| SRS-100 Cable | XR5 Terminal | Function |
|---|---|---|
| Yellow | Channel 1 - 8 | Output signal: 1.67 mV per W/m$^2$ |
| Red | C | Ground |
| Green | C | Ground |
| Black | E | Power: +5V DC, 3 mA |

## LogXR Software Setup

for all XR5 models. (See page 10 for XR440).

**Scaling:**

In the Setup Screen, select channel tab number that the SRS-100 is wired to, and select/enter the following:

Type: 0-2.5V

For units of $W/m^2$
Slope: 600
Offset: 0

For units of foot candles in sunlight*
Slope: 9170
Offset: 0

* The SRS-100's calibration for foot candles is for sunlight only.
Please see "Note on light measurement" (below) for details.

**Excitation:**

Sensor excitation is selected in the Main tab of the Setup screen. The SRS-100 requires a minimum of 30ms of excitation. Any XR5 setup meets to this requirement. A Sensor Excitation of 30ms is recommended for best battery life, unless other connected sensors require a longer excitation time (see note below).

**Note:**
Sensor Excitation must be set to the longest excitation time required by all the connected sensors. For example, if a P1510-25 Pressure Sensor is also connected to the XR5 data logger (which has an excitation requirement of 150ms), then select a Sensor Excitation of 150ms.

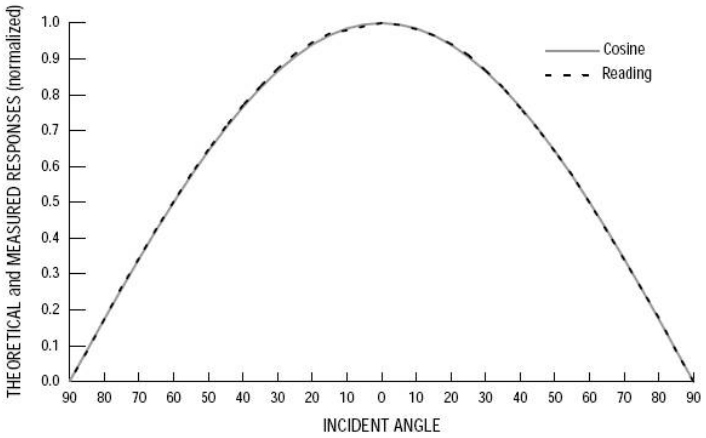
**Note on light measurement**

The SRS-100 Solar Radiation Sensor measures solar irradiance, or the instantaneous quantity of sunlight striking a particular surface area. Units of measurement for irradiance include Watts per square meter ($W/m^2$) and lumens per square foot (foot candles). The above slope/offset scaling for foot candles is valid only for sunlight. The SRS-100 is calibrated for solar radiation in watts per square meter. Watts per square meter is a radiometric unit. Radiometric units are based on physical power, and all wavelengths are equally weighted. Foot candle is a photometric unit which takes into account the human eye's response (sensitivity) to the visible light spectrum. Converting the SRS-100's readings from Watts per square meter to Foot Candles must take into account the spectral composition of the light source. For example, the spectral composition of high pressure sodium lamps, low pressure sodium lamps, metal halide lamps, incandescent lamps and florescent lamps compared to sunlight are all significantly different. If the above slope and offset scaling values for foot candles are used for a light source other than sunlight, a significant measurement error (of up to a factor of 2) will result.

## Specifications

| | |
|---|---|
| **General Operating Temperature** | -40° to 150° F (-40° to 65° C) |
| **Measurement Range** | 0 to 1500 W/m$^2$ |
| **Accuracy** | ±5% |
| **Drift** | up to ±2% per year |
| **Temperature Coefficient** | 0.067 % per degree F (0.12 % per degree C); negative correction above ref. temperature, positive correction below ref. temp. Reference temperature = 77°F (25°C) |
| **Resolution with XR5 Data Logger** | 0.37 W/m$^2$ (using 0-2.5v input range) |
| **Resolution with XR440 Pocket Logger** | 0.73 W/m$^2$ |
| **Signal Output** | 0-2.5vdc; 1.67 mV per W/m$^2$ |
| **Power Requirement** | 5vdc with 1 ma typical current draw |
| **Sensor Type** | Silicon photodiode |
| **Spectral Range** (10% points) | 400 to 1100 nanometers |
| **Cosine Response** | |
| Percent of Reading | ±3% (0° to ±70° incident angle); ±10% (±70° to ±85° incident angle) |
| Percent of Full Scale | ±2% (0° to ±90°) |
| **Attached Cable Length** | 22" (55 cm) |
| **Cable Type** | 4-conductor, 26 AWG |
| **Recommended Maximum Cable Length** | 125 FT (38 m) |
| **Housing Material** | UV-resistant plastic |
| **Dimensions** | 2” x 2.75” x 2.25” (51 mm x 70 mm x 57 mm) |
| **Weight** | 12 oz. (340 g) |

### COSINE RESPONSE (TYPICAL)




## Technical Support

For questions or comments regarding this document,
please contact Pace Scientific Technical Support:
Phone: 704-799-0688 (8-5pm EST)
Email: support@pace-sci.com
Fax: 704-799-0177

# Using with the XR440 Data Logger

### Wiring Connections

An earlier version of the SRS-100 had a 40 ft cable and a different wiring color code. All SRS-100 models shipped after April of 2008 have a 2 ft cable and are wired as follows:

**SRS-100 with 2 ft cable**

| SRS-100 Cable | XR5 Terminal | Function |
|---|---|---|
| Green | Channel 1 - 8 | Output signal: 1.67 mV per $W/m^2$ |
| Red | C | Ground |
| Black | C | Ground |
| Yellow | E | Power: +5V DC, 1 mA |

**Discontinued SRS-100 with integral 40 ft cable**

| SRS-100 Cable | XR5 Terminal | Function |
|---|---|---|
| Yellow | Channel 1 - 8 | Output signal: 1.67 mV per $W/m^2$ |
| Red | C | Ground |
| Green | C | Ground |
| Black | E | Power: +5V DC, 3 mA |

### Pocket Logger Software Setup

**Scaling:**
In the Setup Screen, click the Scaling drop down list for the channel that the SRS-100 is wired to, and select New Linear Scale and then enter the following scaling values:

For units of $W/m^2$
High Value: 3000
Low Value: 0

For units of foot candles in sunlight*
High Value: 45,850
Low Value: 0

* The SRS-100's calibration for foot candles is for sunlight only.
Please see "Note on light measurement" (page 9) for details.