Photosynthetically Active Radiation (PAR)
Smart Sensor (Part # S-LIA-M003)

The Photosynthetically Active Radiation (PAR) smart sensor is designed to work with the HOBO® Weather Station logger. The smart sensor has a plug-in modular connector that allows it to be added easily to a HOBO Weather Station. All calibration parameters are stored inside the smart sensor, which automatically communicates configuration information to the logger without any programming, calibration, or extensive user setup.

Inside this Package

- PAR Smart Sensor

Specifications	PAR Smart Sensor
Measurement Range	0 to 2500 μmol/m^2/sec, wavelengths 400 to 700 nm (see Figure 1)
Accuracy	±5 μmol/m^2/sec or ± 5%, whichever is greater in sunlight. Additional temperature induced error ±0.75 μmol/m^2/sec/° C from +25°C (0.42 μmol/m^2/sec/° F from +77°F)
Angular Accuracy	Cosine corrected 0 to 80 degrees from vertical; Azimuth Error < 2% error at 45 degrees from vertical, 360 degree rotation
Resolution	2.5 μmol/m^2/sec
Drift	< ±2% per year
Calibration	Factory recalibration available
Operating Temperature Range	-40° to +75°C (-40° to +167°F)
Environmental Rating	Weatherproof
Housing	Anodized aluminum housing with acrylic diffuser and O-ring seal
Dimensions	4.1 cm height x 3.2 cm diameter (1 5/8 x 1 1/4 in)
Weight	120 g (4 oz)
Bits per Sample	10
Number of Data Channels *	1
Measurement Averaging Option	Yes
Cable Length Available	3.0 m (9.8 ft)
Length of Smart Sensor Network Cable *	3.0 m (9.8 ft)
Part Number	S-LIA-M003
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

* A single HOBO Weather Station can accommodate 15 data channels and up to 100 m (328 ft) of smart sensor cable(the digital communications portion of the sensor cables).

Typical Quantum Response

The PAR smart sensor is designed to detect photons between 400-700 nm in wavelength. Ideally the sensor would count photons with equal efficiency between 400-700 nm and no photons would be counted outside this range. However, in reality, this sensor undercounts photons between 400-550 nm and between 670-700 nm, and it over counts photons between 550-670 nm. In most applications (where the sensor is used in natural sunlight) the error is not significant.
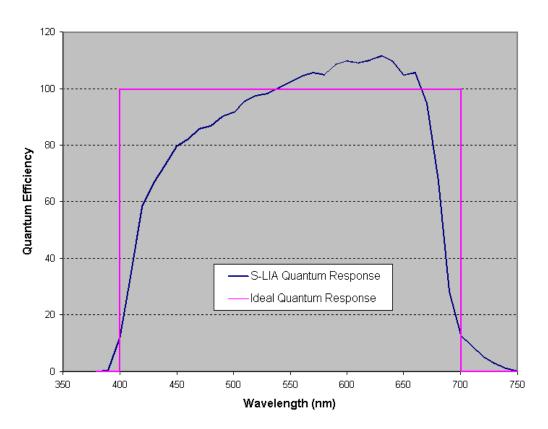

Figure 1: PAR Smart Sensor Typical Quantum Response

Mounting

Accessories

- Light Sensor Mounting Bracket (part # M-LBB)
- Light Sensor Level (part # M-LLA)

Mounting Bracket

Onset recommends that you mount the PAR smart sensor with the light sensor bracket on a pole or tripod (see Figure 2). To mount the PAR smart sensor using the bracket:

1. Attach the light sensor bracket to a 1¼ inch - $1^5/_8$ inch pole with the provided U-bolts.

   Note: The light sensor bracket can also be mounted on a flat, vertical surface using four screws.

2. Position the light sensor on top of the light sensor bracket with its cable running through the slot in the bracket.

3. Using the two screws supplied, attach the sensor to the bracket through the two holes on either side of the slot.

   Note: Do not completely tighten the screws until you level the light sensor.

4. Position the bracket so it faces toward the equator, minimizing the chance of shading.

5. Mount the light sensor bracket on the mast with the two U-bolt assemblies, mounting it high enough on the mast to avoid the possibility of shading the light sensor.

   Note: If you mount the light sensor above eye level, it is recommended that you use a step ladder or other secure platform when leveling the sensor so that you can clearly view the light sensor level (Onset Part # M-LLA).
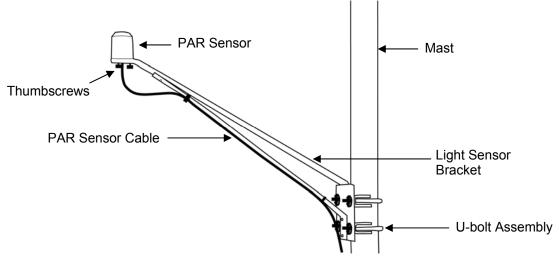

Figure 2: PAR Smart Sensor Bracket Mounting

6. Make sure the screws holding the sensor to the mounting bracket are loose.

7. Place the light sensor level on the light sensor.

8. Adjust the height of the thumbscrews to level the sensor (start with the thumbscrews protruding about 1/16 inch from the bracket).

9. Once the sensor is near level, tighten the Phillips head screws.

10. Check the light sensor level and repeat above steps if necessary (see Figure 3).

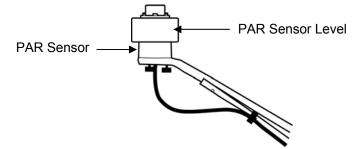11. When the light sensor is level, remove the light sensor level from the light sensor.

Figure 3: Leveling the PAR Smart Sensor on the Light Sensor Bracket

Specialized Application Mounting

To mount the light sensor using a mounting plate of your own design:

1. Drill a 0.56 (9/16) inch hole in the middle of the plate, then drill two #25 holes 1.063 (1-1/16) inches apart on either side of the center hole. Cut a 0.31 (5/16) inch-wide slot in the mounting plate. See Figure 4. The plate should be a thickness of 1/8 inch or less.

2. Slide the sensor through the 0.31 (5/16) inch-wide slot.

3. Attach the sensor using two 6-32 x 3/8 inch screws and lock washers (not included).

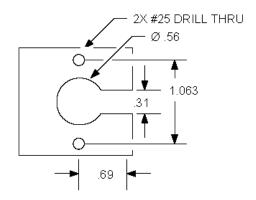4. Shim the sensor as necessary to level it.

Figure 4: Recommended Mounting Plate Dimensions

Mounting Considerations

- Small errors in alignment can produce significant errors. Be certain that the sensor is mounted level.

- Mount the light sensor where it will not be in a shadow.

- If possible, avoid locating the sensors in dusty locations. Dust, pollen, and salt residue that collect on the top of the sensor can significantly degrade accuracy.

- Refer to the *HOBO Weather Station User's Guide* for more information regarding setting up complete HOBO Weather Stations.

Connecting the Sensor to a Logger

To start using the PAR smart sensor, stop the logger and insert the sensor's modular jack into an available port on the logger. If a port is not available, use a 1-to-2 adaptor (Part # S-ADAPT), which allows you to plug two sensors into one port. The next time the HOBO Weather Station is launched it will automatically detect the new sensor.

Note that the HOBO Weather Station supports a maximum of 15 data channels; this sensor uses one data channel. Launch the logger and verify that the sensor is functioning correctly. See the *HOBO Weather Station User's Guide* for more details about connecting smart sensors to the HOBO Weather Station.

Operation

The PAR smart sensor supports measurement averaging. When measurement averaging is enabled, data is sampled more frequently than it is logged. The multiple samples are then averaged together and the average value is stored as the data for the interval. For example, if the logging interval is set at 10 minutes and the sampling interval is set at 1 minute, each recorded data point will be the average of 10 measurements.

Measurement averaging is useful for reducing noise in the data. It is recommended that you use measurement averaging whenever the PAR smart sensor is used in an area where the light level can vary quickly with respect to the logging interval (for example, under a partial plant canopy or during partly cloudy conditions). Note that fast sampling intervals (less than 1 minute) may significantly reduce battery life. See the *HOBO Weather Station User's Guide* for more details about sensor operation and battery life.

Maintenance

Dust on the sensor will degrade sensor accuracy. Periodically inspect the sensor, and if necessary, gently clean the diffuser with a damp sponge. Do not open the PAR smart sensor as there are no user serviceable parts inside.

Warning: DO NOT use alcohol, organic solvents, abrasives, or strong detergents to clean the diffuser element on the light sensor. The acrylic material used in the light sensors can be crazed by exposure to alcohol or organic solvents. Clean the sensor only with water and/or a mild detergent such as dishwashing soap if necessary. It is recommended that you use vinegar to remove hard water deposits from the diffuser element. Under no circumstances should the smart sensor be immersed in any liquid.

Verifying Sensor Accuracy

Onset recommends that you check the accuracy of the PAR smart sensor annually. The PAR smart sensor cannot be user-calibrated. Onset uses precision components to obtain accurate measurements. If the smart sensor is not providing accurate data, then it may be damaged or out of calibration. If you are unsure of the smart sensor's accuracy, you can send it back to Onset for testing and possible re-calibration. Contact Onset or your dealer for a Return Merchandise Authorization (RMA) number before sending it.