Augustyn & Company
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Measuring the Sun since 1983

Worldwide distribution and support of:

The Irradiance RSR2™ Rotating Shadowband Radiometer

The Irradiance, Inc. Rotating Shadowband Radiometer Version 2 (RSR2™) provides accurate and reliable on-site measurement of total and diffuse horizontal, and of direct normal solar radiation for solar power and environmental applications. RSR2™'s are used in large scale solar power development, solar energy resource assessment, solar power system monitoring, and in atmospheric physics to quantify radiative energy transfers in global energy balance research.

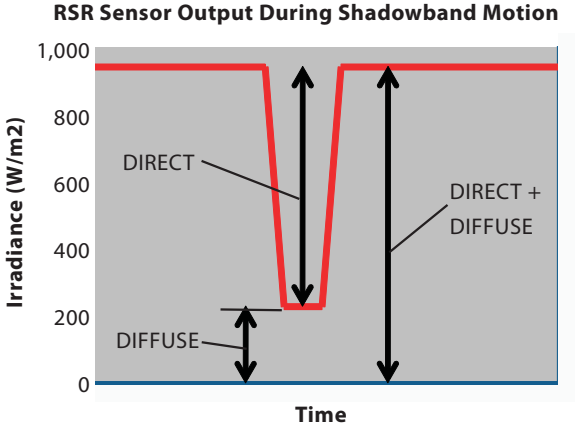
The RSR2™'s low capital and O&M costs combined with its dependably high accuracy and rugged reliability has gained it wide acceptance with both CSP and large scale PV developers worldwide. Because it does not require as precise alignment with the sun as do tracking thermopile pyrheliometers, and its sensor is not as susceptable to soiling as are traditional glass-windowed or domed thermopile sensors, the RSR2™ has proved far more likely to deliver consistently accurate data over extended periods where regular human maintenance for sensor alignment and cleaning is costly.

Those who have chosen the RSR2™ to spearhead their measurement campaigns include most prominent PV and CSP project and technology developers, electric utilities, governments, investment and financing firms, and a growing number of large scale photovoltaic power plant project and technology developers.

The RSR2™ "head unit" includes a moving shadowband that momentarily casts a shadow over a silicon photodiode pyranometer. Irradiance's patented and proprietary pattern recognition algorithm uses data taken during the passage of the shadow to determine direct normal and diffuse horizontal irradiance.

The RSR2™ control unit includes a Campbell Scientific measurement and control system, a shadowband motor controller, and a photovoltaic or line voltage power system; numerous options are available for wired and wireless data retrieval. An extensive range of additional sensors, available from Campbell Scientific and others can be easily configured with the RSR2™ control unit, to measure additional meteorological and solar power system performance parameters.

The RSR2™ uses a single light sensor to measure the total and diffuse horizontal irradiance, and then computes the direct irradiance according to the formula: Total = Direct x (cosine Zenith) + Diffuse



"Total"	total horizontal irradiance
"Direct"	direct normal or "beam" irradiance
"Diffuse"	horizontal irradiance from the entire sky excluding the direct beam
"Zenith"	angle measured from overhead down an arc to a point at the center of the sun

This graph is of sensor output during a single shadowband rotation on a clear day. As the shading arm moves over the sensor, it is sampled over 1200 times. This stream of high-sample-rate data is processed to determine the difference between total and diffuse horizontal irradiance, and then the direct or beam irradiance is derived as above.

TECHNICAL SPECIFICATIONS

Operating temperature range:	-25C to +50C
Operating relative humidity range:	2% to 95% (non condensing)
Power supply voltage	12 VDC to 14.5 VDC
PV power supply storage capacity (17 AH, 33AH or custom to provide 1 to 3 weeks of operation with no solar input)	
Maximum program sample rate:	3 seconds
Standard averaging and output record rates:	1 minute 1 hour 1 day
Diagnostic record generation rate	1 day
Nominal length of time before memory over-write and loss of oldest data records:	30 to 60 days

Maximum recorded wind speeds without failure from over 320 station-years of operation of 200 RSR2™ systems with 10 meter wind speed instrument mounts of the telescoping pole design from Augustyn & Company > 85 mph >38 m/s

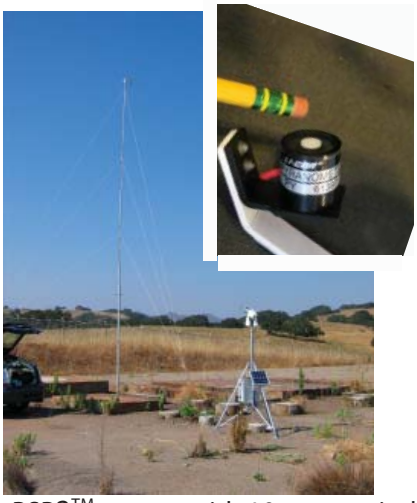
Note that the maximum wind speed varies with the quality of the installition craftsmanship and adherance to recommended maintenance procedures. To date, the only wind speed event resulting in a failure was caused by a combination of a localized micro burst (small tornado) and untightened guy lines.

Shipping weight (varies depending on components selected) from 25 kg. to 75kg.

Note that any solar measuring instrument should be located with no or minimal shading of the sensing elements at any time of day or year with as full and unobstructed view of the sky dome as possible.

NREL's chief solar measurement scientist explaining RSR operating principles at dedication of Solar Measurement Station near Alamosa, Colorado

RSR2™ system installed at CSP plant in California



RSR2™ system with 10 meter wind sensor pole mount (primary irradiance sensor in cutout)

CALIBRATION & ACCURACY

Units shipped from the factory come with the sensor manufacturer's (Li-Cor) calibration, resulting in a measurement uncertainty of total horizontal irradiance from the World Radiation Reference (WRR) of 5 to 6%. Irradiance provides an enhanced calibration value for each sensor shipped which is more directly and accurately tied to the WRR. The RSR2™ datalogger program also contains a series of correction algorithms which adjust the output measurements of the sensor for inherent temperature, incident angle and spectral non-linearities encountered when deployed in the field. Research indicates that these corrections, combined with use of Irradiance's enhanced calibration technique can result in total measurement uncertainties from the WRR of 3.5 to 4.5% for direct irradiance.

WARRANTY, AVAILABILITY, & DISCOUNTS

The basic RSR2™ system component set includes the RSR head unit with primary irradiance sensor, motor controller, datalogger and enclosure. Optional additional components include sensors, communication equipment, mounting systems, power supplies and software Typical complete system can vary widely more depending on options chosen.

Irradiance RSR2™ systems are warranted to be free from manufacturing defects for a period of one year from date of shipment. Further warranty details are available upon request. Normal time from order to ship date is 3 weeks. Orders of 10 or more systems receive an 7% discount, while educational instututions receive a 4% dscount.

Distributed and serviced worldwide by:

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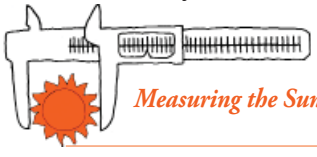

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