



## QSR-2000 Quantum Scalar Reference Measures Sky Irradiance over PAR(400-700nm)

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The QSR-2000 Hemispherical Quantum Scalar Reference Sensors are designed for measuring total incident Photosynthetically Available Radiation (400-700 nm) from the sun and sky. QSR-2000 applications include monitoring solar radiation in energy or aquatic productivity studies. The QSR Series features a patented solid Teflon® spherical collector with hemispherical field-of-view cutoff plate, ensuring uniform directional response over 2 π steradians. An aluminum-encased optical fiber funnels flux from the collector to a silicon photodetector that has a flat quantum response over PAR. The QSR-2000 shares the scalar directional response characteristics of the Biospherical Instruments QSP Series of profiling scalar sensors.

The QSR is ideal for stand-alone use as a surface irradiance sensor or deployed as a reference for our QSP profiling sensors. The QSR-2000 is available in three basic versions:

The **QSR-2100** contains imbedded calibration values and outputs a calibrated digital signal. This sensor connects directly to PC workstation or laptop computer. Using low-power circuitry, all energy for the sensor is supplied by the host computer's serial port to distances of 100 meters. Custom software is included and is compatible with all Microsoft Windows® platforms, including Windows 98, 2000, NT and XP. Data are in a digital format and transferred to the PC or laptop at 9600 baud. The user may configure this software to display in Quanta or MicroEinsteins.

The **QSR-2200** outputs a linear analog signal and is compatible with data loggers that can accept a wide range of signal voltages.

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### Key Features

- *Designed to monitor total incident PAR (400-700 nm) from the sun and sky*
- *1.9 cm (3/4") diameter Teflon® spherical irradiance collector with hemispherical field-of-view cutoff plate*
- *Compact, rugged, and low-cost*
- *Can be used as a surface reference for the QSP-Series of underwater profiling instruments*
- *QSR-2100 includes operating software allowing direct connection to a PC or laptop computer*

**The QSR-2100 is supplied with our LOGGER-2100 software, allowing direct connection with a PC or laptop computer .**



*\*Specifications subject to change without notice*

# Specifications

## Optical Features

**Scalar Irradiance Collector:** 1.9 cm (3/4") diameter solid Teflon® sphere optically connected to the main housing by a 2.5 cm aluminum-encased quartz light pipe.

**Photodetector:** Blue-enhanced, high-stability silicon detector with dichroic blocking filters.

**PAR Spectral Response:** Equal (better than ±10%) quantum response from 400 nm to 700 nm with response sharply attenuated above 700 nm and below 400 nm. Spectral response-induced errors will cause less than 5% errors in naturally occurring light fields.

**Directional Response:** Each instrument's directional response is optimized before final calibration. Front-to-side (approximately 85° from head on) response over all angles is equal (± 6%) with response attenuated to 0 (at 95°) by the 20-cm diameter cutoff shield. Individual detector response plots are available as an option.

## Optical Features (Cont.)

**Sensitivity:** When purchased alone, the sensor is calibrated in quanta/(cm<sup>2</sup>·sec)/volt. Nominal sensitivity is 1 volt = 1x10<sup>17</sup> quanta/(cm<sup>2</sup>·sec) (slightly less than full sunlight). Noise level is typically less than 1 millivolt, temperature coefficient of the dark signal is less than 10 microvolts/°C, and response temperature coefficient is less than 0.15%/°C.

## Electronic Features

**Measured Signals:** PAR Dynamic Range: 1.4x10<sup>-5</sup> μE/(cm<sup>2</sup>·sec) to 0.5 μE/(cm<sup>2</sup>·sec)

**Fully calibrated with lamps traceable to NIST, each QSR-2100 sensor contains imbedded calibration factors.**

## Environmental

**Temperature Range:** -2°C to 35°C

## Calibration

Each QSR-2000 sensor is calibrated using a National Institute of Standards and Technology- (NIST) traceable 1000-watt type FEL Standard of Spectral Irradiance using procedures recommended by NIST. Annual recalibration is strongly recommended.

## Mechanical Features

### Dimensions:

*Diameter:* 20.0 cm

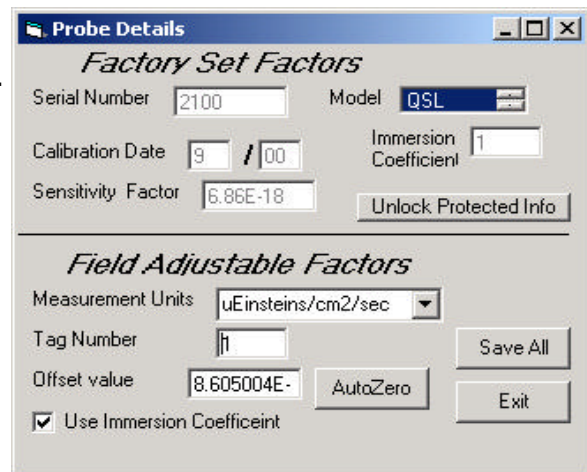
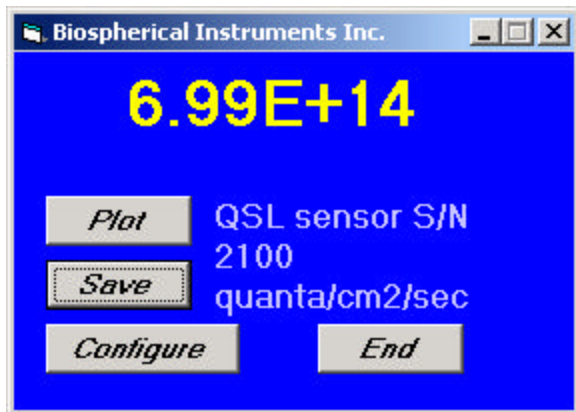
*Height:* 19.0cm

*Weight:* 1.1 kg

### Housing Materials:

*Collector:* Solid PTFE sphere, epoxy mounted to a machined aluminum base

*Housing:* Hard-anodized aluminum



Using BSI's new operating software, the QSR-2100 logs and displays calibrated data in either Quanta or μEinsteins .



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