Biospherical Instruments Inc.

Leaders in Optical Sensing and Profiling Technology

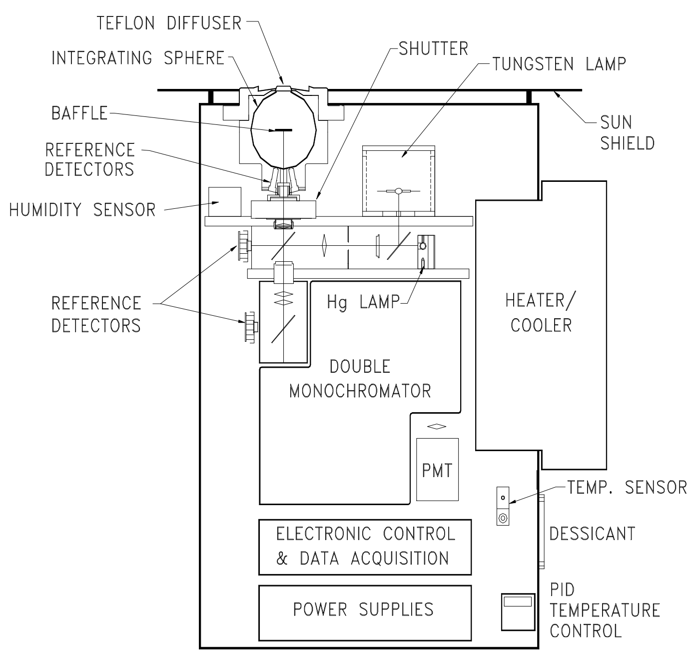
SUV-150 UV-Visible Spectroradiometer

Biospherical Instruments' SUV-150 High Spectral Resolution UV Scanning Spectroradiometer is one of few automated instruments in the world that delivers continuous, high spectral resolution measurements of solar irradiance in the ultraviolet and visible regions of the spectrum. The design is based on instruments proven in the National Science Foundation (NSF) UV Monitoring Network, which has been in operation since 1988 in Antarctica, the Arctic, South America, and California. The SUV-150 is well characterized and temperature-controlled, yielding irradiance measurements between 280 and 600 nm with a 0.7 nm bandwidth. These spectral measurements are invaluable in determining biological weighting functions, developing and validating radiative transfer models, computing ozone concentration, and supporting other UV research programs.

Each SUV system is optimized to meet the specific needs of the customer and the site where the system will be installed. A typical system includes two sections. Housed in a fully weatherproof enclosure, the sensor assembly (see Figure) incorporates an irradiance collector, a monochromator, a photomulitplier tube (PMT), and integral mercury and tungsten-halogen calibration sources. This enclosure is mounted on a rugged tripod and can be easily located on the roof of a building, trailer, or portable structure. Located up to 30 meters away, the data logging section of the system features a high-speed personal computer with custom software to acquire data, provide GPS time synchronization, control the instrument, and process data. In addition, the system supports access to the Internet for remote operation. The design emphasizes the importance of automated calibration for quality control and ease-of-use. Internal wavelength and intensity sources are automatically scanned at user-programmed intervals. To perform absolute calibrations and periodic evaluations of internal calibration sources, a NIST-traceable 200-Watt Standard of Spectral Irradiance, housed in a specially designed calibration fixture, is mounted over the irradiance collector and scanned.

The SUV-150 design is based on a double scanning monochromator coupled to a PMT detector that is housed in a temperature-regulated semi-hermetic enclosure. The temperature is maintained within ±1°C by a thermoelectric heater/cooler, driven by a PID controller. The heart of the system is a 150 mm, f/4.4 Czerny-Turner double monochromator optimized for recording UV-B and visible wavelength solar irradiance.

Significant effort has been expended to achieve outstanding cosine response that is free of asymmetry and spectral distortion over the full operational range. The SUV-150 utilizes a quartz window with vacuum-formed Teflon® diffuser at the entrance port of an integrating sphere with center baffle. The diffuser is heated to minimize ice and snow buildup and to evaporate other moisture that accumulates.



**Specifications subject to change without notice*

Specifications

Optical

Double Monochromator (Czerny-Turner):

- Focal Length: 150 mm
- F/#: 4.4 overall
- Gratings: 240 nm blaze, 2400 g/mm ruling
- Spectral Range: 280 nm to 600 nm
- Drivers: Dual, independent, micro-stepper motors
- Bandwidth: 0.7 nm FWHM, 2.0 nm 0.1% BW
- Accuracy: 0.1 nm
- Precision: 0.03 nm

Collector: cosine-corrected Teflon®-covered quartz.

Cosine Response: ±2% cosine error to 60°, ±4% cosine error to 80°.

Collector Asymmetry and Spectral Effects: < 1%

PMT is selected, low noise type R2371P; 9 stage dynodes; mounted in shielded housing with built-in H.V. power supply.

Typical Scan Time (0.6 sec./ wavelength point): 280-600nm at 0.2 nm steps = 16 min.

Maximum Source Irradiance: 10^{-3} W/cm^2 nm

Noise Equivalent Irradiance (300nm): 2 x 10^{-10} W/cm^2 nm

Typical Repeatability of Solar Scans: 3%

Mechanical

Housing: Weather-tight, portable enclosure mounted on a tripod for ease of installation and leveling.

Size: Measurement Housing = 32 H x 24 W x 14 D

Control Console = 36 H x 27 W x 36 D

HRAD (High Resolution A/D) Multi-Function Radiometer

Controller:

A/D Channels: 56

A/D Resolution: 16 bit/bipolar

D/A Channels: 1 (programmable control of PMT HV)

D/A Resolution: 16 bit

Input Voltage Range: ±10 VDC

Gain Ranging: Automatic/Manual

Amplification Gains: x1, x16, x256 (1.2 µv LSB)

PMT Current to Voltage Converter:

- Input Current Range: 10 µA (Gain 1), 0.1 µA (Gain 100)
- Bessel Band-pass Filter: 4 pole, 100 Hz

Data Acquisition System

The SUV-150 is controlled by a Pentium®-based personal computer running the Microsoft NT®) operating system. The computer can be controlled over the Internet and data can be retrieved remotely. An integral GPS ensures timekeeping accuracy of the data acquisition system.

Software

The system is provided with software that supports remote operation, data acquisition, data processing, quality control, and database production.

Calibration

The instrument has internal wavelength (mercury) and intensity (tungsten-halogen) lamps for automatic calibrations at user-programmable intervals. To maintain a check on these internal calibration standards, a calibration fixture containing a NIST-traceable 200-Watt Standard of Spectral Irradiance is periodically mounted above the irradiance collector and manual calibrations are performed.

Auxiliary Sensors

The SUV is both hardware- and software-compatible with a variety of radiometric and meteorological sensors that can be recorded simultaneously with the spectral irradiance measurements or independently logged.

Support Services

Biospherical Instruments provides factory training for the new SUV user and a wide range of follow-on support services. Support services are provided on a contract basis and can include instrument site preparation and installation, routine operation, annual maintenance and calibration, and data acquisition and management.

References

SUV instruments have seen nearly a decade of continuous service in the National Science Foundation's Polar UV Monitoring Network (Anderson et al., 1993; Benavides et al., 1994; Booth et al., 1988-1994; Cullen et al., 1992; Diaz et al., 1990-1994; Frederick et al., 1993; Holm-Hansen et al., 1993; Lubin and Frederick, 1989-1992; Lubin et al., 1989-1992; Madronich 1993, 1994; Seckmeyer et al., 1995; Smith et al., 1989-1992; Stamnes 1993; Stamnes et al., 1990-1992).

In addition, the reliability and accuracy of the SUV have been proven through numerous intercomparisons with other UV measuring devices from around the world (Seckmeyer et al., 1995; Thompson et al., 1996).

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