The significance of meter readings depends on several considerations:

1. The absolute spectral response of the meter; that is, how the meter "weighs" the different wavelengths of radiation with respect to perfect response and to one another;
2. The spectral output of the emitter; that is, the range of different wavelengths of radiation produced by the emitter and their relative proportions; and
3. The spatial response of the meter; that is, how the meter responds to radiation arriving at the sensor surface at angles other than the perpendicular.

Absolute measurements can only be obtained by using a properly calibrated meter. UV meters can be calibrated against a line source such as a 365nm line source so that it provides a direct reading of irradiance from this type of source. Other sources can be measured, but the meter reading will have to be adjusted as the indication of the meter depends not only on the irradiance at the sensor from the source but also on the interaction of the wavelength distribution of the light source and the meter spectral response. If a meter is calibrated to provide correct readings with a particular lamp, it will not provide correct values for lamps with different spectral distributions. However, **relative comparisons** of lamps with identical spectral distributions of UV light can be made with any stable meter, regardless of the calibration method used, as long as the meter has sensitivity in the desired wavelength region.

The J-221 is calibrated to accurately read the irradiance from longwave phosphor coated lamps. If used to measure irradiance from a 365nm line source (B-100 type lamp), it will read approximately 35% higher than the actual irradiance. To obtain the true value, the reading should be multiplied by 1/1.35 = .74.

CALIBRATION

For best accuracy, ultraviolet meters should be re-certified every six months. Call AJ's Calibration Department at 909-946-3197 for recertification. For recalibration or repairs due to dropping or exposure to moisture (keeps cells dry), return the complete meter to the factory prepaid. A Returned Goods Authorization (RGA) number must be obtained from AJ's Calibration Coordinator prior to returning any product. The unit will be calibrated by a standard traceable to the NIST. Calibration charge is nominal. The average turnaround time is ten days. **NOTE: In order to maintain traceability to NIST standards, meters must be returned to AJ for calibration. AJ does not stand behind unauthorized calibrations.**

PART NUMBERS

J-221, P/N 97-0003-01, Longwave Meter

J-225, P/N 97-0004-01, Shortwave Meter

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81-0032-01 Rev J

UVP J-221 AND UVP J-225 BLAK-RAY® ULTRAVIOLET INTENSITY METERS

USER INSTRUCTIONS

BLAK-RAY® ULTRAVIOLET METERS are hand held photovoltaic devices used for measuring the intensity of ultraviolet energy emitted from ultraviolet lamps. Only ultraviolet plus some infrared registers on the meters; visible light of less than 40 foot candles does not. When infrared or intense visible light is present, it can be eliminated from the readings as detailed under "Infrared Interference". A certification statement of calibration using a standard traceable to the National Institute of Standards and Technology (NIST) is provided with each meter.

IMPORTANT: Recalibration is recommended at least every six months.

TOLERANCES

Meter readout is in radiometric units, i.e., microwatts per square centimeter (µW/cm²). This new silicon detector has an improved linearity tolerance of ±10%. The short-term repeatability is better than ±1% under isothermal conditions. The measurement accuracy is additionally limited by the ±2.6% tolerance of the NIST standard source. The secondary standards used for calibration are traceable to NIST. The minimum detector limit is 20 µW/cm².

ASSEMBLY INSTRUCTIONS

The sensor cell plugs directly into the receptacle on the top of the meter housing. To make readings remote from the metering unit, the extension cord should be plugged into the receptacle with the red and black plugs aligned with their corresponding holes for proper polarity. The sensor cell plugs into the other end of the extension cord in the same manner.

TO READ THE SCALE

The meter should always be used with the scale facing vertically. Before taking readings, the meter zero should be checked with the sensor cell unplugged and the scale vertical. Adjust to zero whenever necessary by means of the screw located directly beneath the scale. Meters have two scales; use the switch to select the A or B scale. Ranges on the longwave meter (J-221) are 0 - 12 and 10 - 60 (B scale). Ranges on the shortwave meter (J-225) are 0 - 24 (A scale) and 20 - 120 (B scale). To obtain µW/cm², multiply reading by 100 (R X 100 = µW/cm² where R = meter reading).

HOW TO READ ANGSTROMS - NANOMETERS - ERGs

The U.S. NIST nomenclature requires measurement of wavelength in nanometers (nm) instead of Angstroms. Ten Angstroms are equal to one nanometer, which also equals one millimicron. To obtain measurements in ergs/second/cm², multiply µW/cm² by 10.

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GENERAL READINGS

If intensity at the surface (such as on a laboratory bench) is to be measured, the sensor is placed directly on the surface and connected to the meter housing by the extension cord. Other measurements can be made at varying distances from the source. For repeatability of readings, the distance should be noted and the sensor placed at the same distance for each reading. For making measurements at the source, the sensor face has four pegs for indexing directly on the tube.

The shortwave meter, J-225, is designed for measuring energy from 220nm to 290nm emitted by germicidal lamps (peak sensitivity is approximately 254nm). The longwave meter, J-221, measures energy from 300nm to 400nm (peak sensitivity is approximately 365nm) and is basically designed for measuring "black light" lamps.

NOTE: When the sensor cell is positioned directly on the tube, it cannot measure the ultraviolet from the entire lamp, only the small area it is on. Readings made by this method are widely used for monitoring lamp condition over a period of time. It should be noted that these readings are only relative to each other, not a measure of total lamp energy, as a result of high loss of incident energy due to cosine reflection losses. The meter cell should be exposed to the UV only long enough to obtain measurement since extended exposure will degrade cell calibration.

TEMPERATURE/HUMIDITY EFFECTS

It is preferable to use the meters at normal room temperatures (60-90°F). A short exposure to higher or lower temperatures may be tolerated although accuracy may be diminished. Upon prolonged exposure to temperatures below the dew point, the instrument may show increased sensitivity (maximum +7%) when immediately used to make measurements at temperatures above the dew point. The cause of the increase in sensitivity is the condensation of water vapor on the detector filter surface. When the detector has reached a temperature above the dew point and surface condensation has dissipated, the above specifications will apply.

INFRARED INTERFERENCE

Although the longwave and shortwave sensor cells have their peak sensitivities at 365nm and 254nm, respectively, they do have a low level response to infrared with little interference or sensitivity to visible light. Since most ultraviolet sources are filtered, the infrared emission is decreased and the amount of infrared seen by the sensor is generally less than 5%, well within the accuracy of the meter reading. For instance, the **unfiltered** Model B-100A 100 watt mercury vapor BLAK-RAY Lamp has an average infrared intensity of 10% of the total reading. The value decreases to an average infrared intensity of 2.6% of the total reading when the **filtered** longwave emission is viewed.

For greatest accuracy, the cells should not be used when visible light at the point of measurement is 40 foot candles or more, or when the equivalent of a 100 watt incandescent source is within 15 feet. Many high pressure mercury arcs have a high percentage of infrared emission, as does the sun. For example, the infrared of a G.E. RS-275 Suntan Lamp typically represents an average of 21.5% of the total longwave UV reading, as determined by the recommended contrast filter procedure described below. When such lamps are to be metered, sun ultraviolet studies made, or when ambient infrared is suspected, the following procedure will provide more accurate ultraviolet readings.

Accurate ultraviolet measurements with no infrared interference can be achieved by using the included Clear Snap-On Contrast Filter. Make one reading without the filter, which will include ultraviolet plus any infrared present. Make another reading by snapping on the Contrast Filter over the sensor cell. As the contrast filter absorbs all ultraviolet and the meter sees no visible light, the resultant reading will be infrared only. When the second (infrared) reading multiplied by 1.06 (an insertion loss correction) is subtracted from the first reading, the resultant figure will be ultraviolet energy only.

MEASURING HIGH INTENSITY LAMPS

Use the Reduction Screen to measure any high intensity ultraviolet lamp (i.e., a lamp which drives the needle off the "B" scale). Readings made with the Reduction Screen are only relative measurements, **not** in microwatts/cm^2, although the Reduction Screen does multiply the reading by approximately 5 times. To install the Reduction Screen, simply snap it on to the sensor cell.

TO MEASURE FILTERED SHORTWAVE TUBES AND FILTERS

Use the J-225 shortwave meter. Remove the lamp filter if present and take a reading directly on the tube. This gives a relative measurement of ultraviolet output without the condition of the filter affecting the reading. Remember to wear UV protective spectacles when making this measurement. As shortwave filters deteriorate with use, it is often desirable to know filter condition. The J-225 meter readily determines transmission. The best technique is to note the transmission of the new filter held between a shortwave source and the meter. Subsequent readings on the filter will give the percent degradation by simple calculation.

The meter sensor cell is subject to the same type of deterioration described above. For this reason, the meter sensor should be exposed to shortwave ultraviolet light only for the minimum time required to make the reading. This is particularly important at high intensities (i.e., those beyond the range of the "A" scale).

MEASURING DETERIORATION OF GERMICIDAL TUBES

The sensor cell should be placed directly on the tube, using the perforated metal reduction screen clipped on to the sensor. Fit the four pegs on the sensor face over the tube for proper positioning. This assures the same placement of the sensor each time for reliable comparative readings. Take a reading approximately four inches from each end of the tube, and another in the middle of the tube. The average of these three readings should be used. The reduction screen should be used for all germicidal measurements, even with low intensity lamps. Remember to wear UV protective eyewear and skin wear when making this measurement.

CORRECTION FACTORS FOR J-221 METER

A meter measures the density of radiant flux incident on a surface. "Radiant incidence (irradiance)" is measured in units of power (radiant flux) per unit area, i.e., watts/cm^2. Meter measurements yield a number; however, this number will be valid only for a particular type light source and wavelength range, depending on the design and calibration of the meter being used.