Measuring Black Light Intensity

Manufactured by
ULTRA-VIOLET PRODUCTS, INC.
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FOOTCANDLES VS. MICROWATTS PER SQUARE CENTIMETER) ($\mu W/cm^2$)

As far back as 1942, selenium cell photoelectric meters were being used to measure black light intensity. The most common, easily usable meters of this type were the footcandle meters made by Weston and General Electric. These meters were designed for use by illumination engineers who at that time wanted their measurements in footcandles, and the meters were so calibrated.

The footcandle, however, is a unit of visible light as seen by the human eye under photopic conditions. There is no such thing as a footcandle of black light. Selenium cell meters, properly filtered to measure footcandles (using "Viscor" filters) do not respond significantly to black light. Black light is the popular name for long wave ultraviolet-that area within the UV region closest to visible light. Unfiltered selenium cell light meters do have some sensitivity to black light, along with considerably more sensitivity to visible light. Thus, for convenience sake, black light has been incorrectly measured in footcandles for many years.

Obviously, it is important to have a unit of measurement for black light intensity. Black light is electromagnetic radiation similar in nature to radio waves, infrared, etc. These radiations are measured in units of energy per unit time, namely watts. Total black light output can equally be well measured in watts or fractions thereof. It should be noted, however, that although black lights are commonly rated by their wattage, the figures given are actually electrical energy input rather than radiated output, which is the point of this discussion. The radiated output is much less than the input due to conversion losses.

Total energy output of a black light source is actually a fairly useless figure because this energy may be spread over a wide and unknown area. Since the area of an indication is finite, the quantity of interest is the amount of black light incident on a given area. Thus, the unit of measurement for black light is most logically watts per unit area, in this age of metrification, watts per square meter. The square meter is an excessively large unit of area for this use, however, so the commonly used unit is the microwatt per square centimeter ($\mu W/cm^2$). On this scale, intensities used for inspection work will range from several hundred to several thousand $\mu W/cm^2$.

Measurement of black light intensity requires the use of a special meter calibrated in $\mu W/cm^2$. The most commonly available type is the BLAK-RAY® J-221 long wave meter. This meter is filtered so that it doesn't respond to visible light but only to black light. Therefore, ambient room light is not measured along with the black light, as is the case with the older footcandle meters.

The J-221 meter comes equipped with two useful accessories that make the meter much more versatile. They are a multiplier screen and an extension lead. The multiplier screen is a perforated metal plate transmitting about 20% of the light striking it. Thus, it extends the range of the meter by about five times.

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The screens are supplied uncalibrated so the user must determine his own multiplier factor. This is done by placing the meter under black light of intensity near the top of the scale, reading the meter, placing the screen over the sensor (without moving the meter) and rereading. Divide the first reading by the second to obtain the multiplier factor of the screen. When using the screen, multiply all readings by this factor. When replacing the screen, care must be taken to position exactly as before.

The second accessory is the 4-foot extension lead. This allows one to disconnect the sensor from the meter and reconnect through the lead so the sensor can be used away from the meter. The main advantage of this is that readings may be taken at a specified surface rather than 2½ inches above it, as is the case when the sensor is on the meter. This distance can make a large difference in reading. Also, the extension allows one to place the sensor in a darkened area and read outside where light is available. This is not a great advantage since the meter face is treated to be phosphorescent and can easily be read under black light.