Analog Sensors • Scotopic Illumination Detector

PMA1131

Measures Illumination According to Dark-Adapted Photopic Luminous Efficiency Curve

Applications

- Low Light Level Testing
- Night Vision Technology
- Display and Illuminator Testing
- Luminescence and Fluorescence
- Photography and Film Studios
- Clinical Studies, Ophtalmology

Features and Benefits

- High Sensitivity
- Wide Dynamic Range
- Excellent Long-Term Stability
- Cosine Corrected
- NIST Traceable Calibration
- Selectable Units

The PMA1131 is a portable illumination detector (Lux detector) with spectral response following the CIE scotopic action spectrum. This detector is designed to have a spectral response like that of the human eye's visual response in the photopic (dark adapted) region.

The human eye has three distinctive regions of response. The first region is the response of the eye under typical lighting conditions (photopic) defined as intensities greater than about 0.1 Lux. The second region is a transitional region known as the Purkinje region defined as intensities between about 0.01 and 0.1 Lux. The third region is the dark adapted region of the human eye (scotopic) defined as intensities between about 0.01 and 0.0001 Lux. Intensities less than 0.0001 Lux are undetectable with the human eye. These three region are distinctive in that the human eye has different spectral response for each region of intensity. The scotopic spectral luminous efficiency curve peaks at 507nm and it is normalized to 1 at that wavelength.

The power-like unit of brightness-sensation-produciing ability of light is lumen [lm]. The relationship between effective Watts and scotopic lumen is now assumed to be 1754 lm/W. For example, 507nm monochromatic radiation flux of 0.0001W would would carry the scotopicluminous flux of 0.1754 lm. Please note, that photopic spectral luminous efficiency as well as the conversion factor between Watts and photopic lumens differ from their scotopic conterparts.

The illumination (illuminance) is measured in luminous flux per unit area. The following units are commonly used with ft-cd and lux dominating in the field:

- 1 lumen/cm^2 = 1 phot
- 1 lumen/ft^2= 1 footcandle (ft-cd)
- 1 lumen/m^2= 1 lux

The PMA1131 detector has a teflon diffuser assuring an angular response close to the cosine function (Lambertian response). It is very important in order to measure accurately radiation flux from extended sources or from sources positioned at an angle to the axis of the detector.

SOLAR®
LIGHT

Calibration

The PMA1131 detector is calibrated by trasfer from a NIST traceable quartz-halogen standard lamp. The spectral irradiace from the lamp, at the nominal distance of 50 cm, is cross-multiplied by the photopic luminous efficiency function and the effective power of the radiation is converted to lm/m^2 (lux) using a conversion factor of 1754 lm/W. The PMA1131 detector is then exposed to this radiation and adjusted accordingly.

The basic radiometric uncertainty of this calibration is under 5%. The detector requires yearly re-calibration.

Specifications	
Spectral Response	Follows CIE scotopic spectral luminous efficiency curve (400-600nm) Figure 1
Angular Response	5% for Angles <60°, Figure 2
Range	200,000 scotopic mLux, 20,000 mft-cd 120,000 µW/m^2
Display Resolution	1 mLux, 0.1 mft-cd, 1 µW/m^2
Operating Environment	32 to 120 °F (0 to +50 °C) No Precipitation
Cable	6 ft. Straight Cable (1.82m)
Diameter	1.6" (40.6mm)
Height	1.8" (45.8mm)
Weight	7.1 oz. (200 grams)
Ordering Information	
PMA1131	Scotopic Illumination Detector
See list of accessories for mounting hardware available. For photopic illumination detector (for light levels above 0.1 Lux) see the PMA2130	

References

[1] "American National Standards: Nomenclature and Definitions for Illuminating Engineering" (1981) Illuminating Engineering Society, New York
[2] Smith, Warren J. "Modern Optical Engineering", McGraw-Hill, New York (1966)

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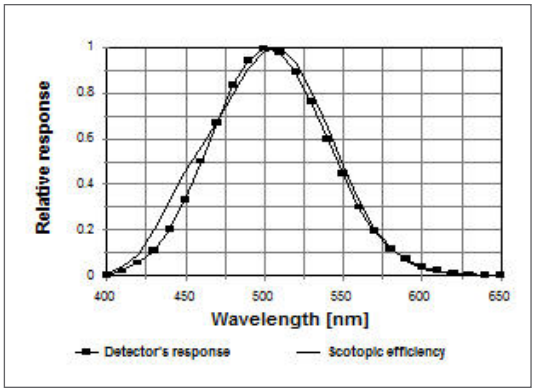

Fig. 1. PMA1131 Spectral Response

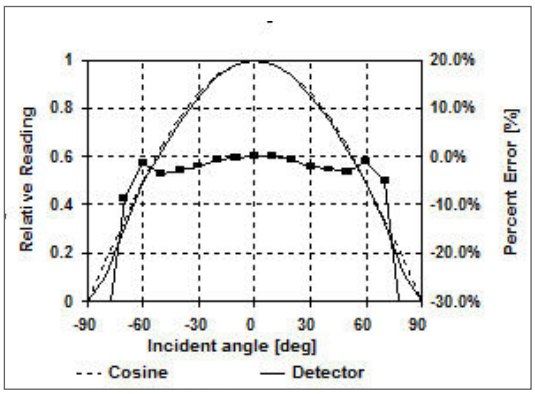

Fig. 2. PMA1131 Solar Simulator Spectral Output