

20.3 Instrumentation

Field measurements of lighting are usually undertaken with two basic instruments, an illuminance meter and a luminance meter.

20.3.1 Illuminance meters

Illuminance meters usually consist of a selenium or silicon photovoltaic cell connected directly, or indirectly via an amplifier, to an analogue or digital display (Figure 20.1). The quality of an illuminance meter is determined by a number of factors including calibration uncertainty, non-linearity, spectral correction error, cosine correction error, range change error and temperature change error. All these errors are discussed in detail in BS 667: *Specification for illuminance meters*. This standard defines two types of meter, type L mainly designed for laboratory use and type F designed for field use. The total uncertainty for a type L meter is $\pm 4\%$ and $\pm 6\%$ for a type F meter. These error limits assume the measurement of nominally white light. Measurements of highly coloured light sources, such as some light emitting diodes, may show much greater errors because of the poor fit of the spectral sensitivity of the meter to the CIE Standard Photopic Observer at particular wavelengths.



Figure 20.1

An illuminance meter

Illuminance meters are available for measuring illuminance from 0.1 lux to 100,000 lux, i.e. from emergency lighting conditions to daylight conditions. It is important to use an illuminance meter with a range matched to the illuminances to be measured.

20.3.2 Luminance meters

A luminance meter consists of an imaging system, a photoreceptor, and a display (Figure 20.2). The optical imaging system is used to form an image of the object of interest on the photoreceptor. The photoreceptor produces a signal that is dependent on the average luminance of the image it receives. The object of interest must be in focus and fill the photoreceptor aperture in order to obtain valid readings. This signal is amplified and displayed in either analogue or digital form. By changing the imaging system it is possible to alter the field of view of the photoreceptor to give different areas of measurement. The photoreceptors used in luminance meters may be photovoltaic cells or photomultiplier tubes. The photovoltaic cells, as in illuminance meters, need to be colour corrected and used with associated circuitry to give a linear response and operate acceptably over a range of ambient temperature.