



**The National Optical Astronomy Observatory's
Dark Skies and Energy Education Program
SQM-L Instruction Sheet**



Thank you for purchasing a Sky Quality Meter (SQM-L) from Unihedron!

Features

The SQM-L has the following features:

- It is sensitive only to visual light (there is a near-infrared blocking filter in front of the sensor).
- The effects of temperature on the “dark frequency” of the sensor are removed.
- The effects of temperature on the microcontroller oscillator are removed.
- It is protected against accidental reversal of battery polarity.
- Each SQM-L is calibrated using a NIST-traceable light meter. The absolute precision of each meter is believed to be $\pm 10\%$ (± 0.10 mag/arcsec²). The difference in zeropoint between each calibrated SQM-L is typically $\pm 10\%$ (± 0.10 mag/sq arcsec)
- The brightness of the numeric LED

display has two (automatic) settings. Under dark skies, you won't have your dark adaption ruined by use of your SQM-L! Under urban skies, the display will be correspondingly brighter.

- A repeating audible beep indicates when a measurement is in progress.
- Any kind of 9V battery is usable. The SQM-L contains a voltage regulator to power the sensor, microcontroller and other components.
- After reading is taken and displayed, the meter automatically turns itself off.
- The Half Width Half Maximum (HWHM) of the angular sensitivity is $\sim 10^\circ$. The Full Width Half Maximum (FWHM) is then $\sim 20^\circ$. The sensitivity to a point source $\sim 19^\circ$ off-axis is a factor of 10 lower than on-axis. A point source $\sim 20^\circ$ and $\sim 40^\circ$ off-axis would register 3.0 and 5.0 magnitudes fainter, respectively.

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Quick Start

The SQM-L is very simple to use. Point the lens towards the zenith. Press the Start button once and release. Under urban skies, a reading will be displayed almost immediately. Under the very darkest conditions (no moon in the sky, far from civilization) the meter may take up to a minute to complete its measurement. Please ensure that you maintain the orientation of the meter until the reading is displayed.

The SQM-L's reading is indicative of the sky brightness within its field of view. There must be no direct illumination or shading of the sensor by a terrestrial light source if the reading is to be meaningful.

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Typical Readings

Magnitudes per square arcsecond is a logarithmic measurement. Therefore large changes in sky brightness correspond to relatively small numerical changes. A difference of 1 magnitude is defined to be a factor of $(100)^{(1/5)}$ in received photons. Therefore a sky brightness 5.0 mag/arcsec² fainter corresponds to a reduction in photon arrival rate of a factor of 100.

The following schematic gives a rough idea of how to interpret the readings:



At the darkest sites, natural variations in conditions such as airglow and the brightness of the zodiacal light are limiting factors.

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Temperature reading

The temperature in °C then °F are displayed when you press and hold the button a second time. Also, the model and serial number are displayed after the temperature.

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Care of your SQM-L

The SQM-L is a fairly simple and robust device. Avoid dropping, immersing, and compressing it and it will give you years of dependable service. Keep the faceplate clean and ensure that the battery still has useful capacity. If you have left your SQM-L for a long period of time (i.e. years) and see a white, powdery substance around one of the battery contacts, your battery will need to be replaced and the contacts cleaned before you can expect reliable operation.

The SQM-L should not be negatively affected by dew during normal operation EXCEPT for the reduction in received light by the sensor. Make sure that the sensor faceplate has been wiped before making measurements.

During storage, make sure that the push-button is not being continuously pressed since the meter will draw current from the battery and drain it in that situation.

Do not point the meter at the Sun.

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