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 ±10% (±0.10 mag/arcsec²). The difference in zeropoint between each calibrated SQM-L is typically ±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 ~10°. The Full Width Half Maximum (FWHM) is then ~20°. The sensitivity to a point source ~19° off-axis is a factor of 10 lower than on-axis. A point source ~20° and ~40° off-axis would register 3.0 and 5.0 magnitudes fainter, respectively.

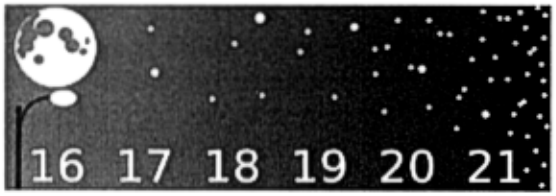
Quick Start

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.

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 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.

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.

Troubleshooting

After I push the button, no reading is displayed.

Are you in a very dark location?

Yes → The Sky Quality Meter may take up to a minute to acquire a reading when the sky is very dark. If your meter is operating properly, you will here a soft beeping sound while the measurement is in progress. When complete, the sky brightness will be displayed for a fixed number of seconds.

No → Your 9V battery may need to be replaced.

The connector to your 9V battery may be loose.

If, after you have checked for both of these possibilities and your SQM-L still won't display a reading under normal operating conditions, contact Unihedron for further information and a possible replacement.

I don't know how to make sure the SQM-L is off.

The SQM-L functions in such a way that it is only temporarily on and turns itself off automatically. This is a design feature to maximize battery life.

The readings don't repeat exactly.

Are you pointing the SQM-L in the same direction each time? Under dark conditions, you must keep the SQM-L pointed in the same direction until the reading appears on the LED display.

Your SQM-L must be pointed at an angle sufficiently high above the horizon that it will not detect light directly from terrestrial sources (cars, buildings, streetlights). It is normally the zenith sky brightness which is measured.

The readings do not change when pointing to various parts of the night sky.

Each SQM-L reading must be initiated by pressing the button. The displayed reading will stay on for 10 seconds before shutting down. After the unit has shut down, press the button to initiate another reading.

The readings are numerically lower (brighter) than expected.

Make sure that no stray light from street lights or other sources directly illuminates the lens/sensor.

The readings are numerically higher (darker) than expected.

Make sure that nothing shades the field of view of the lens/sensor (such as a tall stand of trees or the side of a building).

When I use the meter during the day, all I see is a ∩∩∩∩ on the display.

The SQM-L has a fantastically large range over which it will report accurate sky brightnesses. However, to be sensitive in the darkest conditions, it is necessary to sacrifice the ability to record daytime sky surface brightnesses. Normal lux meters can be used in such circumstances once the effective solid angle for the lux meter's sensor is known. The ∩∩∩∩ indicates that the sensor is saturated.

All I see is a UUUU on the display.

The UUUU indicates that the sensor was unable to produce a reading. This can occur in a light-tight dark room or if the sensor is faulty.

Sometimes the first reading is different.

As the temperature of the unit changes slightly due to being powered up, the very first reading may be slightly higher than the following readings. Ignore this first reading and average the following ones for the most accurate value.

Other scales

To convert the SQM-L mag/arcsec² reading to cd/m², use the following formula:

$$[cd/m^2] = 10.8 \times 10^4 \times 10^{(-0.4 * [mag/arcsec2])}$$

Unanswered Questions

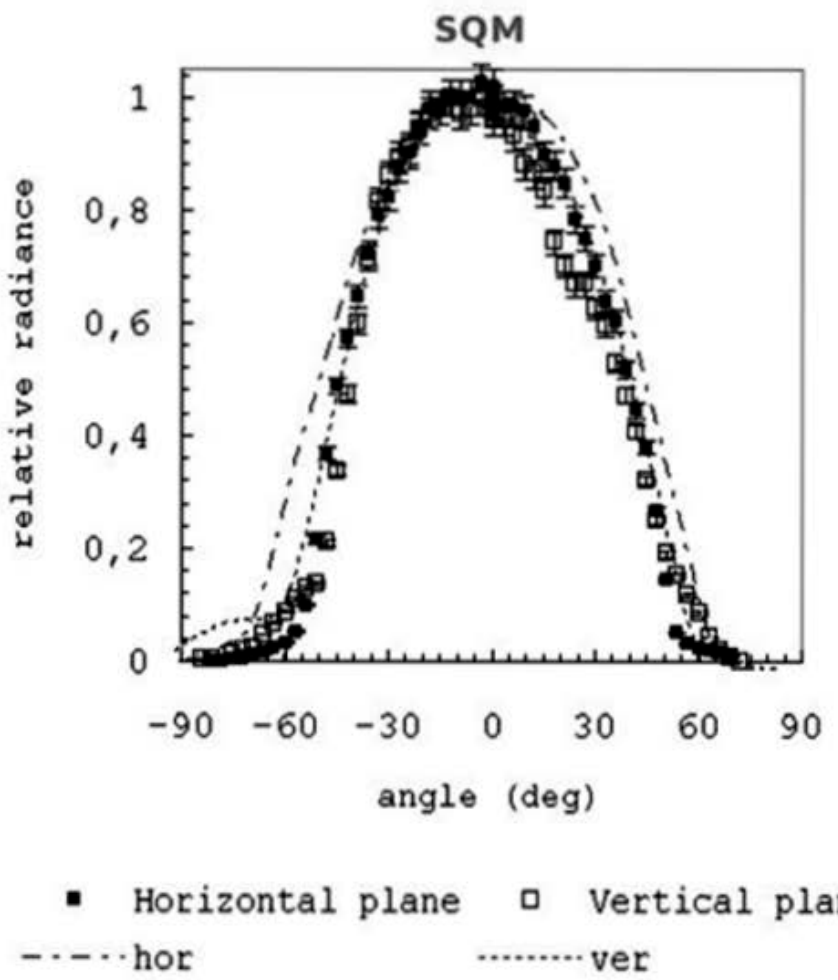
Help us to inform you and other customers better by forwarding unanswered questions about the SQM-L and measuring light pollution to:
info@unihedron.com

Contact Information

Unihedron
4 Lawrence Ave
Grimsby, ON L3M 2L9
Canada
Tel: (905) 945-1197

Warranty

Unihedron warrants this product 1 year.



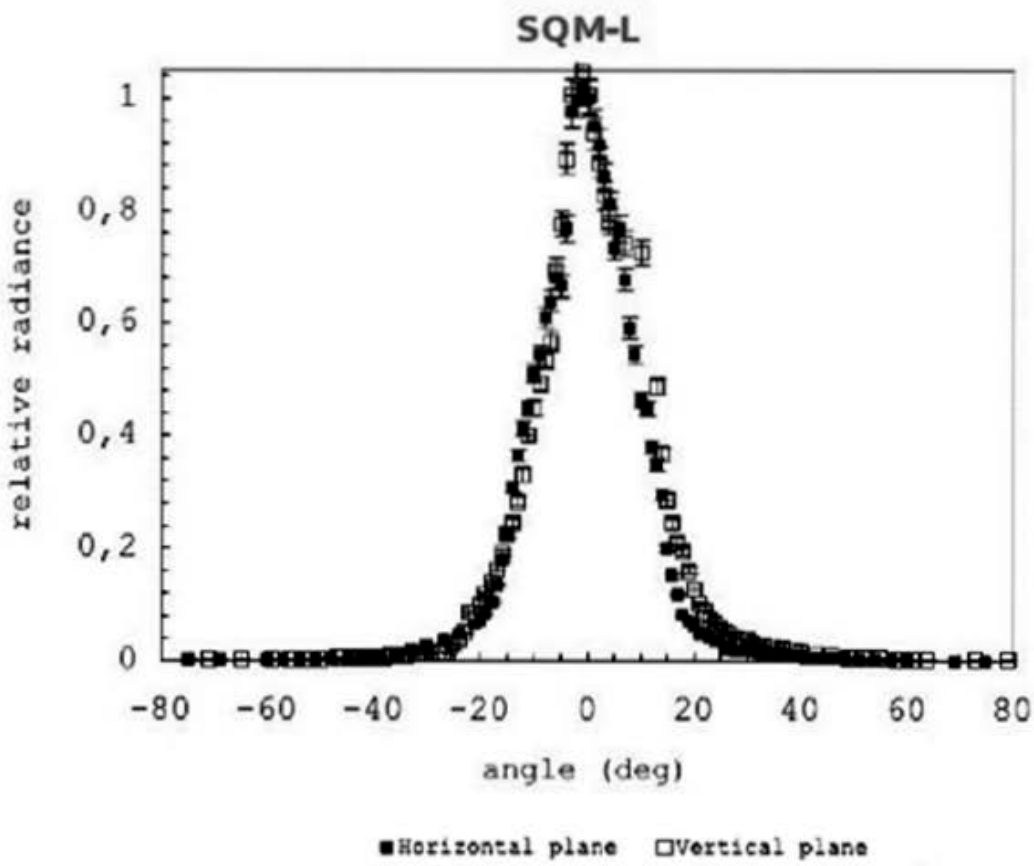


Fig. 3.— Angular response of SQM in a linear scale. Lines show the normalized output frequency of the detector at each angle provided by the detector manufacturer, along the vertical (dashed) and horizontal (dot-dashed) planes.

SQM READINGS COMPARISON:

Note: The Unihedron SQM is sensitive enough to be affected by Milky Way, Zodiacal Light, and natural sky-glow. SQM readings are based on the following logarithmic scale:

$\Delta 1.0 = 2.512$ x brightness, measured in M/arc-second^2 (higher numbers = darker sky)

According to the Unihedron database, any reading higher than 21.0 is considered to be excellent conditions. The theoretical maximum reading of 22.0 is limited by natural sky-glow, and rarely seen anywhere on the planet.

1. Midtown Tucson, by Dan McKenna (instrumentation expert) Q = 18.5
2. Suburban Tucson (Keith Schlottman, Xanadu Observatory) Q = 19.5
   Texas Star Party Q = 21.76
   Main Street USA in Disneyland Q = 14.97
3. Full Moon up at Flagstaff (Brian Skiff, Lowell astronomer) Q = 18.0 – 18.5
   Best values for Mars Hill = 20.8, Anderson Mesa Q = 21.8
4. Fountain Hills, AZ (Gene Lucas, engineer) Q = 19.5
5. Dr. Constance Walker, NOAO: Mid-town Hong Kong Q = 13.2
6. Some major observatory sites:
   - Mount Wilson Q = 19.8
   - Mount Palomar Q = 21.5
   - Lick Observatory Q =20.7
   - Mount Lemmon Q = 21.5
   - Lowell Observatory Q = 20.5
7. Readings at Heimhenge, New River, AZ (using Unihedron model SQM-L):
   Nov 1, 2009, 6:45 pm, Full Moon rising, sky = clear, T = 26 °C, Q = 18.5
   Nov 5, 2009, 8:00 pm, no Moon, sky = clear, T = 26 °C, Q = 21.1
   Jan 4, 2010, 7:30 pm, no Moon, sky = clear, T = 24 °C, Q = 20.3
   Aug 9, 2013, 1:00 am, no Moon, sky = clear, T = 25 °C, Q = 20.9