apogee® INSTRUMENTS

APOGEE UNDERWATER QUANTUM METER | MQ-210

Ensure proper light levels for underwater photosynthesis

Features

Accurate, Stable Measurements
Long-term non-stability is determined from multiple replicate quantum sensors in accelerated aging tests and field conditions less than 2 % per year.

Ready for Underwater Use
The MQ-210 has the immersion effect correction factor preprogrammed in the meter firmware allowing you to make excellent underwater measurements right out of the box.

Unique Design
The original Apogee quantum sensor works well for broadband radiation sources (sun, high pressure sodium, metal halide, cool white fluorescent lamps). The meter features a waterproof sensor head that is fully-potted for a complete seal and to ensure it has no hollow cavities for water to penetrate and cause measurement errors.

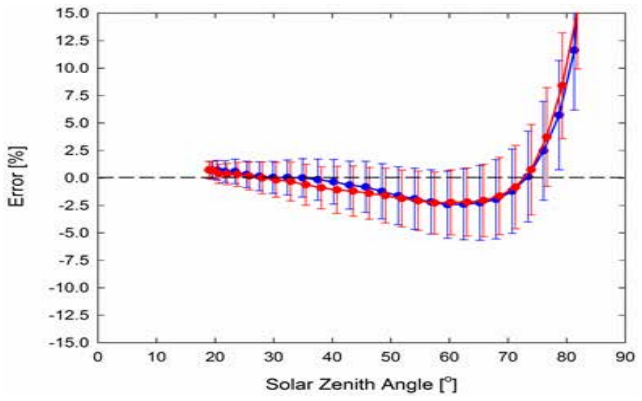
Datalogging Capabilities
The meter records up to 99 manual measurements. In logging mode the meter will make a measurement every 30 seconds. Every 30 minutes the meter will average the sixty 30 second measurements and record the averaged value. The meter can store up to 99 averages.

Calibration Traceability
Apogee SQ sensors are calibrated through side-by-side comparison to the mean of (4) Apogee model SQ-110 or SQ-120 transfer standard sensors under high output T5 cool white fluorescent lamps. The transfer standard sensors are calibrated through side-by-side comparison to the mean of at least (3) LI-COR model LI-190R reference quantum sensors under high output T5 cool white fluorescent lamps. The reference sensors are recalibrated on a biannual schedule with a LI-COR model 1800-02 and quartz halogen lamp that are traceable to the National Institute of Standards and Technology (NIST).

Product Specifications

	MQ-210
Calibration Uncertainty	± 5 %
Measurement Repeatability	Less than 0.5 %
Long-term Drift (Non-stability)	Less than 2 % per year
Non-linearity	Less than 1 % (up to 3000 µmol m^{-2} s^{-1})
Response Time	Less than 1 ms
Field of View	180°
Spectral Range	410 to 655 nm (wavelengths where response is greater than 50 % of maximum)
Directional (Cosine) Response	± 5 % at 75° zenith angle
Temperature Response	0.06 ± 0.06 % per C
Operating Environment	0 to 50 C; less than 90 % non-condensing relative humidity up to 30 C; less than 70 % non-condensing relativity humidity from 30 to 50 C; separate sensors can be submerged in water up to depth of 30 m
Meter Dimensions	114 mm length, 60 mm width, 14 mm depth
Sensor Dimensions	24 mm diameter, 33 mm height
Mass	180 g
Cable	2 m of shielded, twisted-pair wire; additional cable available; TPR jacket
Warranty	4 years against defects in materials and workmanship

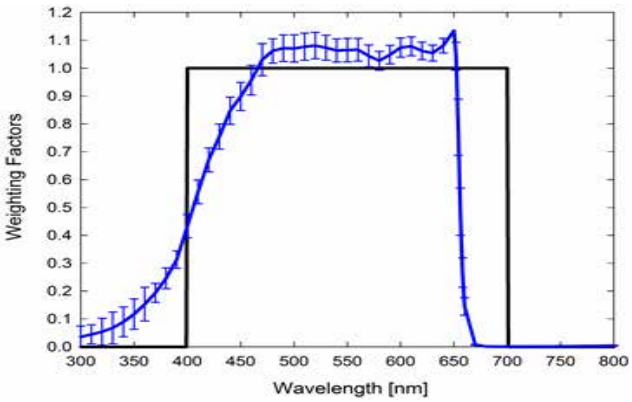
Cosine Response



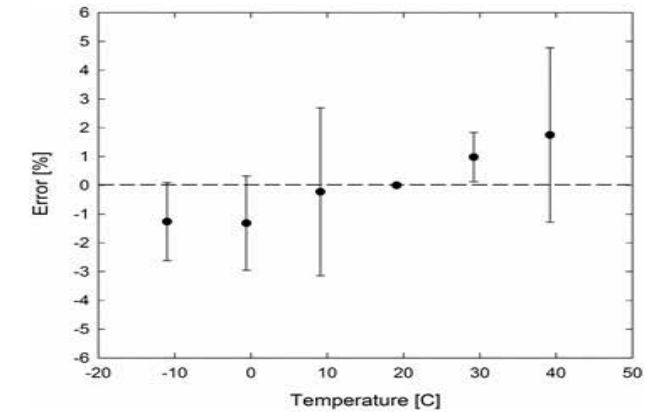
Mean **cosine response** of twenty-three MQ-210 quantum sensors (error bars represent two standard deviations above and below mean). Cosine response measurements were made by direct side-by-side comparison to the mean of four reference thermopile pyranometers, with solar zenith angle-dependent factors applied to convert total shortwave radiation to PPFD. Blue points represent the AM response and red points represent the PM response.

Spectral Response

Mean **spectral response** measurements of six MQ-210 quantum sensors (error bars represent two standard deviations above and below mean) compared to PPFD weighting function. Spectral response measurements were made at 10 nm increments across a wavelength of 300 to 800 nm in a monochromator with an attached electric light source. Measured spectral data from each quantum sensor were normalized by the measured spectral response of the monochromator/electric light combination, which was measured with a spectroradiometer.



Temperature Response



Mean **temperature response** of eight MQ-210 quantum sensors (error bars represent two standard deviations above and below mean). Temperature response measurements were made at 10 C intervals across a temperature range of approximately -10 to 40 C in a temperature controlled chamber under a fixed, broad spectrum electric lamp. At each temperature set point, a spectroradiometer was used to measure light intensity from the lamp and all quantum sensors were compared to the spectroradiometer. The spectroradiometer was mounted external to the temperature control chamber and remained at room temperature during the experiment.

Dimensions