

Provides research-grade underwater measurements under all light sources, including LEDs



FULL-SPECTRUM UNDERWATER QUANTUM METER | MQ-510

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-510 has the immersion effect correction factor preprogrammed in the meter firmware allowing you to make excellent underwater measurements right out of the box.

Unique Waterproof Design

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.

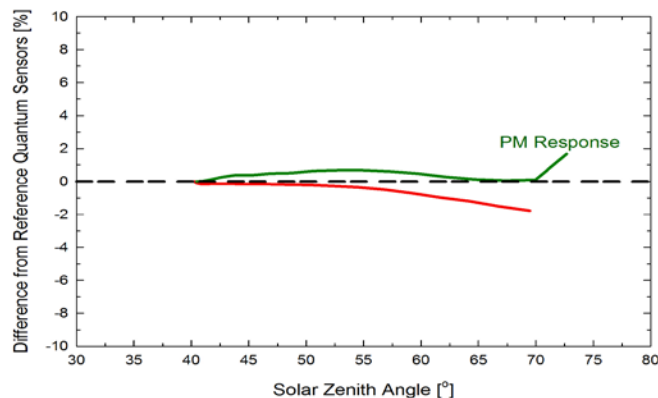
Datalogging Capabilities

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.

Spectral Errors

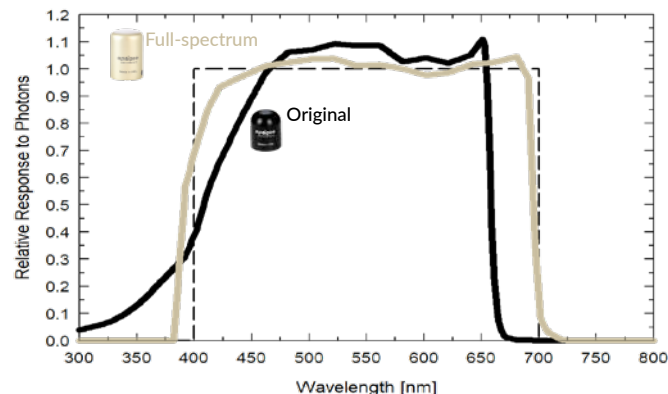
	Apogee SQ-500	Apogee SQ-110 SQ-120	LI-COR LI-190	Kipp & Zonen PQS 1
Sun (Clear Sky)	-2.2	0.0	-0.4	-1.0
Sun (Cloudy Sky)	-1.7	1.4	-0.2	-1.3
Sun (Reflected from Deciduous Leaves)	-2.0	4.9	-0.8	1.1
Sun (Transmitted below Wheat Canopy)	-1.1	6.4	-0.1	-0.3
Cool White Fluorescent (T5)	0.0	0.0	0.0	0.0
Metal Halide	0.9	-3.7	0.2	-1.7
Ceramic Metal Halide	-0.3	-6.0	0.4	-0.7
High Pressure Sodium	0.0	0.8	1.3	1.4
Red/Blue LED (16 % 444 nm, 84 % 667 nm peaks)	-3.4	-65.3	3.5	-1.8
Red/White LED (6.5 % 436 nm, 4.5 % 531 nm, 89 % 668 nm peaks)	-3.0	-60.3	2.6	-1.7

Cosine Response



Mean cosine response of seven Apogee SQ-500 quantum sensors. Cosine response was calculated as the relative difference of SQ-500 quantum sensors from the mean of replicate reference quantum sensors. The red data are AM measurements; the green data are PM measurements.

Spectral Response

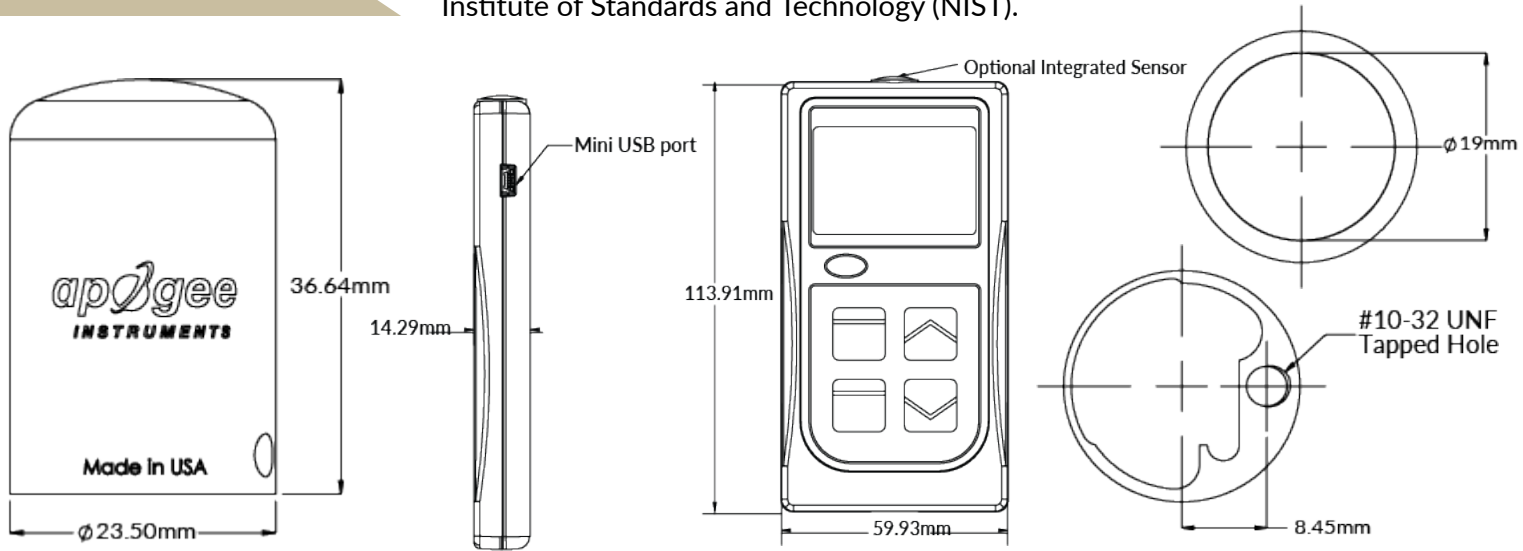


Mean spectral response measurements of six replicate Apogee SQ-100 and SQ-500 series quantum sensors. Spectral response measurements were made at 10 nm increments across a wavelength range of 300 to 800 nm in a monochromator with an attached electric light source. Measured spectral data from each quantum sensor were normalized by the measured spectral response of the monochromator/electric light combination, which was measured with a spectroradiometer.

Dimensions

Calibration Traceability

Apogee SQ-500 sensors are calibrated through side-by-side comparison to the mean of four transfer standard sensors under a reference lamp. The reference sensors are recalibrated with a quartz halogen lamp traceable to the National Institute of Standards and Technology (NIST).



Product Specifications

MQ-510	
Calibration Uncertainty	$\pm 5\%$
Measurement Range	0 to 4000 $\mu\text{mol m}^{-2} \text{s}^{-1}$
Measurement Repeatability	Less than 0.5 %
Long-term Drift (Non-stability)	Less than 2 % per year
Non-linearity	Less than 1 % (up to 4000 $\mu\text{mol m}^{-2} \text{s}^{-1}$)
Response Time	Less than 1 ms
Field of View	180°
Spectral Range	389 to 692 nm ± 5 nm (wavelengths where response is greater than 50 % of maximum)
Spectral Selectivity	Less than 10 % from 412 to 682 nm ± 5 nm
Directional (Cosine) Response	$\pm 5\%$ at 75° zenith angle
Azimuth Error	Less than 0.5 %
Tilt Error	Less than 0.5 %
Temperature Response	$-0.11 \pm 0.04\%$ per C
Uncertainty in Daily Total	Less than 5 %
Detector	Blue-enhanced silicon photodiode
Housing	Anodized aluminum body with acrylic diffuser
IP Rating	IP68
Operating Environment	0 to 50 C; less than 90 % non-condensing relative humidity up to 30 C; less than 70 % non-condensing relative humidity from 30 to 50 C; separate sensors can be submerged in water up to depth of 30 m
Meter Dimensions	126 mm length, 70 mm width, 24 mm depth
Sensor Dimensions	24 mm diameter, 37 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