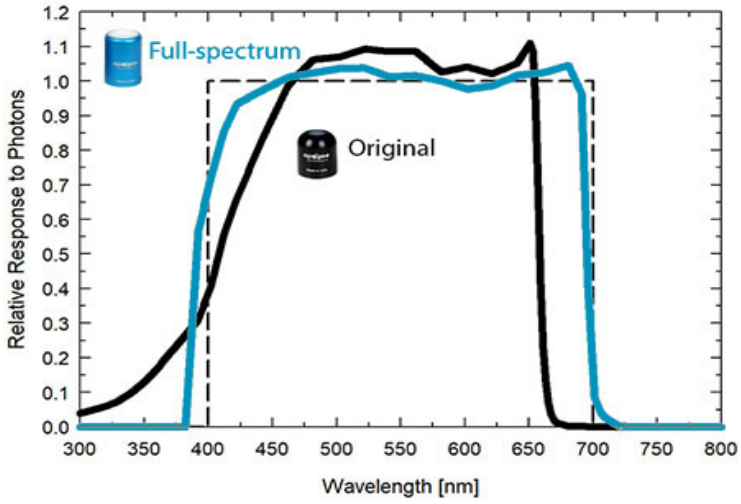
UNDERWATER QUANTUM (PAR) METERS

MQ-510 & MQ-210

Spectral Response

Research-grade measurements of underwater photosynthetically active radiation



Mean **spectral response** measurements of six replicate Apogee MQ-210 and MQ-510 series quantum sensors.

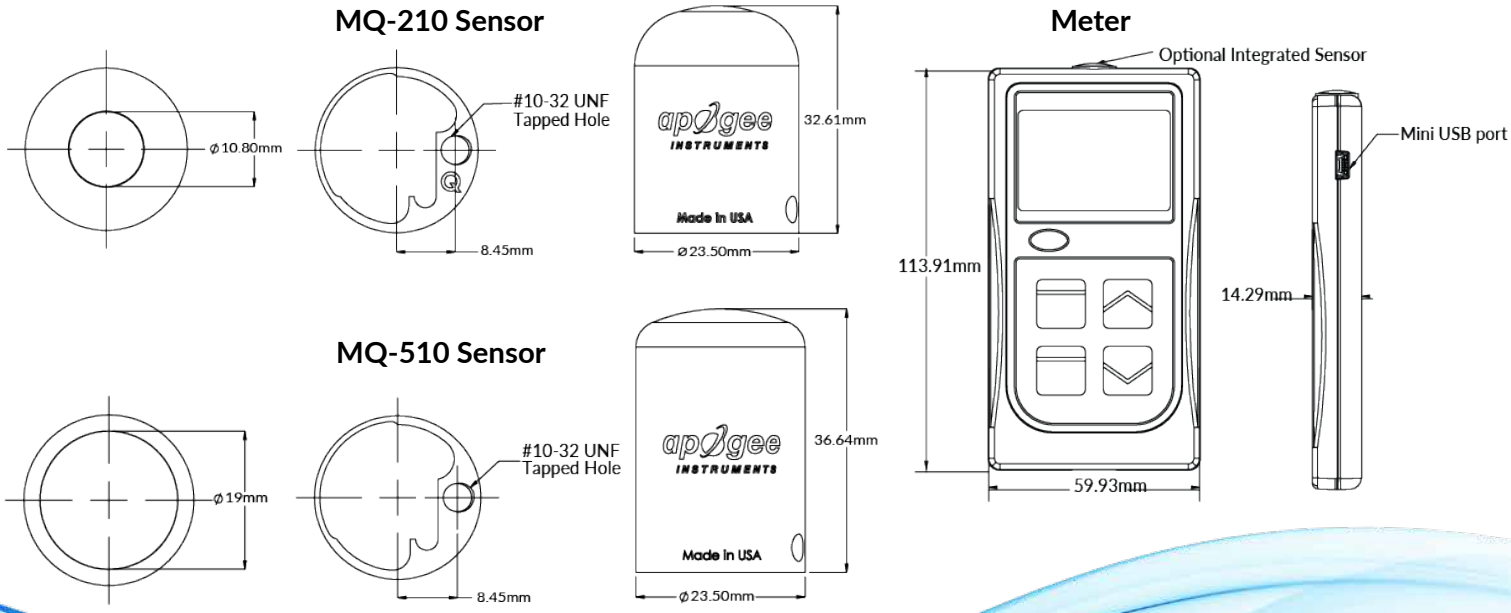
Product Specifications

	MQ-510	MQ-210
Calibration Uncertainty	± 5 %	
Measurement Range	0 to 4000 µmol m^{-2} 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 µmol m^{-2} 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)	410 to 655 nm (wavelengths where response is greater than 50 % of maximum)
Spectral Selectivity	Less than 10 % from 412 to 682 nm ± 5 nm	Less than 10 % from 469 to 655 nm ± 5 nm
Directional (Cosine) Response	± 5 % at 75° zenith angle	
Temperature Response	-0.11 ± 0.04 % per C	0.06 ± 0.06 % 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 relativity 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	114 mm length, 60 mm width, 14 mm depth
Sensor Dimensions	24 mm diameter, 37 mm height	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	

Overview

Apogee Instruments PAR meters are the tool of choice for cost-effective, scientific-grade measurement of underwater PAR levels. Accurate tank PAR mapping, daily light integral measurements, and the adjusting of photosynthetic radiation levels to mimic nature are all critical to specimen health. Apogee offers two different underwater calibrated meters at two different price points. The basic MQ-210 features our original detector that is excellent for broadband light sources. The research-grade MQ-510 features an improved detector excellent for all light sources, including LEDs, and matches LI-COR and Kipp & Zonen PAR sensors in accuracy while costing much less.

Dimensions



Spectral Errors

	Apogee SQ-500	Apogee SQ-110 SQ-120	LI-COR LI-190	Kipp & Zonen PQS 1
Sun (Clear Sky)	**0.0**	0.0	-0.4	-1.0
Sun (Cloudy Sky)	**0.1**	0.2	-0.2	-1.3
Sun (Reflected from Grass Canopy)	**-0.3**	3.8	-0.8	1.1
Sun (Transmitted below Wheat Canopy)	**0.1**	4.5	-0.1	-0.3
Cool White Fluorescent (T5)	**0.0**	0.0	0.0	0.0
Metal Halide	**0.9**	-2.8	0.2	-1.7
Ceramic Metal Halide	**0.3**	-16.1	0.4	-0.7
High Pressure Sodium	**0.1**	0.2	1.3	1.4
Red LED (667 nm peak, 20 nm full-width half-maximum)	**2.8**	-62.1	3.5	-1.8
Red, Blue, White LED Mixture (60 % Red, 25 % White, 15 % Blue)	**-2.0**	-35.5	2.6	-1.7

Features

DESIGNED FOR UNDERWATER USE

Sensor heads are fully epoxy potted to be completely waterproof. Diffuser is cosine corrected for accurate 2-pi PAR-mapping. Sensor readings are adjusted in firmware to correct for the immersion effect.

ACCURATE, STABLE MEASUREMENTS

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

DATALOGGING CAPABILITIES

The meter records up to 99 measurements in logging mode, making automatic measurements every 30 seconds and recording 30-minute averages. Data can be downloaded to calculate DLI.

NIST TRACEABLE CALIBRATION

Apogee Quantum sensors are calibrated by comparison to the mean of four transfer standard sensors under a reference lamp. The reference sensors are recalibrated regularly to a halogen lamp traceable to the National Institute of Standards and Technology. Calibration certificates are available upon request.