

Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 11/21/16

Model Number: QSP200L4S

Job No.: R12783

Serial Number: 4617

Operator: TPC

Standard Lamp: 91453(7/20/16)

Operating Voltage Range: 6 to 15 VDC (+)

Note: The QSP200L4S uses a log amplifier to measure the detector signal current with $V = \log I \text{ (Amps)} / I_{Ref}$
To calculate irradiance, use this formula:

$$\text{Irradiance} = \text{Calibration factor} * (10^{\text{Light Signal Voltage}} - 10^{\text{Dark Voltage}})$$

With the appropriate (solar corrected) Irradiance Calibration Factor:

Dry Calibration Factor:	8.49E+12	quanta/cm ² -sec per volt	1.41E-05	μEinsteins/cm ² -sec per volt
Wet Calibration Factor:	1.50E+13	quanta/cm ² -sec per volt	2.49E-05	μEinsteins/cm ² -sec per volt

Sensor Test Data and Results⁴⁾

Sensor Supply Current (Dark):	77.3	mA								
Supply Voltage:	6	Volts								
Lamp Integrated PAR Irradiance:	8.38E+15	quanta/cm ² -sec	0.01391	μEinsteins/cm ² sec						
SC3 Immersion Coefficient:	0.5664	Scalar Correction:	1	PAR Solar Correction: 1.0000						
Nominal Filter OD	Calibrated Trans.	Sensor Voltage	Measured Trans.	Measured Signal (Amps)	Estimated Signal (Amps)	Calc. Output (Volts)	Error (Volts)	Error (%)	Test Irrad. (quanta/cm ² -sec)	
No Filter	100.00%	2.995	100.00%	9.89E-08	9.89E-08	2.996	0.001	0.0	8.38E+15	
0.3	36.10%	2.554	36.08%	3.57E-08	3.57E-08	2.554	0.001	0.0	3.02E+15	
0.5	27.60%	2.441	27.81%	2.75E-08	2.73E-08	2.438	-0.003	-0.8	2.33E+15	
1	9.27%	1.973	9.36%	9.26E-09	9.16E-09	1.969	-0.004	-1.0	7.85E+14	
2	1.11%	1.104	1.13%	1.12E-09	1.10E-09	1.097	-0.007	-1.8	9.48E+13	
3	0.05%	0.359	0.08%	7.43E-11	5.28E-11	0.316	-0.043	-29.0	6.30E+12	

Dark Before: 0.189 Volts
 Light - No Filter Hldr.: 2.994 Volts
 Dark After - NFH: 0.188 Volts
 Average Dark: 0.189 Volts

$I_{Ref} = 1.00E-10$ Amps
 $I_{Dark} = 1.54E-10$ Amps
 $10^{V_{Dark}} = 1.543476$

RG780 0.31

Notes:

- Annual calibration is recommended.
- The collector should be cleaned frequently with alcohol.
- This section is for internal use and for more advanced analysis.