

# Biospherical Instruments Inc

## CALIBRATION CERTIFICATE

### UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

**Calibration Date:** 03/14/13

**Job No.:** R11562

**Model Number:** QSP200L4S

**Serial Number:** 4497

**Operator:** TPC

**Standard Lamp:** V-030(3/7/12)

**Operating Voltage Range:** 6 to 15 VDC (+)

Note: The QSP-200 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:

<b>Dry Calibration Factor:</b>	8.74E+12	quanta/cm <sup>2</sup> ·sec/"amps"	1.45E-05	μEinsteins/cm <sup>2</sup> ·sec/"amps"
<b>Wet Calibration Factor:</b>	1.54E+13	quanta/cm <sup>2</sup> ·sec/"amps"	2.56E-05	μEinsteins/cm <sup>2</sup> ·sec/"amps"

**Sensor Test Data and Results<sup>4)</sup>**

Sensor Supply Current (Dark):		74.0	mA							
Supply Voltage:		6	Volts							
Lamp Integrated PAR Irradiance:		9.83E+15	quanta/cm <sup>2</sup> ·sec	0.01632	μEinsteins/cm <sup>2</sup> 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 <sup>2</sup> ·sec)	
No Filter	100.00%	3.052	100.00%	1.13E-07	1.13E-07	3.052	0.001	0.0	9.83E+15	
0.3	36.10%	2.606	35.76%	4.03E-08	4.07E-08	2.611	0.005	1.0	3.51E+15	
0.5	27.60%	2.495	27.66%	3.12E-08	3.11E-08	2.495	0.000	-0.2	2.72E+15	
1	9.27%	2.023	9.23%	1.04E-08	1.04E-08	2.025	0.002	0.4	9.07E+14	
2	1.11%	1.136	1.08%	1.22E-09	1.25E-09	1.146	0.010	2.5	1.06E+14	
3	0.05%	0.360	0.07%	8.02E-11	6.01E-11	0.320	-0.040	-25.0	7.00E+12	

Dark Before:	0.173	Volts	$I_{Ref} = 1.00E-10$	Amps	
Light - No Filter Hldr.:	3.052	Volts	$I_{Dark} = 1.49E-10$	Amps	
Dark After - NFH:	0.174	Volts	$10^{V_{Dark}} = 1.490047$	Amps	RG780      0.263
Average Dark:	0.173	Volts			

- Notes:
1. Annual calibration is recommended.
  2. There is increasing error associated with readings below zero.
  3. The collector should be cleaned frequently with alcohol.
  - 4) This section is for internal use and for more advanced analysis.