

Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 02/06/18

Job No.: R13138

Model Number: QSP200L4S

Serial Number: 4516

Operator: TPC

Standard Lamp: V-041(7/21/16)

Operating Voltage Range: 6 to 15 VDC (+)

Note: The QSP200L4S uses a log amplifier to measure the detector signal current with $V = \log I \text{ (Amps)} / I_{\text{Ref}}$
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:	8.70E+12	quanta/cm²·sec per volt	1.44E-05	μEinsteins/cm²·sec per volt
Wet Calibration Factor:	1.54E+13	quanta/cm²·sec per volt	2.55E-05	μEinsteins/cm²·sec per volt

Sensor Test Data and Results⁴⁾

Sensor Supply Current (Dark):	<u>63.3</u>	mA								
Supply Voltage:	<u>6</u>	Volts								
Lamp Integrated PAR Irradiance:	<u>9.73E+15</u>	quanta/cm ² ·sec		0.01615	μEinsteins/cm ² ·sec					
SC3 Immersion Coefficient:	0.5664	Scalar Correction:	<u>1</u>	PAR Solar Correction:	<u>1.0000</u>					
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%	<u>3.049</u>	100.00%	1.12E-07	1.12E-07	3.050	0.001	0.0	9.73E+15	
0.3	36.10%	<u>2.610</u>	36.31%	4.06E-08	4.04E-08	2.608	-0.002	-0.6	3.53E+15	
0.5	27.60%	<u>2.497</u>	27.96%	3.13E-08	3.09E-08	2.492	-0.005	-1.3	2.72E+15	
1	9.27%	<u>2.032</u>	9.50%	1.06E-08	1.04E-08	2.022	-0.010	-2.4	9.24E+14	
2	1.11%	<u>1.158</u>	1.16%	1.30E-09	1.24E-09	1.141	-0.017	-4.3	1.13E+14	
3	0.05%	<u>0.360</u>	0.08%	8.86E-11	5.98E-11	0.302	-0.058	-32.6	7.70E+12	

Dark Before: 0.148 Volts
 Light - No Filter Hldr.: 3.049 Volts
 Dark After - NFH: 0.148 Volts
 Average Dark 0.148 Volts

$I_{\text{Ref}} = 1.00\text{E-}10$ Amps
 $I_{\text{Dark}} = 1.41\text{E-}10$ Amps
 $10^{V_{\text{Dark}}} = 1.405724$
 RG780 **0.169**

Notes:

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