

Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 03/28/08

Job No.: R-9888

Model Number: QSP-2300

Serial Number: 4701

Operator: TPC

Standard Lamp: 91537(10/25/06)

Operating Voltage Range: 6 to 15 VDC (+)

Note: The QSP-200 uses a log amplifier to measure the detector signal current with $V = \log I \text{ (Amps)} / I_{\text{Ref}}$
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:	2.22E+13	quanta/cm ² ·sec/"amps"	3.69E-05	μEinsteins/cm ² ·sec/"amps"
Wet Calibration Factor:	3.74E+13	quanta/cm ² ·sec/"amps"	6.21E-05	μEinsteins/cm ² ·sec/"amps"

Sensor Test Data and Results⁴⁾

Sensor Supply Current (Dark):			82.3	mA						
Supply Voltage:			6	Volts						
Lamp Integrated PAR Irradiance:			8.83E+15	quanta/cm ² ·sec	0.01467	μEinsteins/cm ² sec				
SC3 Immersion Coefficient:			0.594	Scalar Correction:	1	PAR Solar Correction:				1.0000
Measured Estimated Calc. Test Irrad.										
Nominal	Calibrated	Sensor	Measured		Signal	Signal	Output	Error		(quanta/
Filter OD	Trans.	Voltage	Trans.		(Amps)	(Amps)	(Volts)	(Volts)	Error (%)	cm ² ·sec)
No Filter	100.00%	2.601	100.00%		3.99E-08	3.99E-08	2.603	0.002	0.0	8.83E+15
0.3	36.10%	2.168	36.64%		1.46E-08	1.44E-08	2.163	-0.005	-1.5	3.24E+15
0.5	27.60%	2.057	28.33%		1.13E-08	1.10E-08	2.048	-0.010	-2.6	2.50E+15
1	9.27%	1.614	9.96%		3.98E-09	3.70E-09	1.585	-0.029	-6.9	8.80E+14
2	1.11%	0.822	1.29%		5.16E-10	4.43E-10	0.772	-0.049	-14.1	1.14E+14
3	0.05%	0.272	0.09%		3.79E-11	2.13E-11	0.232	-0.040	-43.7	8.39E+12

Dark Before:	0.174	Volts	$I_{\text{Ref}} = 1.00\text{E-}10$	Amps		
Light - No Filter Hldr.:	2.601	Volts	$I_{\text{Dark}} = 1.49\text{E-}10$	Amps	RG780	0.2167
Dark After - NFH:	0.174	Volts	$10^{V_{\text{Dark}}} = 1.492451$	Amps		
Average Dark	0.174	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.