

Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 09/29/09

Job No.: R-10394

Model Number: QSP-2300

Serial Number: 4644

Operator: TPC

Standard Lamp: GS1018(8/28/08)

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: $1.38E+13$ quanta/cm²·sec/"amps" $2.28E-05$ μEinsteins/cm²·sec/"amps"

Wet Calibration Factor: $2.32E+13$ quanta/cm²·sec/"amps" $3.84E-05$ μEinsteins/cm²·sec/"amps"

Sensor Test Data and Results¹⁾

Sensor Supply Current (Dark):		90.0	mA						
Supply Voltage:		6	Volts						
Lamp Integrated PAR Irradiance:		$9.09E+15$	quanta/cm ² ·sec	0.01509	μEinsteins/cm ² ·sec				
SC2 Immersion Coefficient:		0.594		3	PAR Solar Correction				
Nominal Filter OD	Calibrated Trans.	Sensor Voltage	Measured Trans.	Measured Signal (Amps)	Estimated Signal (Amps)	Calc. Output (Volts)	Error (Volts)	Error (%)	
No Filter	100.00%	2.821	100.00%	$6.62E-08$	$6.62E-08$	2.822	0.001	0.0	
0.3	36.10%	2.389	36.85%	$2.44E-08$	$2.39E-08$	2.381	-0.008	-2.0	
0.5	27.60%	2.278	28.49%	$1.89E-08$	$1.83E-08$	2.265	-0.013	-3.4	
1	9.27%	1.841	10.28%	$6.81E-09$	$6.14E-09$	1.798	-0.043	-9.8	
2	1.11%	1.016	1.35%	$8.97E-10$	$7.35E-10$	0.943	-0.073	-18.0	
3	0.05%	0.320	-0.10%	$6.70E-11$	$3.54E-11$	0.249	-0.071	-47.2	
Dark Before:		0.152	Volts						
Light - No Filter Hdr:		2.821	Volts	$I_{\text{Ref}} = 1.00E-10$	Amps				
Dark After - NFH:		0.153	Volts	$I_{\text{Dark}} = 1.42E-10$	Amps	RG780	0.2		
Average Dark:		0.153	Volts	$10^{\text{VDark}} = 1.420692$	Amps				

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.