

Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 07/15/10

Job No.: R-10686

Model Number: QSP-200L

Serial Number: 4246

Operator: TPC

Standard Lamp: GS1024(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 $V = \log I \text{ (Amps)} / I_{Ref}$
To calculate irradiance, use this formula:

Irradiance = Calibration factor * (10[^]Light Signal Voltage - 10[^]Dark Voltage)
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With the appropriate (solar corrected) Irradiance Calibration Factor:

Dry Calibration Factor:	2.12E+13	quanta/cm ² ·sec/"amps"	3.52E-05	μEinsteins/cm ² ·sec/"amps"
Wet Calibration Factor:	3.57E+13	quanta/cm ² ·sec/"amps"	5.93E-05	μEinsteins/cm ² ·sec/"amps"

Sensor Test Data and Results⁴⁾

Sensor Supply Current (Dark):		56.8	mA							
Supply Voltage:		6	Volts							
Lamp Integrated PAR Irradiance:		9.27E+15	quanta/cm ² ·sec	0.01540	μEinsteins/cm ² ·sec					
SC3 Immersion Coefficient:		0.594	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%	2.642	100.00%	4.39E-08	4.39E-08	2.643	0.001	0.0	9.27E+15	
0.3	36.10%	2.211	36.85%	1.62E-08	1.58E-08	2.203	-0.007	-2.0	3.42E+15	
0.5	27.60%	2.100	28.48%	1.25E-08	1.21E-08	2.088	-0.012	-3.1	2.64E+15	
1	9.27%	1.651	9.93%	4.35E-09	4.07E-09	1.624	-0.027	-6.6	9.20E+14	
2	1.11%	0.831	1.23%	5.38E-10	4.87E-10	0.798	-0.033	-9.5	1.14E+14	
3	0.05%	0.250	0.08%	3.62E-11	2.34E-11	0.218	-0.032	-35.4	7.66E+12	

Dark Before: 0.152 Volts
 Light - No Filter Hldr.: 2.647 Volts
 Dark After - NFH: 0.151 Volts
 Average Dark 0.151 Volts

$I_{Ref} = 1.00E-10$ Amps
 $I_{Dark} = 1.42E-10$ Amps
 $10^{V_{Dark}} = 1.417098$ Amps
 RG780 **0.176**

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.