Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 05/28/99 **Job No.:** R6986
Model Number: QSP200L
Serial Number: 4550
Operator: JSR
Standard Lamp: 94532 (03/13/98)
Operating Voltage Range: 5 to 15 VDC (+)

Note: The QSP-200L uses a log amplifier to measure the detector signal current with V = log I (Amps) / IRef
To calculate irradiance, use this formula:

Irradiance = Calibration factor * (10^Light Signal Voltage - 10^Dark Voltage)

With the appropriate (solar corrected) Irradiance Calibration Factor:

Dry Calibration Factor:	**9.98E+12**	**quanta/cm² sec/"amps"**	**1.66E-05**	**µEinsteins/cm² sec/"amps"**
Wet Calibration Factor:	**1.68E+13**	**quanta/cm² sec/"amps"**	**2.79E-05**	**µEinsteins/cm² sec/"amps"**

Sensor Test Data and Results[4)]

Sensor Supply Current (Dark):	69.9	mA			
Supply Voltage:	6	Volts			
Lamp Integrated PAR Irradiance:	8.55E+15	quanta/cm² sec	0.01420	µEinsteins/cm²sec	
SC3 Immersion Coefficient:	0.594	Scalar Correction:	1.02	PAR Solar Correction:	0.9922

Nominal Filter OD	Calibrated Trans.	Sensor Voltage	Measured Trans.	Measured Signal (Amps)	Estimated Signal (Amps)	Calc. Output (Volts)	Error (Volts)	Error (%)	Test Irrad. (quanta/ cm² sec)
No Filter	100.00%	2.939	100.00%	8.68E-08	8.68E-08	2.940	0.001	0.0	8.65E+15
0.3	36.10%	2.501	36.39%	3.16E-08	3.14E-08	2.498	-0.003	-0.8	3.15E+15
0.5	27.60%	2.385	27.81%	2.42E-08	2.40E-08	2.382	-0.003	-0.8	2.41E+15
1	9.27%	1.927	9.57%	8.31E-09	8.05E-09	1.914	-0.013	-3.2	8.28E+14
2	1.11%	1.062	1.15%	1.00E-09	9.64E-10	1.049	-0.013	-3.7	9.97E+13
3	0.05%	0.345	0.08%	6.71E-11	4.64E-11	0.303	-0.042	-30.9	6.68E+12

Dark Before: 0.184 Volts
Light - No Filter Hldr.: 2.935 Volts
Dark After - NFH: 0.193 Volts
Average Dark 0.188505 Volts

I_{Ref} = 1.00E-10 Amps
I_{Dark} = 1.54E-10 Amps
10^{VDark} = 1.543492 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.