Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

Calibration Date: 03/14/13 **Job No.:** R11561
Model Number: QSP200L4S
Serial Number: 4516
Operator: TPC
Standard Lamp: V-030(3/7/12)
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 (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:	**1.21E+13**	**quanta/cm²·sec/"amps"**	**2.00E-05**	**µEinsteins/cm²·sec/"amps"**
Wet Calibration Factor:	**2.13E+13**	**quanta/cm²·sec/"amps"**	**3.53E-05**	**µEinsteins/cm²·sec/"amps"**

Sensor Test Data and Results[4)]

Sensor Supply Current (Dark):	61.4	mA			
Supply Voltage:	6	Volts			
Lamp Integrated PAR Irradiance:	9.83E+15	quanta/cm²·sec	0.01632	µEinsteins/cm²sec	
SC3 Immersion Coefficient:	0.5664	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/ cm²·sec)
No Filter	100.00%	2.912	100.00%		8.17E-08	8.17E-08	2.913	0.001	0.0	9.83E+15
0.3	36.10%	2.473	36.24%		2.96E-08	2.95E-08	2.472	-0.001	-0.4	3.56E+15
0.5	27.60%	2.359	27.83%		2.27E-08	2.25E-08	2.356	-0.003	-0.8	2.74E+15
1	9.27%	1.893	9.41%		7.68E-09	7.57E-09	1.887	-0.006	-1.5	9.25E+14
2	1.11%	1.024	1.13%		9.19E-10	9.06E-10	1.019	-0.005	-1.4	1.11E+14
3	0.05%	0.300	0.07%		6.04E-11	4.36E-11	0.262	-0.038	-27.8	7.27E+12

Dark Before: 0.143 Volts
Light - No Filter Hldr.: 2.910 Volts
Dark After - NFH: 0.145 Volts
Average Dark 0.144 Volts

I_{Ref} = 1.00E-10 Amps
I_{Dark} = 1.39E-10 Amps
10^{VDark} = 1.392035 Amps

RG780 **0.157**

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.