Biospherical Instruments Inc

CALIBRATION CERTIFICATE

UNDERWATER PAR SENSOR WITH LOG AMPLIFIER

RECEIVED 18 Aug 04

Calibration Date: 10/07/03 **Job No.:** L8494
Model Number: QSP2300
Serial Number: 4672
Operator: TPC
Standard Lamp: 98700(5/19/01)
Operating Voltage Range: 6 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:	**2.20E+13**	**quanta/cm² sec/"amps"**	**3.65E-05**	**µEinsteins/cm² sec/"amps"**
Wet Calibration Factor:	**3.70E+13**	**quanta/cm² sec/"amps"**	**6.14E-05**	**µEinsteins/cm² sec/"amps"**

Sensor Test Data and Results[4)]

Sensor Supply Current (Dark):	90.4	mA			
Supply Voltage:	6	Volts			
Lamp Integrated PAR Irradiance:	9.14E+15	quanta/cm² sec	0.01518	µEinsteins/cm²sec	
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/ cm² sec)
No Filter	100.00%	2.621	100.00%	4.17E-08	4.17E-08	2.622	0.002	0.0	9.14E+15
0.3	36.10%	2.186	36.53%	1.52E-08	1.51E-08	2.182	-0.004	-1.2	3.34E+15
0.5	27.60%	2.075	28.22%	1.18E-08	1.15E-08	2.067	-0.008	-2.2	2.58E+15
1	9.27%	1.639	10.11%	4.22E-09	3.87E-09	1.604	-0.035	-8.3	9.24E+14
2	1.11%	0.847	1.33%	5.57E-10	4.63E-10	0.786	-0.061	-16.8	1.22E+14
3	0.05%	0.278	0.10%	4.14E-11	2.23E-11	0.232	-0.046	-46.2	9.08E+12

Dark Before: 0.171 Volts
Light - No Filter Hldr.: 2.621 Volts
Dark After - NFH: 0.172 Volts
Average Dark 0.17135 Volts

I_{Ref} = 1.00E-10 Amps
I_{Dark} = 1.48E-10 Amps
10^{VDark} = 1.483713 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.