Biospherical Instruments Inc.

CALIBRATION CERTIFICATE for PRR Spectroradiometer

Calibration Date: 7/28/2005 **Job:** R9105
Model Number: PRR-600
Serial Number: 9665
Operator: TPC
Standard Lamp: 99190(4/12/05)

Ch	Tag	O(nm)	Lamp Irradiance @ 50 cm	Immersion Coefficient (Type P6-2)	Calibration Voltage - Dark[3]	Calibration Voltage - Light	Calibration Factor - Dry (V/µW)	Calibration Factor - Wet (V/µW)	Max E (Dry)	
DOWNWELLING IRRADIANCE CHANNELS						**Irradiance Units: µW/cm²·nm, E = Irradiance**				
1	0	412	2.355	0.677	-0.000634	-0.074759	-0.031471	-0.021297	317.8	
2	0	443	3.629	0.682	-0.000645	-0.118344	-0.032432	-0.022121	308.3	
3	0	490	6.014	0.690	-0.000644	-0.202414	-0.033551	-0.023155	298.1	
4	0	510	7.141	0.694	-0.000467	-0.245947	-0.034374	-0.023841	290.9	
5	0	555	9.780	0.701	-0.000585	-0.303767	-0.030999	-0.021740	322.6	
6	0	665	15.736	0.720	-0.000430	-0.533911	-0.033903	-0.024418	295.0	
7	0	PAR[4]	0.0142	0.694	-0.000429	-0.222662	-15.684034	-10.884876	0.638	[5]
8	0	Gnd.[5]	-0.000547	Volts						

Calibration Factor: WET = ((Light - Dark) x Immers. Coeff.)/Lamp Output
DRY = (Light - Dark)/Lamp Output

Ch	Tag	O(nm)	Lamp Irradiance @ 50 cm	Immersion Coefficient (BK7 window)	Plaque Reflectivity 11/17/03	Radiance[6]	Calibration Voltage - Dark	Calibration Voltage - Blocked[3]	Calibration Voltage - Light	Calibration Factor - Wet (V/µW)	Max L (Wet)
UPWELLING RADIANCE CHANNELS						**Radiance Units: µW/cm²·nm·sr, L = Radiance**					
2	1	412	2.355	1.747	0.990	0.0225	-0.000511	-0.000544	-0.031548	-0.788331	12.7
3	1	443	3.629	1.742	0.991	0.0347	-0.000244	-0.000251	-0.031496	-0.516522	19.4
4	1	490	6.014	1.735	0.992	0.0576	-0.000479	-0.000499	-0.102852	-1.024127	9.8
5	1	510	7.141	1.733	0.991	0.0683	-0.000383	-0.000397	-0.131775	-1.109348	9.0
6	1	555	9.780	1.729	0.991	0.0936	0.000341	0.000303	-0.177721	-1.100756	9.1
7	1	665	15.736	1.721	0.992	0.1507	-0.000164	-0.000217	-0.295535	-1.138769	8.8
8	1	Gnd.[5]	-0.000315	Volts							

Dry Radiance = (Lamp Output x Plaque Reflectivity x Lamp Distance Factor)/Σ
Lamp Distance Factor = $(50\ cm)^2/(287.1\ cm)^2$
Calibration Factor: WET = (Light - Dark)/(Dry Radiance x Immersion Coefficient)

9	0	**TEMPERATURE[7]**	**Temperature (°C) = (Voltage - Offset)/Scale**	
		Scale	**0.0673**	0.0673
		Offset	**-0.0688**	-0.07
10	0	**PRESSURE/DEPTH[8]**	**Pressure/Depth (dbars or meters) = (a x Voltage²) + (b x Voltage) + c**	
		Scale Factor "a"	**0.5118**	
		Scale Factor "b"	**82.4404**	
		Offset "c"	**20.3781**	

	Profiler
Scale	0.0119
Offset	-0.2392

NOMINAL TO ACTUAL VOLTAGE CONVERSION FACTORS (For use with external sensors, only, see manual)

	Irr. Array	Rad. Array
Scale Factor	**1.062241**	**1.066883**
Offset	**-0.000208**	**-0.000436**
Full Scale Voltage	**9.4141**	**9.3731**

FIRMWARE VERSION(S)

	Tag 0	Tag 1
Underwater ROM	**2601HB**	**2043B**

Notes:

1. Annual calibration is recommended.
2. Calibrations were performed at approximately 20 to 30 °C.
3) "Dark" irradiance and "Blocked" radiance values represent a blocking of the calibration source. These values should not be used as the "Offset" when entering values into the calibration file. Use the totally dark sensor values obtained at the temperature where the instrument will be used.
4) PAR irradiance units are µEinsteins/cm²·sec.
5) Nominal/Typical value(s).
6) For conversion of area to solid angle, a factor (divisor) of Pi is incorporated.
7) Water temperature sensor.
8) A change in depth of 1 meter in seawater corresponds to approximately a 1 dbar change in pressure.
9) These channels/sensors were not calibrated during this service period.

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CALIBRATION CERTIFICATE for PRR Spectroradiometer

Calibration Date: 7/28/2005 **Job:** R9105
Model Number: PRR-600
Serial Number: 9665
Operator: TPC

OPTIONAL CHANNELS

Ch	Tag		
11	0	AXIS 1 ANGLE SENSOR - "TILT"	Degrees = (Voltage - Offset)/Scale
		Scale Factor	0.0394
		Offset	2.6541
12	0	AXIS 2 ANGLE SENSOR - "ROLL"	Degrees = (Voltage - Offset)/Scale
		Scale Factor	0.0399
		Offset	2.6605

		O(nm)	Chla-Like Radiance	Calibration Voltage - Dark[2]	Calibration Voltage - Light	Calibration Factor - Wet (V/nE)	Maximum Radiance (Wet)
		NATURAL FLUORESCENCE CHANNEL	Chla-Like Radiance Units: nE/m^2-sr-sec				
1	1	NF	159.200	-0.000407	-3.127100	-0.019640	509.2

Notes:

1) Annual calibration is recommended.

2) "Dark" irradiance and "Blocked" radiance values represent a blocking of the calibration source. These values should not be used as the "Offset" when entering values into the calibration file. Use the totally dark sensor values obtained at the temperature where the instrument will be used.

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CALIBRATION CERTIFICATE for PRR Spectroradiometer

Calibration Date: 7/27/2005 **Job:** R9106
Model Number: PRR-610
Serial Number: 9666
Operator: TPC
Standard Lamp: 99190(4/12/05)

Ch	Tag	E_s O(nm)	Lamp Output	Calibration Voltage - Dark[3]	Calibration Voltage - Light	Calibration Factor - Dry (V/µW)	Max E (Dry)
		SURFACE IRRADIANCE CHANNELS			Irradiance Units: µW/cm²·nm, E = Irradiance		
1	2	412	2.355	-0.000426	-0.082056	-0.034657	288.5
2	2	443	3.629	-0.000193	-0.124295	-0.034197	292.4
3	2	490	6.014	-0.000152	-0.196255	-0.032609	306.7
4	2	510	7.141	-0.000184	-0.237802	-0.033273	300.5
5	2	555	9.780	-0.000744	-0.326118	-0.033268	300.6
6	2	665	15.736	0.000003	-0.532933	-0.033868	295.3
7	2	PAR[4]	0.0142	-0.000429	-0.220309	-15.517972	0.644 [4]
8	2	Gnd.[5]	-0.00019	Volts			

Calibration Factors: DRY = (Light - Dark)/Lamp Output

NOMINAL TO ACTUAL VOLTAGE CONVERSION FACTORS (For use with external sensors, only, see manual)

	Irr. Array
Scale	1.072860
Offset	-0.000274
Full Scale Voltage	9.3209

FIRMWARE VERSION

	Tag 2
Surface ROM	2106B

Notes:

1. Annual calibration is recommended.
2. Calibrations were made at approximately 20 to 30 °C.
3) Dark values represent a blocking of the calibration source. These values should not be used as the 'offset' when entering values into the calibration file. Use the totally dark sensor values obtained at the temperature where the instrument will be used.
4) PAR irradiance units are µEinsteins/cm²·sec.
5) Typical value(s).