Biospherical Instruments Inc.

CALIBRATION CERTIFICATE for PRR Spectroradiometer

Calibration Date: 5/4/2004 **Job:** R8725
Model Number: PRR-610
Serial Number: 9666
Operator: TPC
Standard Lamp: 99132(12/26/03)

Ch	Tag	λ (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	2.400	-0.000376	-0.082095	-0.034045	293.7	
2	2	443	3.711	-0.000171	-0.125067	-0.033653	297.2	
3	2	490	6.196	-0.000109	-0.200345	-0.032315	309.5	
4	2	510	7.383	-0.000153	-0.241557	-0.032696	305.8	
5	2	555	10.185	-0.000688	-0.333054	-0.032632	306.4	
6	2	665	16.611	0.000039	-0.549887	-0.033106	302.1	
7	2	PAR[4]	0.0148	-0.000391	-0.224608	-15.104687	0.662	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).

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CALIBRATION CERTIFICATE for PRR Spectroradiometer

Calibration Date: 5/4/2004 **Job:** R8724
Model Number: PRR-600
Serial Number: 9665
Operator: TPC
Standard Lamp: 99132(12/26/03)

Ch	Tag	λ (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	2.400	0.677	-0.000659	-0.076387	-0.031549	-0.021350	317.0	
2	0	443	3.711	0.682	-0.000666	-0.121523	-0.032564	-0.022211	307.1	
3	0	490	6.196	0.690	-0.000651	-0.208041	-0.033470	-0.023099	298.8	
4	0	510	7.383	0.694	-0.000469	-0.253838	-0.034317	-0.023801	291.4	
5	0	555	10.185	0.701	-0.000609	-0.316621	-0.031027	-0.021760	322.3	
6	0	665	16.611	0.720	-0.000438	-0.563916	-0.033921	-0.024432	294.8	
7	0	PAR[4]	0.0148	0.694	-0.000433	-0.232393	-15.626305	-10.844812	0.640	[5]
8	0	Gnd.[5]	-0.000563	Volts						

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

Ch	Tag	λ (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	2.400	1.747	0.990	0.0217	-0.000518	-0.000509	-0.030724	-0.797000	12.5
3	1	443	3.711	1.742	0.991	0.0336	-0.000248	-0.000244	-0.030448	-0.516184	19.4
4	1	490	6.196	1.735	0.992	0.0561	-0.000488	-0.000506	-0.100632	-1.027965	9.7
5	1	510	7.383	1.733	0.991	0.0668	-0.000401	-0.000406	-0.129550	-1.115138	9.0
6	1	555	10.185	1.729	0.991	0.0922	0.000315	0.000297	-0.174454	-1.096938	9.1
7	1	665	16.611	1.721	0.992	0.1505	-0.000163	-0.000207	-0.288507	-1.113358	9.0
8	1	Gnd.[5]	-0.000315	Volts							

Dry Radiance = (Lamp Output x Plaque Reflectivity x Lamp Distance Factor)/π
Lamp Distance Factor = $(50\ cm)^2/(295.2\ cm)^2$
Calibration Factor: WET = (Light - Dark)/(Dry Radiance x Immersion Coefficient)

9	0	TEMPERATURE [7]	Temperature (°C) = (Voltage - Offset)/Scale
		Scale	0.0673
		Offset	-0.0897

10	0	PRESSURE/DEPTH [8]	Pressure/Depth (dbars or meters) = (a x Voltage²) + (b x Voltage) + c		
		Scale Factor "a"	0.5330		Profiler
		Scale Factor "b"	82.4042	Scale	0.0119
		Offset "c"	20.4526	Offset	-0.2421

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: 5/4/2004 **Job:** R8724
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

		λ (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: $nE/m^2 \cdot sr \cdot sec$				
1	1	NF	169.196	-0.000408	-3.382251	-0.019988	500.3

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.