

System Calibration Certificate

THE INSTRUMENTS REFERENCED BELOW WERE FACTORY TESTED AND CALIBRATED BY

BIOSPHERICAL INSTRUMENTS INC.

5340 Riley Street

San Diego, California 92110 USA

Instrument: C-OPS S/N 000272

Pressure Testing:

The housing for this instrument has been tested to 125 meters.

NIST-traceable Optical Calibrations:

The instrument was calibrated using a 1000 Watt FEL lamp with serial number V-039. This lamp was calibrated on 7/20/2016 against the NIST Standard of Spectral Irradiance F-616; NIST certificate spline-interpolated with $w=0.001$. Traceability of lamps, the calibration set up (e.g., shunts, voltmeters, power supplies) and calibration procedures follow recommendations published by the National Bureau of Standards (US), specifically "NBS Special Publication 250-20 Spectral Irradiance Calibrations (1987)" and "NBS Publication 594-13 Optical Radiation Measurements: The 1973 Scale of Spectral Irradiance (1977)."

All calibration information provided on the following pages is a subset of calibration information stored internally in the instrument.



C-OPS

Serial Number: 000272

Date of Certificate 4/6/2017

Optical Channels, Irradiance (EdZ) Calibration

Acquisition Rate 5 Hz
Internal Temperature (Max) 24.944 °C
Internal Temperature (Min) 23.749 °C
Aggregator Vin (Avg) 6.5 V
Aggregator Iin (Avg) 91.8 mA
Aggregator Internal Temperature (Avg) 26.2 °C
Aggregator Internal Pressure (Avg) 5.5 psi
Date of Calibration 4/4/2017
Calibration Engineer TC
Standard of Spectral Irradiance V-039

Channel	Wavelength (nm)	Tag	Firmware Version	Offset High Gain (mV)	Offset Medium Gain (mV)	Offset Low Gain (mV)	Signal/Noise Ratio	Immersion Coefficient	Responsivity in Water ¹	Calibrated Units
EdZ305	305	A	v:2.003 03/04/11 3Gain	-0.290	-0.141	-0.142	1143.43	0.6346	0.06429	μW/(cm ² nm)
EdZ320	320	B	v:2.003 03/04/11 3Gain	-0.257	-0.088	-0.087	2275.63	0.6371	0.10477	μW/(cm ² nm)
EdZ340	340	C	v:2.003 03/04/11 3Gain	-0.217	-0.089	-0.090	2343.21	0.6404	0.08873	μW/(cm ² nm)
EdZ380	380	D	v:2.003 03/04/11 3Gain	-0.065	0.082	0.081	2135.07	0.6471	0.03004	μW/(cm ² nm)
EdZ395	395	E	v:2.003 03/04/11 3Gain	-0.406	-0.041	-0.042	3250.78	0.6496	0.10064	μW/(cm ² nm)
EdZ412	412	F	v:2.003 03/04/11 3Gain	-0.035	0.086	0.085	3428.82	0.6525	0.12967	μW/(cm ² nm)
EdZ443	443	G	v:2.003 03/04/11 3Gain	-0.272	0.039	0.039	3372.73	0.6576	0.20752	μW/(cm ² nm)
EdZ465	465	H	v:2.003 03/04/11 3Gain	-0.294	-0.106	-0.106	3510.23	0.6613	0.16473	μW/(cm ² nm)
EdZ490	490	I	v:2.003 03/04/11 3Gain	-0.071	0.087	0.087	3095.97	0.6655	0.42847	μW/(cm ² nm)
EdZ510	510	J	v:2.003 03/04/11 3Gain	-0.022	0.113	0.114	2851.25	0.6688	0.42865	μW/(cm ² nm)
EdZ532	532	K	v:2.003 03/04/11 3Gain	-0.349	-0.151	-0.152	3551.23	0.6725	0.42376	μW/(cm ² nm)
EdZ555	555	L	v:2.003 03/04/11 3Gain	-0.224	-0.023	-0.023	3604.67	0.6763	0.58734	μW/(cm ² nm)
EdZ565	565	M	v:2.003 03/04/11 3Gain	-0.072	0.094	0.094	3454.57	0.6780	0.46215	μW/(cm ² nm)
EdZ625	625	N	v:2.003 03/04/11 3Gain	-0.235	-0.129	-0.128	3501.14	0.6880	0.90907	μW/(cm ² nm)
EdZ665	665	O	v:2.003 03/04/11 3Gain	-0.054	0.106	0.105	3578.63	0.6946	1.28280	μW/(cm ² nm)
EdZ683	683	P	v:2.003 03/04/11 3Gain	-0.011	0.106	0.105	3708.93	0.6976	1.00569	μW/(cm ² nm)
EdZ710	710	Q	v:2.003 03/04/11 3Gain	-0.133	-0.009	-0.010	3617.64	0.7021	1.50541	μW/(cm ² nm)
EdZ780	780	R	v:2.003 03/04/11 3Gain	-0.375	-0.149	-0.149	3690.65	0.7138	1.41613	μW/(cm ² nm)
EdZ875	875	S	v:2.003 03/04/11 3Gain	-0.101	0.021	0.020	3702.35	0.7297	0.85029	μW/(cm ² nm)

¹: Volts/Calibrated Units



C-OPS

Serial Number: 000272

Date of Certificate 4/6/2017

Optical Channels, Irradiance (EdZ) Calibration

The values listed in the section below are common for all optical microradiometers

Date of Calibration 4/4/2017
Calibration Engineer TC

Model Number uRv2:3G

Firmware Version v:2.003 03/04/11 3Gain

Adc Rate Rate_125_Hz
Adc Buffer Enabled False

Adc Channel Type PrimaryInput

Adc Gain Gain_1

Ranging Mode Auto

Ranging Delay High 3

Ranging Delay Medium 3

Ranging Delay Low 3

Switch Point High 31000

Switch Point Low 7782400

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Serial Number: 000272

Date of Certificate 4/6/2017

Angle Channels, Irradiance (EdZ) Calibration

Pitch and roll sensors zeroed according to manufacturer's specifications.

Date of Calibration 3/29/2017
Calibration Engineer TC