

# 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 000271**

## **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: 000271

Date of Certificate 4/6/2017

Optical Channels, Irradiance (Ed0) Calibration

Acquisition Rate 5 Hz

Aggregator Vin (Avg) 6.48 V

Date of Calibration 4/4/2017

Aggregator lin (Avg) 92.3 mA

Calibration Engineer TC

Internal Temperature (Max) 24.091 °C

Aggregator Internal Temperature (Avg) 26.6 °C

Internal Temperature (Min) 23.322 °C

Aggregator Internal Pressure (Avg) 5.7 psi

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 Air <sup>1</sup>	Calibrated Units
Ed0305	305	A	v:2.003 03/04/11 3Gain	-0.270	0.046	0.046	1169.11	-	0.10549	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0320	320	B	v:2.003 03/04/11 3Gain	0.142	0.303	0.302	2402.78	-	0.17191	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0340	340	C	v:2.003 03/04/11 3Gain	0.146	0.323	0.323	2860.12	-	0.15117	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0380	380	D	v:2.003 03/04/11 3Gain	-0.333	-0.064	-0.065	2960.16	-	0.04754	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0395	395	E	v:2.003 03/04/11 3Gain	-0.182	-0.026	-0.026	3783.92	-	0.12997	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0412	412	F	v:2.003 03/04/11 3Gain	-0.233	-0.132	-0.133	3435.87	-	0.15370	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0443	443	G	v:2.003 03/04/11 3Gain	-0.117	0.065	0.065	3691.65	-	0.31391	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0465	465	H	v:2.003 03/04/11 3Gain	-0.187	0.035	0.035	3929.43	-	0.24969	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0490	490	I	v:2.003 03/04/11 3Gain	-0.135	0.086	0.085	3159.55	-	0.61164	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0510	510	J	v:2.003 03/04/11 3Gain	-0.500	-0.216	-0.217	4446.27	-	0.62914	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0532	532	K	v:2.003 03/04/11 3Gain	-0.120	0.040	0.039	3757.31	-	0.63127	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0555	555	L	v:2.003 03/04/11 3Gain	-0.089	0.029	0.029	3744.05	-	0.79026	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0565	565	M	v:2.003 03/04/11 3Gain	-0.164	-0.007	-0.009	3315.18	-	0.65920	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0625	625	N	v:2.003 03/04/11 3Gain	-0.016	0.107	0.107	3804.73	-	1.26850	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0665	665	O	v:2.003 03/04/11 3Gain	-0.027	0.128	0.127	3921.81	-	1.83987	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0683	683	P	v:2.003 03/04/11 3Gain	-0.155	-0.035	-0.034	3994.85	-	1.36618	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0710	710	Q	v:2.003 03/04/11 3Gain	-0.384	-0.156	-0.157	3822.24	-	2.03472	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0780	780	R	v:2.003 03/04/11 3Gain	-0.329	-0.106	-0.106	3814.27	-	1.83854	$\mu\text{W}/(\text{cm}^2 \text{ nm})$
Ed0875	875	S	v:2.003 03/04/11 3Gain	-0.201	-0.092	-0.093	3737.61	-	1.24285	$\mu\text{W}/(\text{cm}^2 \text{ nm})$

1: Volts/Calibrated Units



**C-OPS**

**Serial Number: 000271**

**Date of Certificate** 4/6/2017

**Optical Channels, Irradiance (Ed0) 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

**C-OPS**

**Serial Number: 000271**

**Date of Certificate** 4/6/2017

**Angle Channels, Irradiance (Ed0) Calibration**

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

**Date of Calibration** 3/9/2017  
**Calibration Engineer** TC