



CALIBRATION RESULTS

DISCUSSION: The rad system arrived from Eppley calibrated and in good condition.

Instrument	Radiometer Analog to Digital Interface (RAD)
Serial Number	217
RMR Job#	426
Customer	URI-Endeavor
Cal ID	2112
PSP	30600
PIR	30606
Lead Tech	J. Reynolds
Location	RMRCO Seattle
System recvd and inspected.	<10/21
PSP & PIR cal at Eppley Labs	10/1-10/23/2021
Electronic Cal	12/7/2021
Burn-in test	12/8 - 12/10/2021
Est. ship date.	12/10/2021
Calibration Type	Electronic gain and ADC conversion.
After calibration	Returned to R/V Dyson R/V Endeavor

DISCUSSION: Excellent calibration. The equipment has been handled well.

Program a1_radcal.m v3 Runtime:2021-12-09 (343) 10:18:09.0

Calibration date: 2112

SN: 217

Calpath: /Users/rmr/Dropbox/instruments/RAD/RAD_CALIBRATION/217_uri_fanning/2112

PLOT FILE NAME: radcalplot_217_2112

Reference voltage = 4099.0 millivolts (TP16)

PSPCAL

-1.0,	-116.92
-0.5,	-57.45
-0.1,	-10.49
0.0,	1.37
0.1,	13.72
0.2,	25.56
0.5,	61.09
1.0,	120.39
2.0,	238.64
4.0,	475.83
8.0,	949.72

PIRCAL

-2.0,	-1676.95
-1.0,	-839.21
-0.8,	-672.73
-0.4,	-338.30
-0.2,	-170.83
0.0,	-1.59
0.2,	164.06
0.4,	330.03
0.6,	497.62
1.0,	833.26

Reference Rcase=33020.0

Reference Rdome=33080.0

caseR

5600,	594.000
10000,	952.000
15600,	1315.000
20000,	1544.000
25600,	1786.000
30000,	1948.000

domeR

5600,	593.100
10000,	950.700
15600,	1311.000
20000,	1542.000
25600,	1785.000
30000,	1946.000

==== CASE TEMPERATURE =====

Case Rref = 33020, Rref based on measurements of v_t = 33083. %Error = -0.2

Case fit : -6.115e-05 8.530e-02 -2.990e+01

CASE THERMISTOR MILLIVOLTS

Meas	ADC	ADC-Corrected
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594.0	593.7	594.5
952.0	947.1	951.1
1315.0	1292.5	1314.3
1544.0	1505.1	1545.2
1786.0	1722.8	1787.3
1948.0	1863.4	1946.7

CASE THERMISTOR OHMS

CalR	Meas	ADC	ADC-corrected
5600	5596	5593	5602
10000	9989	9922	9976
15600	15597	15207	15585
20000	19954	19160	19978
25600	25497	23940	25528
30000	29904	27523	29866

CASE THERMISTOR DEG C

CalR	Meas	ADC	ADC-correc
39.96	39.98	40.00	39.95
25.00	25.03	25.19	25.06
14.28	14.29	14.88	14.31
8.58	8.63	9.55	8.60
3.08	3.17	4.55	3.14
-0.37	-0.30	1.49	-0.27

==== DOME TEMPERATURE =====

Dome Rref = 33080, Rref based on measurements of v_t = 33155. %Error = -0.2

Dome fit : -4.221e-05, 7.291e-02, -2.914e+01

DOME THERMISTOR MILLIVOLTS

Meas	ADC	ADC-Corrected
593.1	593.3	594.0
950.7	950.5	948.5
1311.0	1305.7	1311.6
1542.0	1526.9	1543.1
1785.0	1754.4	1785.6
1946.0	1901.8	1945.0

DOME THERMISTOR OHMS

CalR	Meas	ADC	ADC-corrected
5600	5596	5598	5607
10000	9989	9987	9959
15600	15555	15463	15566
20000	19949	19638	19972
25600	25518	24753	25532
30000	29900	28633	29869

DOME THERMISTOR DEG C

CalR	Meas	ADC	ADC-correc
39.96	39.98	39.97	39.93
25.00	25.03	25.03	25.10
14.28	14.35	14.49	14.33

8.58	8.64	8.99	8.61
3.08	3.15	3.82	3.14
-0.37	-0.30	0.63	-0.28

==== PSP THERMOPILE CIRCUIT =====

PSP Calibration Gain (g) = 118.51, Offset (o) = 1.7 millivolts

==== PIR THERMOPILE CIRCUIT =====

PIR Calibration Gain (g) = 836.47, Offset (o) = -3.4 millivolts

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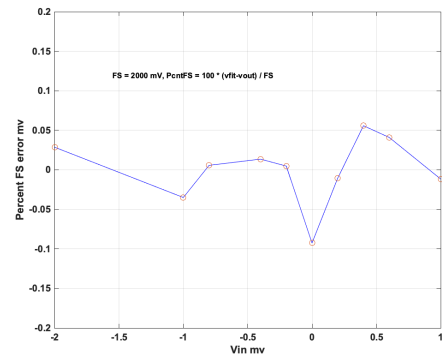
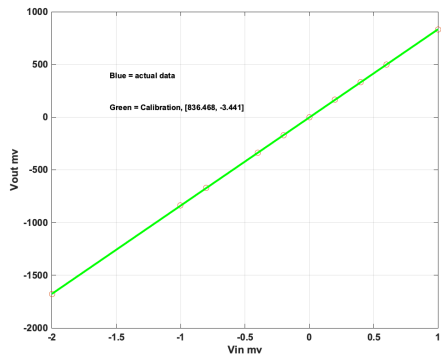
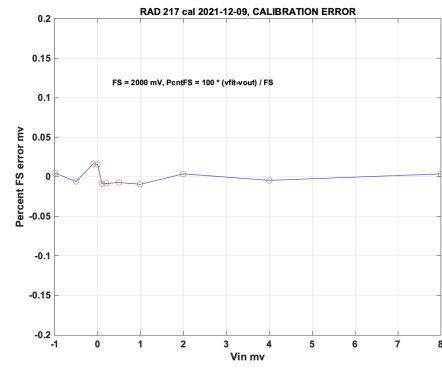
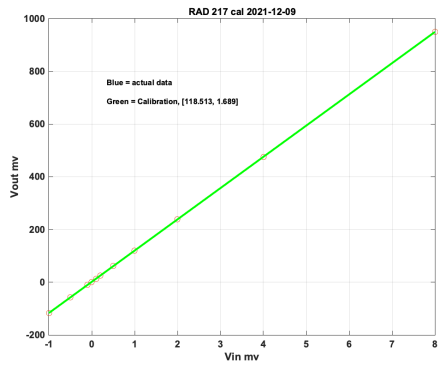
RAD SETUP COMMANDS

L : 10
k : 7.77e-6
K : 3.93e-6
A : 17
V : 4099
C 0 : 33083
C 1 : -6.115e-05
C 2 : 8.530e-02
C 3 : -2.990e+01
D 0 : 33155
D 1 : -4.221e-05
D 2 : 7.291e-02
D 3 : -2.914e+01
g : 118.51
o : 1.69
G : 836.47
O : -3.44

VERIFY OHMS

OHMS YSI CASE DOME

5600 39.96 39.87 39.83
10000 25.00 24.97 25.00
15600 14.28 14.22 14.24
20000 8.58 8.51 8.51
25600 3.08 3.05 3.03
30000 -0.37 -0.34 -0.38





THE EPPLEY LABORATORY, INC.

12 Sheffield Avenue, PO Box 419, Newport, Rhode Island USA 02840
 Phone: 401.847.1020 Fax: 401.847.1031 Email: info@eppleylab.com

Calibration Certificate

Instrument: Precision Spectral Pyranometer, Model PSP, Serial Number 30600F3

Procedure: This pyranometer was compared in Eppley's Integrating Hemisphere according to procedures described in *ISO 9847 Section 5.3.1* and Technical Procedure, TP01 of The Eppley Laboratory, Inc.'s Quality Assurance Manual on Calibrations.

Transfer Standard: Eppley Standard Precision Pyranometer, Model SPP, Serial Number 37501F3

Results:

Sensitivity: $S = 7.77 \mu\text{V} / \text{Wm}^{-2}$

Uncertainty: $U_{95} = \pm 0.91\%$ (95% confidence level, k=2)

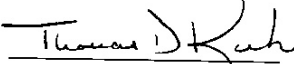
Resistance: 731 Ω at 23°C

Date of Test: October 21, 2021

Traceability: This calibration is traceable to the World Radiation Reference (WRR) through comparisons with Eppley's AHF standard self-calibrating cavity pyrheliometers which participated in the Twelfth International Pyrheliometric Comparisons (IPC XII) at Davos, Switzerland in September-October 2015. Unless otherwise stated in the remarks section below or on the Sales Order, the results of this calibration are "AS FOUND / AS LEFT".

Due Date: Eppley recommends a minimum calibration cycle of five (5) years but encourages annual calibrations for highest measurement accuracy.

Customer: URI // RMR
 Narragansett, RI // Seattle, WA

In Charge of Test: 

Eppley SO: 66054

Date of Certificate: November 3, 2021

Remarks:

End of Report



THE EPPLEY LABORATORY, INC.

12 Sheffield Avenue, PO Box 419, Newport, Rhode Island USA 02840
 Phone: 401.847.1020 Fax: 401.847.1031 Email: info@eppleylab.com

Calibration Certificate

Instrument: Precision Infrared Radiometer, Model PIR, Serial Number 30606F3

Procedure: This pyrometer was compared against Eppley's Blackbody Calibration System under radiation intensities of approximately 350 Wm^{-2} with an average ambient temperature of 20°C according to procedures described in Technical Procedure, TP05 of The Eppley Laboratory, Inc.'s Quality Assurance Manual on Calibrations.

Transfer Standard: Eppley Precision Infrared Radiometer, Model PIR, Serial Number 32227F3

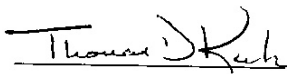
Results:
Sensitivity: $S = 3.93 \mu\text{V} / \text{Wm}^{-2}$
Uncertainty: $U_{95} = \pm 1.7\%$ (95% confidence level, $k=2$)
Resistance: 723Ω at 23°C

Date of Test: October 21, 2021

Traceability: This calibration is traceable to the International Practical Temperature Scale (IPTS). Additionally, transfer standard PIR #32227F3 provides traceability to the World Infrared Standard Group (WISG) of pyrometers housed at the Infrared Radiometry Section of the World Radiation Centre (WRC-IRS). Unless otherwise stated in the remarks section below or on the Sales Order, the results of this calibration are "AS FOUND / AS LEFT".

Due Date: Eppley recommends a minimum calibration cycle of five (5) years but encourages annual calibrations for highest measurement accuracy.

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Remarks:

End of Report