



# SEA-BIRD ELECTRONICS, INC.

13431 NE 20th St. Bellevue, Washington 98005 USA

Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

<b>Service</b>
<b>Report</b>

<b>RMA Number</b>	74880
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### Customer Information:

<b>Company</b>	WEBB RESEARCH CORPORATION	<b>Date</b>	7/18/2013
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<b>Contact</b>	Annie Fish
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<b>PO Number</b>	TWR8735
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<b>Serial Number</b>	0104 Payload Glider
<b>Model Number</b>	Glider

### Services Requested:

1. Evaluate/Repair Instrumentation.
2. Perform Routine Calibration Service.

### Problems Found:

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### Services Performed:

1. Performed initial diagnostic evaluation.
2. Calibrated the pressure sensor.
3. Performed "Post Cruise" calibration of the temperature & conductivity sensors.
4. Performed complete system check and full diagnostic evaluation.

### Special Notes:

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SENSOR SERIAL NUMBER: 0104  
CALIBRATION DATE: 09-Jul-13

SLOCUM PAYLOAD CTD  
TEMPERATURE CALIBRATION DATA  
ITS-90 TEMPERATURE SCALE

### ITS-90 COEFFICIENTS

a0 = -6.847602e-005  
a1 = 3.029473e-004  
a2 = -4.286840e-006  
a3 = 1.949444e-007

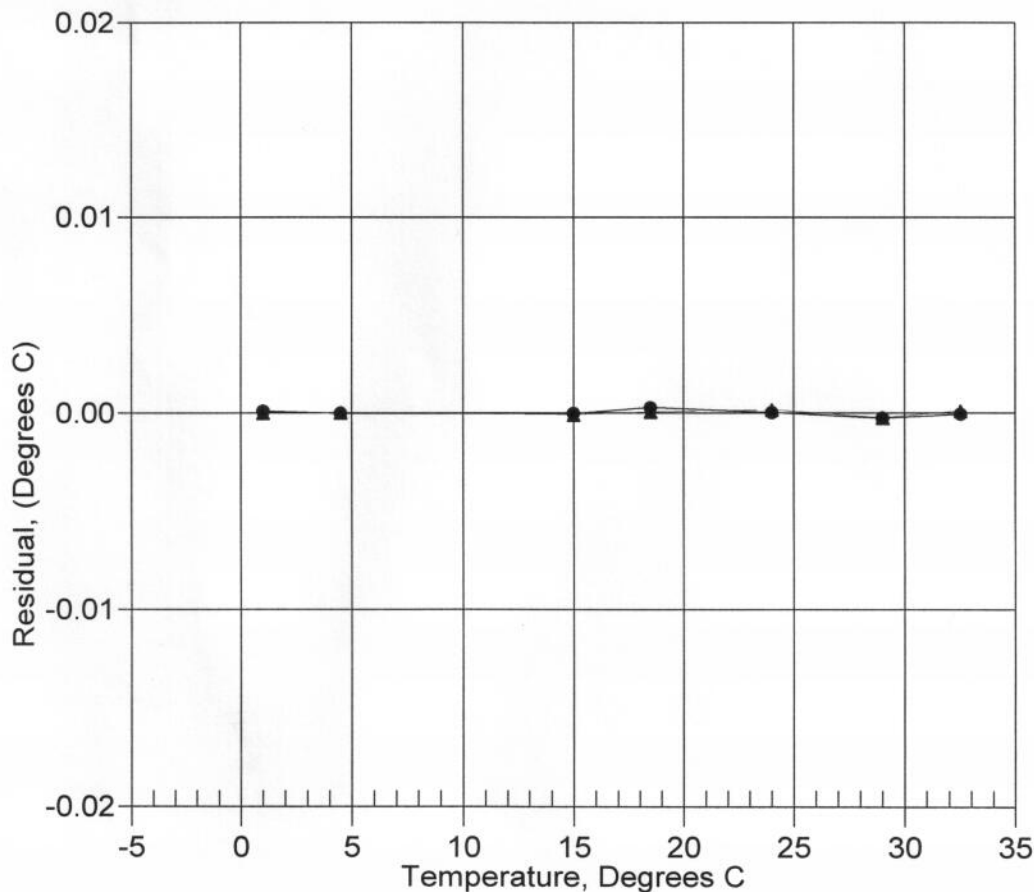
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	570390.3	1.0000	-0.0000
4.5000	487155.1	4.5000	0.0000
15.0000	309580.8	14.9999	-0.0001
18.5000	267841.7	18.5001	0.0001
24.0000	214619.6	24.0002	0.0002
29.0000	176561.9	28.9998	-0.0002
32.5000	154529.2	32.5001	0.0001

$$\text{Temperature ITS-90} = 1 / \{a_0 + a_1[\ln(n)] + a_2[\ln^2(n)] + a_3[\ln^3(n)]\} - 273.15 \text{ (}^\circ\text{C)}$$

$$\text{Residual} = \text{instrument temperature} - \text{bath temperature}$$

Date, Delta T (mdeg C)

● 11-Dec-11 -0.00  
▲ 09-Jul-13 0.00



POST CRUISE  
CALIBRATION



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## Temperature Calibration Report

Customer:	WEBB RESEARCH CORPORATION		
Job Number:	74880	Date of Report:	7/9/2013
Model Number	Glider	Serial Number:	0104 Payload Glider

*Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.*

*An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.*

### 'AS RECEIVED CALIBRATION'

Performed  Not Performed

Date:

Drift since last cal:  Degrees Celsius/year

Comments:

### 'CALIBRATION AFTER REPAIR'

Performed  Not Performed

Date:

Drift since Last cal:  Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 0104  
CALIBRATION DATE: 09-Jul-13

SLOCUM PAYLOAD CTD  
CONDUCTIVITY CALIBRATION DATA  
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -9.849181e-001  
h = 1.467389e-001  
i = -4.390754e-004  
j = 5.330470e-005

CPcor = -9.5700e-008  
CTcor = 3.2500e-006  
WBOTC = 3.8494e-007

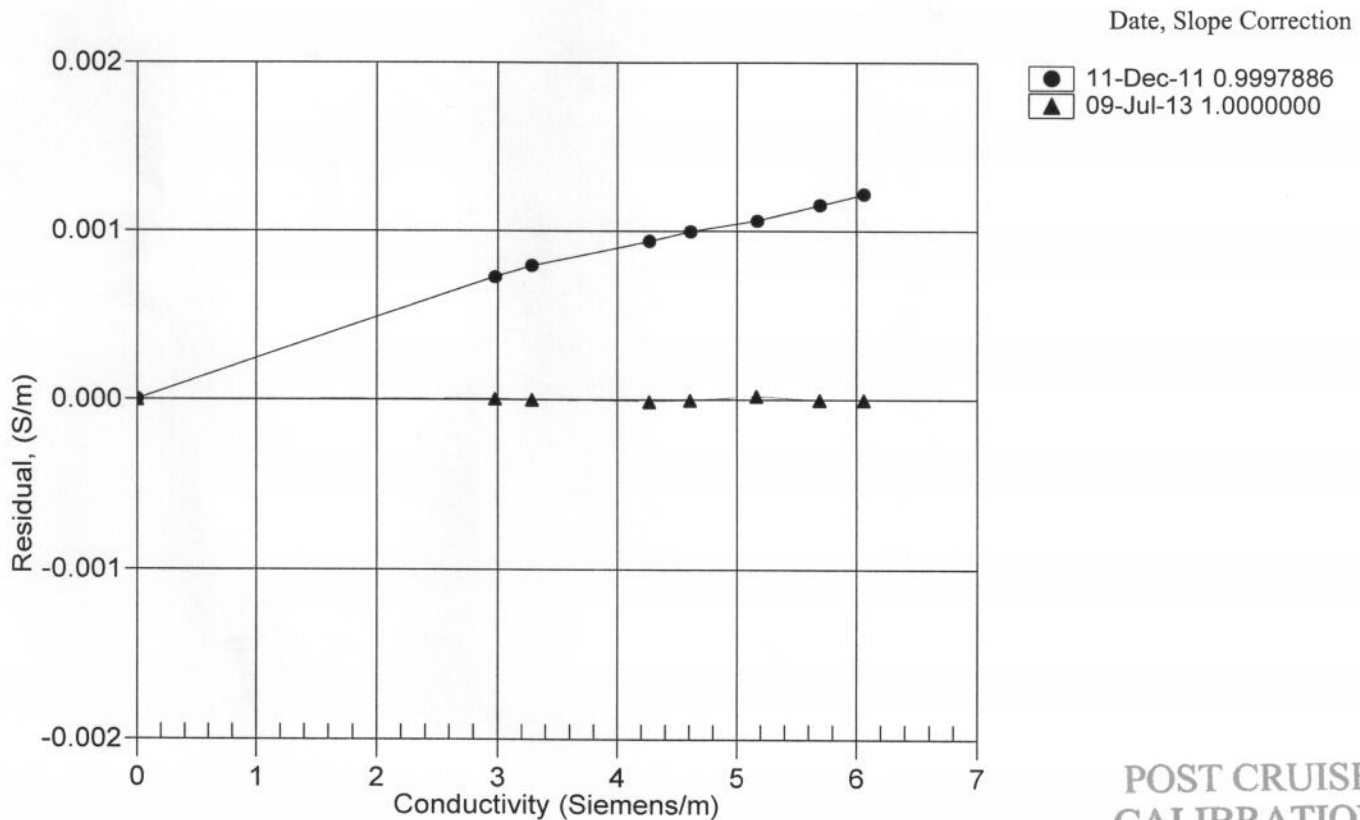
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2597.67	0.00000	0.00000
1.0000	34.8061	2.97518	5209.89	2.97518	0.00001
4.5000	34.7859	3.28214	5407.59	3.28214	-0.00000
15.0000	34.7422	4.26348	5995.29	4.26347	-0.00001
18.5000	34.7329	4.60850	6188.39	4.60849	-0.00000
24.0000	34.7226	5.16623	6488.06	5.16625	0.00002
29.0000	34.7169	5.68787	6755.95	5.68786	-0.00000
32.5000	34.7135	6.06009	6940.58	6.06008	-0.00000

$$f = \text{INST FREQ} * \text{sqrt}(1.0 + \text{WBOTC} * t) / 1000.0$$

$$\text{Conductivity} = (g + hf^2 + if^3 + jf^4) / (1 + \delta t + \epsilon p) \text{ Siemens/meter}$$

t = temperature[°C]; p = pressure[decibars];  $\delta$  = CTcor;  $\epsilon$  = CPcor;

Residual = instrument conductivity - bath conductivity



POST CRUISE  
CALIBRATION



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## Conductivity Calibration Report

Customer:	WEBB RESEARCH CORPORATION		
Job Number:	74880	Date of Report:	7/9/2013
Model Number	Glider	Serial Number:	0104 Payload Glider

*Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.*

*An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.*

### 'AS RECEIVED CALIBRATION'

Performed  Not Performed

Date:

Drift since last cal:  PSU/month

Comments:

### 'CALIBRATION AFTER CLEANING & REPLATINIZING'

Performed  Not Performed

Date:

Drift since Last cal:  PSU/month

Comments:

*\*Measured at 3.0 S/m*

*Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.*

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SENSOR SERIAL NUMBER: 0104  
CALIBRATION DATE: 03-Jul-13

SLOCUM PAYLOAD CTD  
PRESSURE CALIBRATION DATA  
1450 psia S/N 3459008

**COEFFICIENTS:**

PA0 = 1.423479e-001	PTCA0 = 5.248915e+005
PA1 = 4.928527e-003	PTCA1 = 2.945504e+000
PA2 = -2.507592e-011	PTCA2 = -7.258767e-002
PTEMPA0 = -7.408430e+001	PTCB0 = 2.531113e+001
PTEMPA1 = 4.727371e-002	PTCB1 = 4.250000e-004
PTEMPA2 = -6.635892e-008	PTCB2 = 0.000000e+000

**PRESSURE SPAN CALIBRATION**

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.68	527873.0	2059.0	14.69	0.00
314.96	588840.0	2060.0	314.95	-0.00
614.96	649785.0	2060.0	614.91	-0.00
914.98	710787.0	2061.0	914.97	-0.00
1214.96	771812.0	2061.0	1214.95	-0.00
1465.04	822711.0	2062.0	1465.02	-0.00
1214.98	771822.0	2061.0	1215.00	0.00
914.95	710790.0	2061.0	914.98	0.00
614.93	649794.0	2060.0	614.95	0.00
314.96	588842.0	2061.0	314.96	-0.00
14.67	527872.0	2061.0	14.68	0.00

**THERMAL CORRECTION**

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	2262	527894.10
29.00	2187	527902.00
24.00	2081	527908.30
18.50	1964	527906.40
15.00	1889	527902.10
4.50	1666	527888.30
1.00	1592	527880.30
TEMP (ITS90)	SPAN (mV)	
-5.00	25.31	
35.00	25.33	

$$y = \text{thermistor output}; t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$$

$$x = \text{pressure output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$$

$$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$$

$$\text{pressure (psia)} = PA0 + PA1 * n + PA2 * n^2$$

Date, Avg Delta P %FS

