



# 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>	<b>88183</b>
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**Customer Information:**

<b>Company</b>	WEBB RESEARCH CORPORATION	<b>Date</b>	3/14/2016
<b>Contact</b>	CHARLES STILL		
<b>PO Number</b>	TBD		

<b>Serial Number</b>	SLOCUM-0104
<b>Model Number</b>	SLOCUM



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<b>Contact</b>	CHARLES STILL		
<b>PO Number</b>	TBD		

### Services Requested:

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

### Problems Found:

1. The anti-foulant devices appeared "dirty".
2. The end cap was replaced as part of the grounding MOD's.
3. The impeller support was replaced as part of the grounding MOD's.
4. The motor mount was replaced as part of the grounding MOD's.
5. The magnet cup assembly was replaced as part of the grounding MOD's.
6. The pump motor was replaced as part of the grounding MOD's.

### Services Performed:

1. Performed initial diagnostic evaluation.
2. Install NEW MOTOR, PORTESCAP 22N 2R 78 215E 1014
3. NEODYMIUM MAGNET CUP ASSY, PORTESCAP, 4 MAGS
4. Installed NEW pump insulator.
5. Installed NEW impeller support assembly.
6. WEBB PAYLOAD CTD, ENDCAP, HARDCOATED
7. Calibrated the pressure sensor.
8. Performed "Post Cruise" calibration of the temperature & conductivity sensors.
9. Installed NEW AF24173 Anti-foulant cylinder(s).
10. Performed complete system check and full diagnostic evaluation.

### Special Notes:

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SENSOR SERIAL NUMBER: 0104  
CALIBRATION DATE: 27-Feb-16

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

## COEFFICIENTS:

g = -9.847594e-001  
h = 1.465522e-001  
i = -3.723759e-004  
j = 4.935013e-005

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

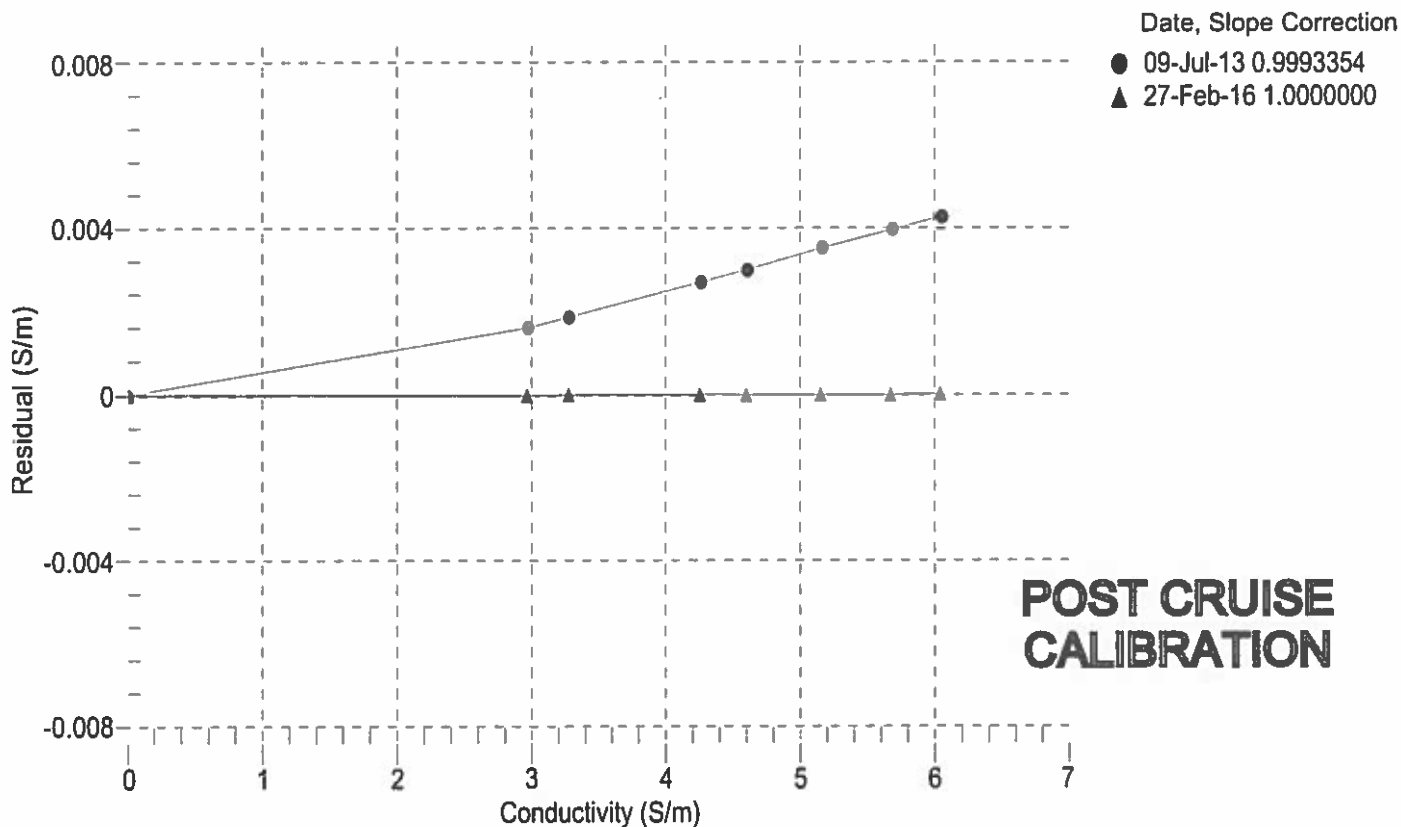
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2597.82	0.00000	0.00000
1.0000	34.7043	2.96730	5203.66	2.96730	-0.00000
4.5000	34.6849	3.27355	5400.99	3.27355	0.00000
15.0000	34.6440	4.25271	5987.64	4.25271	0.00001
18.5000	34.6354	4.59695	6180.37	4.59695	-0.00000
24.0000	34.6261	5.15345	6479.52	5.15345	-0.00000
29.0000	34.6210	5.67392	6746.94	5.67392	-0.00000
32.5001	34.6178	6.04529	6931.25	6.04529	0.00000

$$f = \text{Instrument Output(Hz)} * \text{sqrt}(1.0 + \text{WBOTC} * t) / 1000.0$$

t = temperature (°C); p = pressure (decibars);  $\delta$  = CTcor;  $\epsilon$  = CPcor;

$$\text{Conductivity (S/m)} = (g + h * f^2 + i * f^3 + j * f^4) / 10 (1 + \delta * t + \epsilon * p)$$

Residual (Siemens/meter) = instrument conductivity - bath conductivity





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## Conductivity Calibration Report

Customer:	WEBB RESEARCH CORPORATION		
Job Number:	88183	Date of Report:	3/2/2016
Model Number	SLOCUM	Serial Number:	SLOCUM-0104

*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: 27-Feb-16

Slocum Payload CTD TEMPERATURE CALIBRATION DATA  
ITS-90 TEMPERATURE SCALE

## COEFFICIENTS:

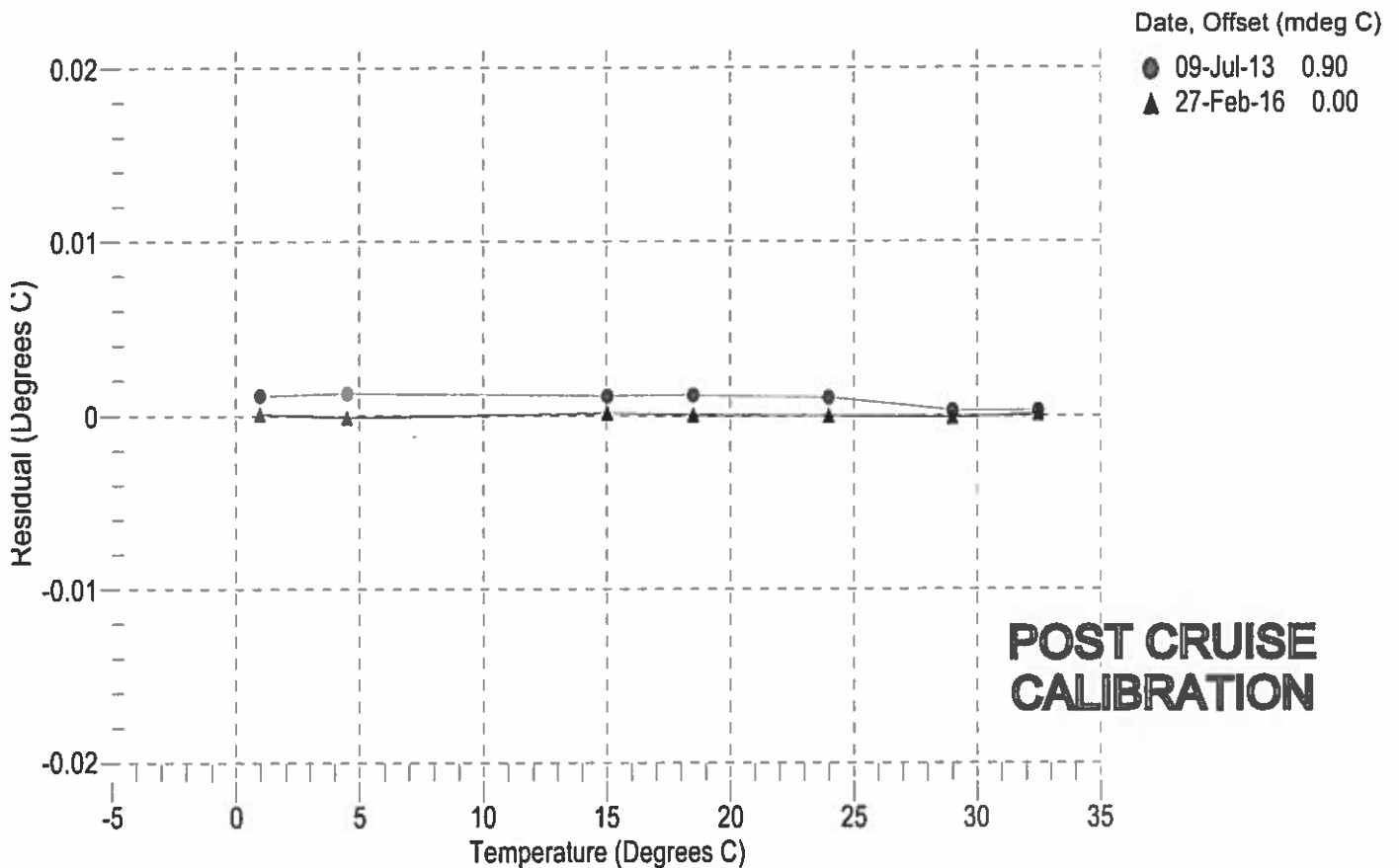
a0 = -6.539410e-005  
a1 = 3.023933e-004  
a2 = -4.256611e-006  
a3 = 1.944872e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	570418.0	1.0001	0.0001
4.5000	487185.7	4.4999	-0.0001
15.0000	309593.8	15.0001	0.0001
18.5000	267854.3	18.5000	0.0000
24.0000	214628.4	24.0000	-0.0000
29.0000	176564.7	28.9999	-0.0001
32.5001	154529.8	32.5002	0.0001

n = Instrument Output (counts)

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

Residual (°C) = instrument temperature - bath temperature





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## Temperature Calibration Report

Customer:	WEBB RESEARCH CORPORATION		
Job Number:	88183	Date of Report:	3/2/2016
Model Number:	SLOCUM	Serial Number:	SLOCUM-0104

*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: 25-Feb-16

Slocum Payload CTD PRESSURE CALIBRATION DATA  
1450 psia S/N 3459008

**COEFFICIENTS:**

PA0 =	-8.635844e-001	PTCA0 =	5.248999e+005
PA1 =	4.942497e-003	PTCA1 =	-9.213355e+001
PA2 =	-3.254685e-011	PTCA2 =	3.904783e+000
PTEMPA0 =	-7.426469e+001	PTCB0 =	2.531113e+001
PTEMPA1 =	4.744988e-002	PTCB1 =	4.250000e-004
PTEMPA2 =	-1.089970e-007	PTCB2 =	0.000000e+000

**PRESSURE SPAN CALIBRATION**

**THERMAL CORRECTION**

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (volts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)	TEMP (°C)	THERMISTOR OUTPUT (volts)	INSTRUMENT OUTPUT (counts)
14.71	527911.0	2029.0	14.86	0.01	32.50	2262	529776.00
314.99	588728.0	2037.0	315.06	0.01	29.00	2188	528130.20
615.00	649517.0	2039.0	614.99	-0.00	24.00	2081	527905.40
914.85	710320.0	2039.0	914.78	-0.00	18.50	1964	527896.80
1214.90	771230.0	2041.0	1214.82	-0.01	15.00	1889	527895.20
1464.91	822052.0	2043.0	1464.98	0.00	4.50	1666	527884.30
1214.82	771221.0	2041.0	1214.78	-0.00	1.00	1592	527878.10
914.87	710369.0	2042.0	914.96	0.01			
614.98	649525.0	2042.0	614.97	-0.00			
314.94	588728.0	2042.0	314.96	0.00			
14.71	527903.0	2046.0	14.51	-0.01			

TEMPERATURE (°C)	SPAN (mV)
-5.00	25.31
35.00	25.33

y = thermistor output (counts)

$$t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$$

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

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

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

$$\text{Residual (\%FSR)} = (\text{computed pressure} - \text{true pressure}) * 100 / \text{Full Scale Range}$$

Date, Offset (%FSR)

● 25-Feb-16 -0.00

