SEA-BIRD ELECTRONICS, INC.
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Service Report

RMA Number: 75564

Customer Information:

Company	The University of Hawaii	Date	10/17/2013
Contact	Jennie Mowatt		
PO Number	Z10048071		

Serial Number	0073 Glider
Model Number	Glider

Services Requested:

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

Problems Found:

1. The conductivity cell was found to have failed. Unstable output during calibration even after cleaning and re-platinizing. Replacement is required.
2. E-test replaced U2 and C22 on the board set.

Services Performed:

1. Performed initial diagnostic evaluation.
2. Performed "Post Cruise" calibration of the temperature & conductivity sensors.
3. Cleaned and replatinized the conductivity cell.
4. Replaced the conductivity cell.
5. Performed "Final" calibration of the temperature & conductivity sensors.
6. Performed complete system check and full diagnostic evaluation.

Special Notes:

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SENSOR SERIAL NUMBER: 0073
CALIBRATION DATE: 05-Oct-13

GliderAPL TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.29393507e-003
h = 6.27645672e-004
i = 2.26957442e-005
j = 2.29455674e-006
f0 = 1000.0

IPTS-68 COEFFICIENTS

a = 3.64763506e-003
b = 5.87208077e-004
c = 1.53811222e-005
d = 2.29603758e-006
f0 = 2904.916

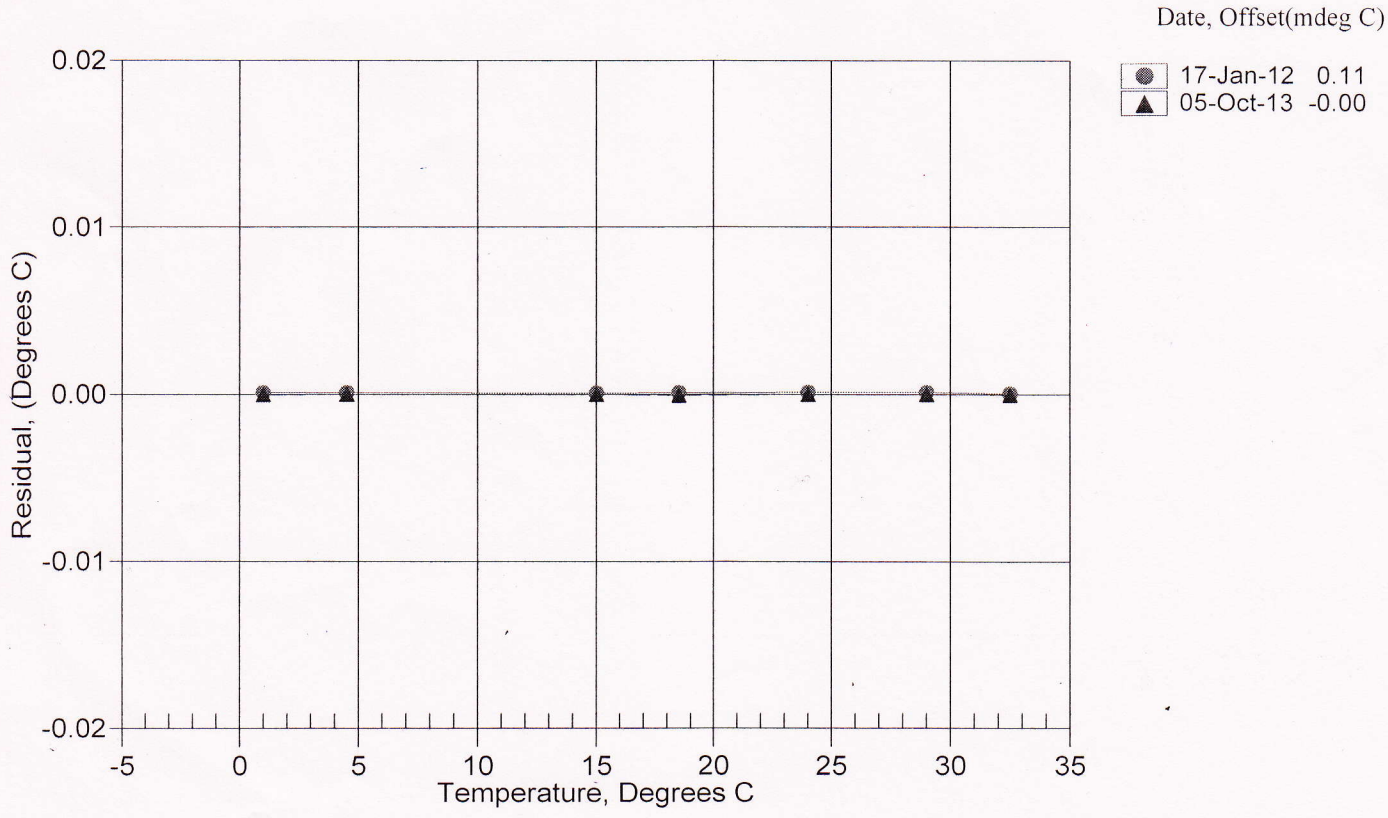
BATH TEMP (ITS-90)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	2904.916	1.0000	-0.00001
4.5000	3142.089	4.5000	0.00001
15.0000	3937.689	15.0000	0.00002
18.5000	4232.189	18.5000	-0.00005
24.0000	4725.966	24.0000	0.00002
29.0000	5208.686	29.0000	0.00002
32.5000	5566.292	32.5000	-0.00002

Temperature ITS-90 = $1/\{g + h[ln(f_0/f)] + i[ln^2(f_0/f)] + j[ln^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 = $1/\{a + b[ln(f_0/f)] + c[ln^2(f_0/f)] + d[ln^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: T_{68} is assumed to be 1.00024 * T_{90} (-2 to 35 °C)

Residual = instrument temperature - bath temperature



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Temperature Calibration Report

Customer:	The University of Hawaii		
Job Number:	75564	Date of Report:	10/7/2013
Model Number:	Glider	Serial Number:	0073 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: 10/5/2013 Drift since 17 Jan 12 -0.00007 Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 0073
CALIBRATION DATE: 05-Oct-13

GliderAPL CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Seimens/meter

GHIJ COEFFICIENTS

g = -9.80313606e+000
h = 1.09886565e+000
i = -1.72199564e-003
j = 1.78346251e-004
CPcor = -9.5700e-008 (nominal)
CTcor = 3.2500e-006 (nominal)

ABCDM COEFFICIENTS

a = 1.47589932e-006
b = 1.09355628e+000
c = -9.78618552e+000
d = -8.71533871e-005
m = 5.6
CPcor = -9.5700e-008 (nominal)

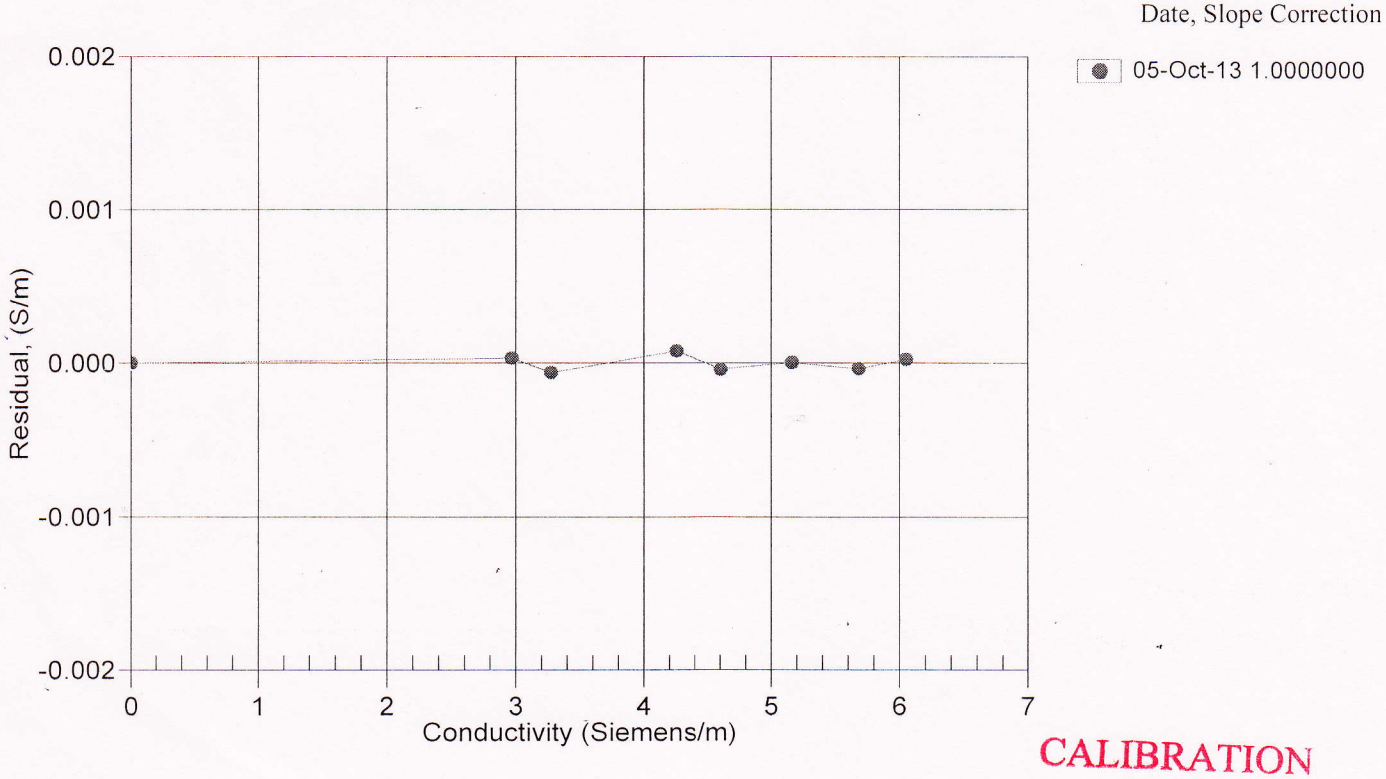
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2.99167	0.00000	0.00000
1.0000	34.7570	2.97138	6.00752	2.97141	0.00003
4.5000	34.7367	3.27795	6.23586	3.27789	-0.00006
15.0000	34.6927	4.25805	6.91523	4.25813	0.00008
18.5000	34.6834	4.60264	7.13843	4.60260	-0.00004
24.0000	34.6733	5.15970	7.48514	5.15970	0.00000
29.0000	34.6677	5.68071	7.79518	5.68068	-0.00004
32.5000	34.6637	6.05238	8.00893	6.05241	0.00002

Conductivity = $(g + hf^2 + if^3 + jf^4) / 10(1 + \delta t + \varepsilon p)$ Siemens/meter

Conductivity = $(af^m + bf^2 + c + dt) / [10 (1 + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



CALIBRATION AFTER MODIFICATIONS

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Conductivity Calibration Report

Customer:	The University of Hawaii		
Job Number:	75564	Date of Report:	10/7/2013
Model Number:	Glider	Serial Number:	0073 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 REPAIR' ☑ Performed ☐ Not Performed

Date: 10/5/2013 Drift since Last cal: N/A PSU/month*

Comments:
The conductivity cell was replaced.

**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.