Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 0026
CALIBRATION DATE: 30-Jan-15

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

COEFFICIENTS:

```
g = -1.045300e+000
h =  1.700405e-001
i = -3.271941e-004
j =  5.479309e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
WBOTC =  8.3917e-007
```

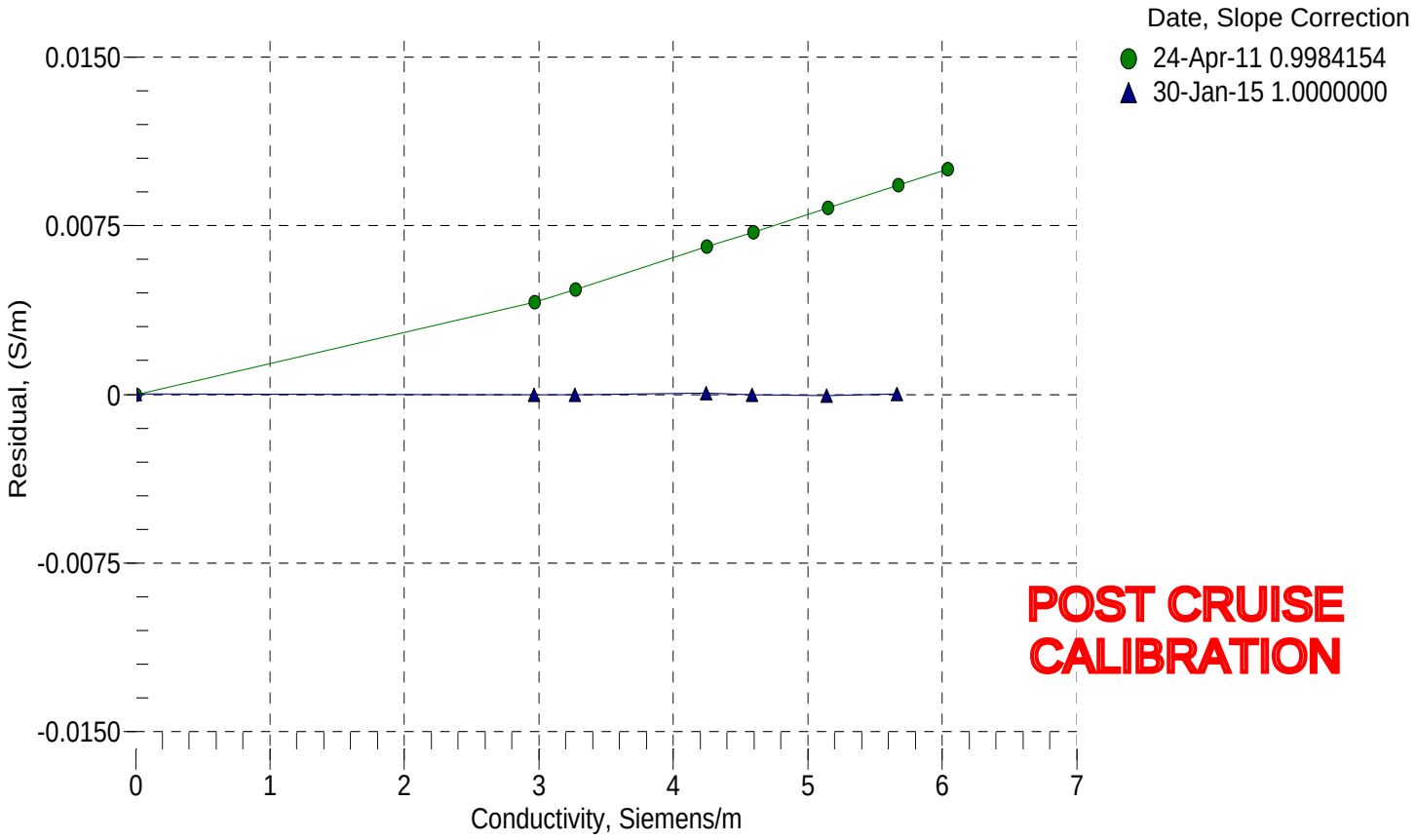
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2482.83	0.00000	0.00000
1.0000	34.6276	2.96137	4858.41	2.96136	-0.00000
4.5000	34.6077	3.26698	5039.73	3.26696	-0.00001
14.9999	34.5650	4.24402	5579.37	4.24408	0.00005
18.5000	34.5556	4.58750	5756.78	4.58749	-0.00001
23.9999	34.5454	5.14275	6032.30	5.14270	-0.00006
29.0001	34.5395	5.66207	6278.82	5.66210	0.00003
32.5000	34.5361	6.03263	6448.80	6.03274	0.00011

f = INST FREQ * sqrt(1.0 + WBOTC * t) / 1000.0

Conductiv ity = $(g + h * f^2 + i * f^3 + j * f^4) / (1 + \delta * t + \varepsilon * p)$ Siemens / meter

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

Residual = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 0026
CALIBRATION DATE: 30-Jan-15

Glider Payload CTD TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

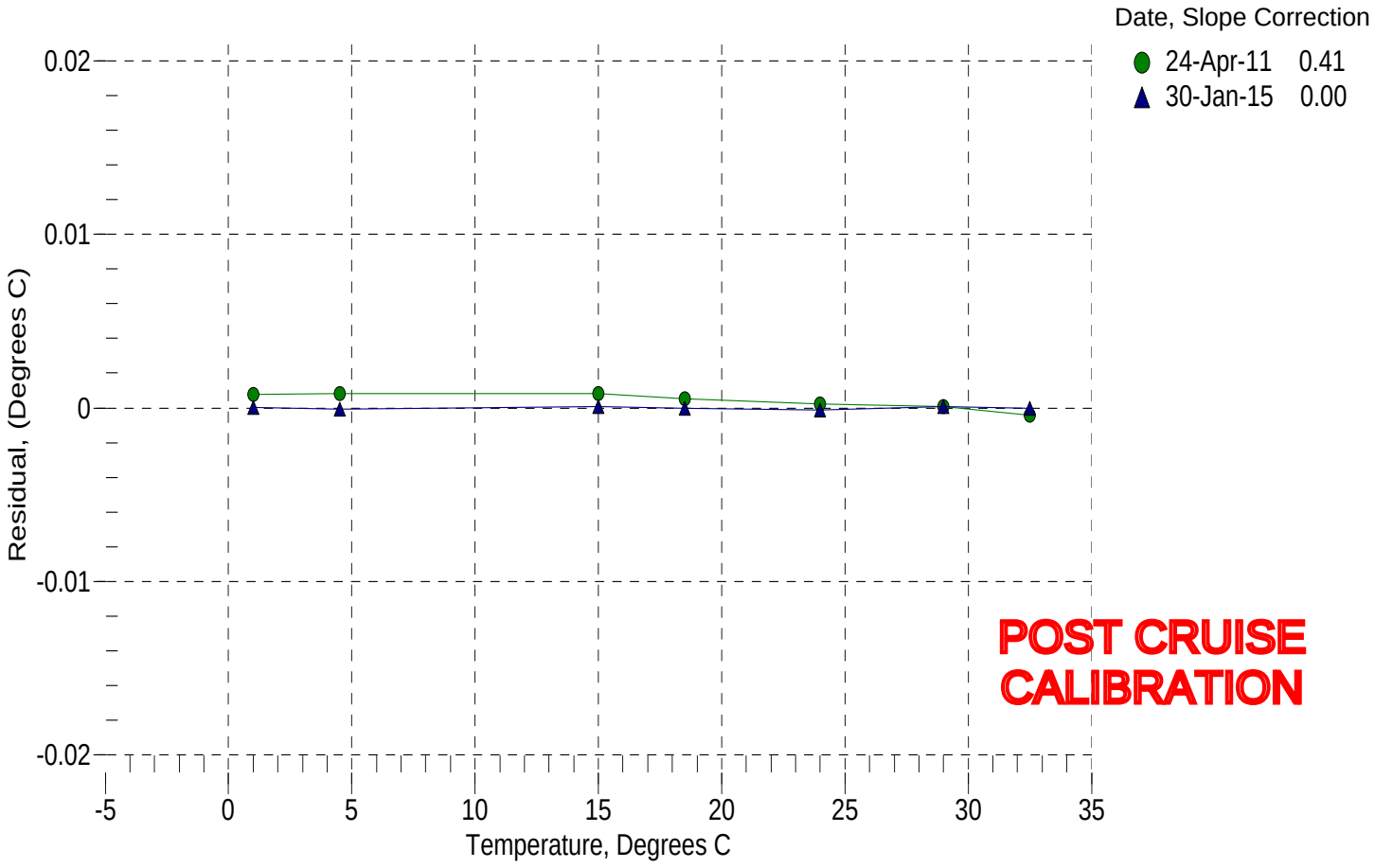
```
a0 = -1.247467e-004
a1 =  3.102681e-004
a2 = -4.701193e-006
a3 =  2.065083e-007
```

BATH TEMP (ITS-90)	INSTRUMENT OUTPUT	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	580362.7	1.0000	0.0000
4.5000	496354.3	4.4999	-0.0001
14.9999	316668.9	15.0000	0.0001
18.5000	274322.1	18.5000	-0.0000
23.9999	220241.1	23.9998	-0.0001
29.0001	181492.0	29.0002	0.0001
32.5000	159033.6	32.5000	-0.0000

Temperature ITS-90 = $1/\{a0 + a1[ln(n)] + a2[ln^2(n)] + a3[ln^3(n)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature

n = instrument output



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Conductivity Calibration Report

Customer:	Kongsberg Underwater Technology		
Job Number:	82670	**Date of Report:**	2/17/2015
Model Number	Glider	**Serial Number:**	0026 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: 1/30/2015 **Drift since last cal:** -0.00110 **PSU/month***

Comments:
The conductivity cell was found to require cleaning and re-platinization.

'CALIBRATION AFTER REPAIR' ☑ Performed ☐ Not Performed

Date: 2/12/2015 **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.

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SENSOR SERIAL NUMBER: 0026
CALIBRATION DATE: 12-Feb-15

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

COEFFICIENTS:

```
g = -9.939478e-001
h =  1.619094e-001
i = -3.932528e-004
j =  5.568922e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
WBOTC =  8.3917e-007
```

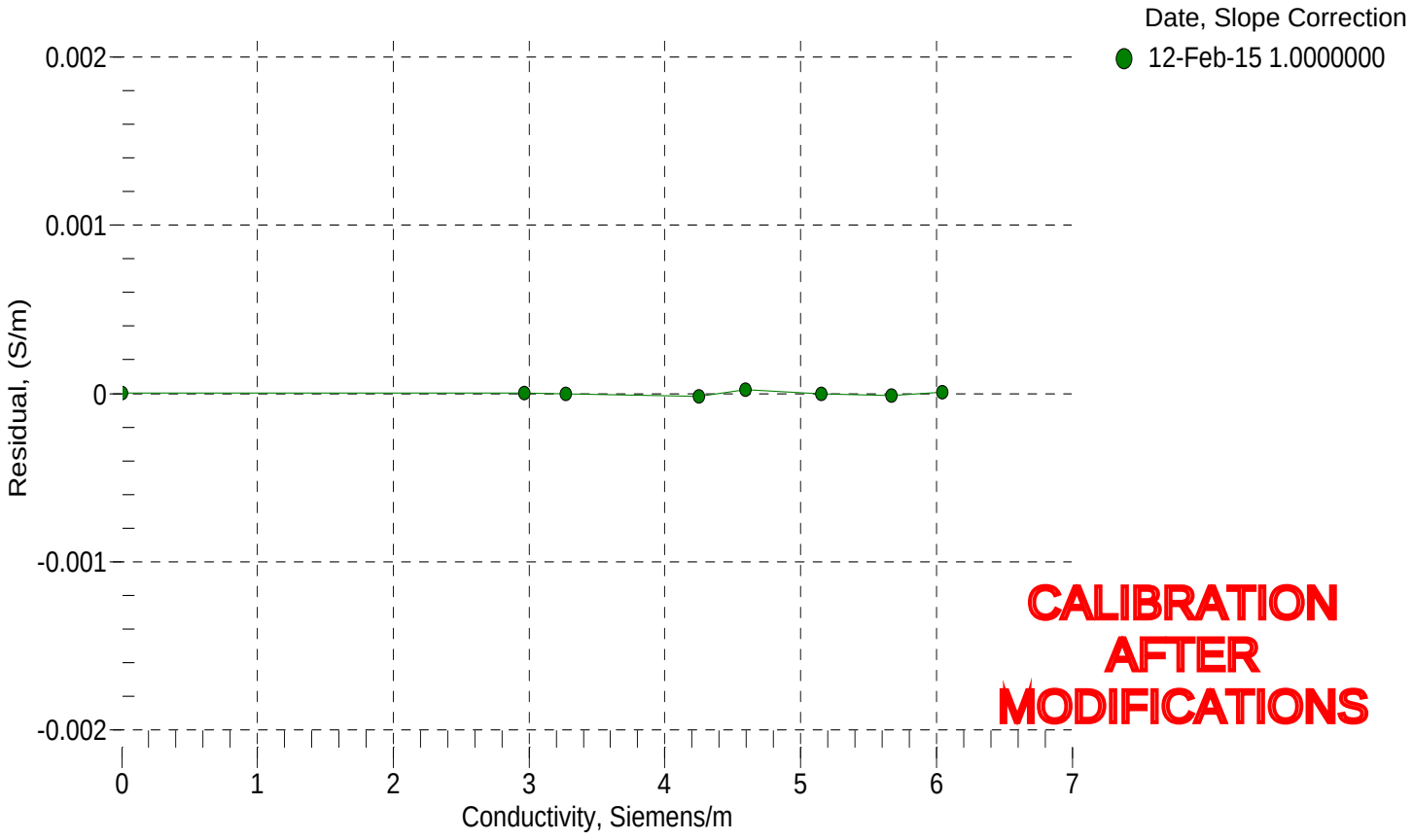
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2482.52	0.00000	0.00000
1.0000	34.6902	2.96621	4954.52	2.96621	0.00000
4.5000	34.6704	3.27231	5141.95	3.27231	-0.00000
15.0000	34.6279	4.25094	5699.25	4.25092	-0.00002
18.5000	34.6189	4.59500	5882.42	4.59502	0.00002
24.0000	34.6092	5.15121	6166.70	5.15121	-0.00000
29.0000	34.6043	5.67149	6420.92	5.67148	-0.00001
32.5000	34.6021	6.04285	6596.21	6.04285	0.00001

f = INST FREQ * sqrt(1.0 + WBOTC * t) / 1000.0

Conductiv ity = $(g + h * f^2 + i * f^3 + j * f^4) / (1 + \delta * t + \varepsilon * p)$ Siemens / meter

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

Residual = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 0026
CALIBRATION DATE: 28-Jan-15

Glider Payload CTD PRESSURE CALIBRATION DATA
FSR: 2900 psia S/N 2085959

COEFFICIENTS:

PA0 =	-1.608185e+000	PTCA0 =	5.235852e+005
PA1 =	9.805885e-003	PTCA1 =	-1.295152e+001
PA2 =	8.344352e-011	PTCA2 =	2.490016e-001
PTEMPA0 =	-9.697195e+001	PTCB0 =	1.047710e+002
PTEMPA1 =	3.967176e-002	PTCB1 =	-5.062501e-003
PTEMPA2 =	1.298175e-006	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FS
14.79	525101.0	2770.0	14.90	0.00
615.06	586198.0	2771.0	615.01	-0.00
1215.06	647224.0	2772.0	1215.04	-0.00
1714.98	698028.0	2773.0	1715.04	0.00
2314.94	758928.0	2773.0	2314.98	0.00
2914.83	819746.0	2774.0	2914.73	-0.00
2314.91	758932.0	2774.0	2315.02	0.00
1715.04	698030.0	2774.0	1715.07	0.00
1215.11	647223.0	2774.0	1215.04	-0.00
615.05	586192.0	2773.0	614.95	-0.00
14.80	525090.0	2774.0	14.80	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	2974	525160.10
29.00	2900	525149.70
24.00	2794	525147.70
18.50	2676	525161.70
15.00	2601	525180.20
4.50	2374	525264.60
1.00	2297	525302.80

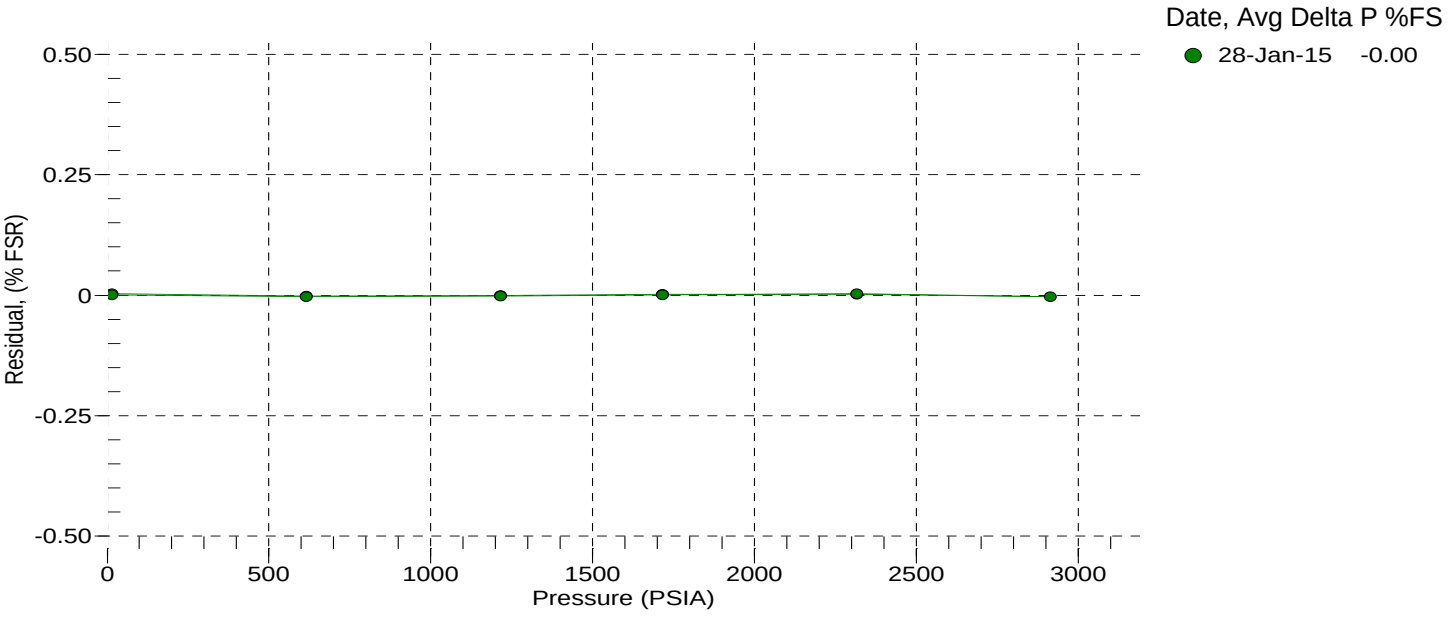
TEMP (ITS90)	SPAN (mV)
-5.75	104.80
37.53	104.58

y = thermistor output; $t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$

x = pressure output - $PTCA0 - PTCA1 * t - PTCA2 * t^2$

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

pressure (psia) = $PA0 + PA1 * n + PA2 * n^2$



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SENSOR SERIAL NUMBER: 0026
CALIBRATION DATE: 12-Feb-15

Glider Payload CTD TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

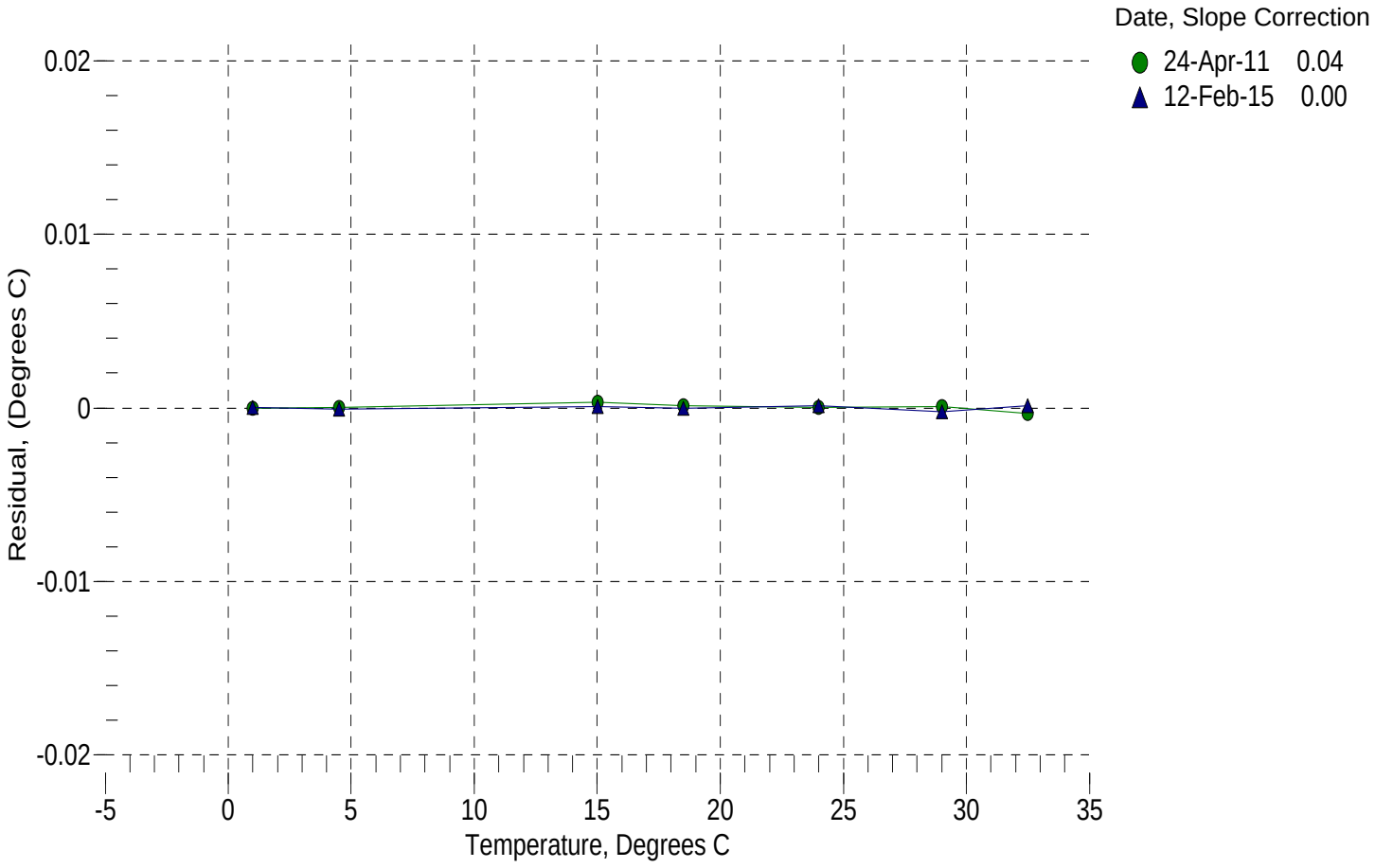
```
a0 = -1.171026e-004
a1 =  3.084028e-004
a2 = -4.550386e-006
a3 =  2.024696e-007
```

BATH TEMP (ITS-90)	INSTRUMENT OUTPUT	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	580340.5	1.0000	0.0000
4.5000	496336.7	4.4999	-0.0001
15.0000	316661.1	15.0001	0.0001
18.5000	274318.2	18.5000	-0.0000
24.0000	220236.8	24.0001	0.0001
29.0000	181494.7	28.9998	-0.0002
32.5000	159033.7	32.5001	0.0001

Temperature ITS-90 = $1/\{a0 + a1[ln(n)] + a2[ln^2(n)] + a3[ln^3(n)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature

n = instrument output



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Temperature Calibration Report

Customer:	Kongsberg Underwater Technology		
Job Number:	82670	**Date of Report:**	2/17/2015
Model Number	Glider	**Serial Number:**	0026 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: 1/30/2015 Drift since last cal: -0.00011 Degrees Celsius/year

Comments:

'FINAL CALIBRATION' ☑ Performed ☐ Not Performed

Date: 2/12/2015 Drift since 24 Apr 11 -0.00001 Degrees Celsius/year

Comments: