



SEA-BIRD ELECTRONICS, INC.

1808 - 136th Place Northeast, Bellevue, Washington 98005 USA

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

Service

Report

RMA Number

56902

Customer Information:

Company Atlantic Marine Center Date 12/22/2009

Contact Eric Thompson

PO Number Credit card

Serial Number 09P47490-0905
Model Number SBE 09Plus

Services Requested:

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

Problems Found:

Services Performed:

1. Performed initial diagnostic evaluation.
2. Performed internal inspection and O-ring replacement.
3. Performed hydrostatic pressure test.
4. Calibrated the pressure sensor.
5. Performed complete system check and full diagnostic evaluation.

Special Notes:

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington, 98005 USA

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

SENSOR SERIAL NUMBER: 0905
CALIBRATION DATE: 10-Dec-09

SBE9plus PRESSURE CALIBRATION DATA
10000 psia S/N 107063

DIGIQUARTZ COEFFICIENTS:

C1 = -4.575720e+004
C2 = -5.863610e-001
C3 = 1.203100e-002
D1 = 3.538700e-002
D2 = 0.000000e+000
T1 = 3.024771e+001
T2 = -4.970043e-004
T3 = 3.066360e-006
T4 = 6.276250e-009
T5 = 0.000000e+000

AD590M, AD590B, SLOPE AND OFFSET:

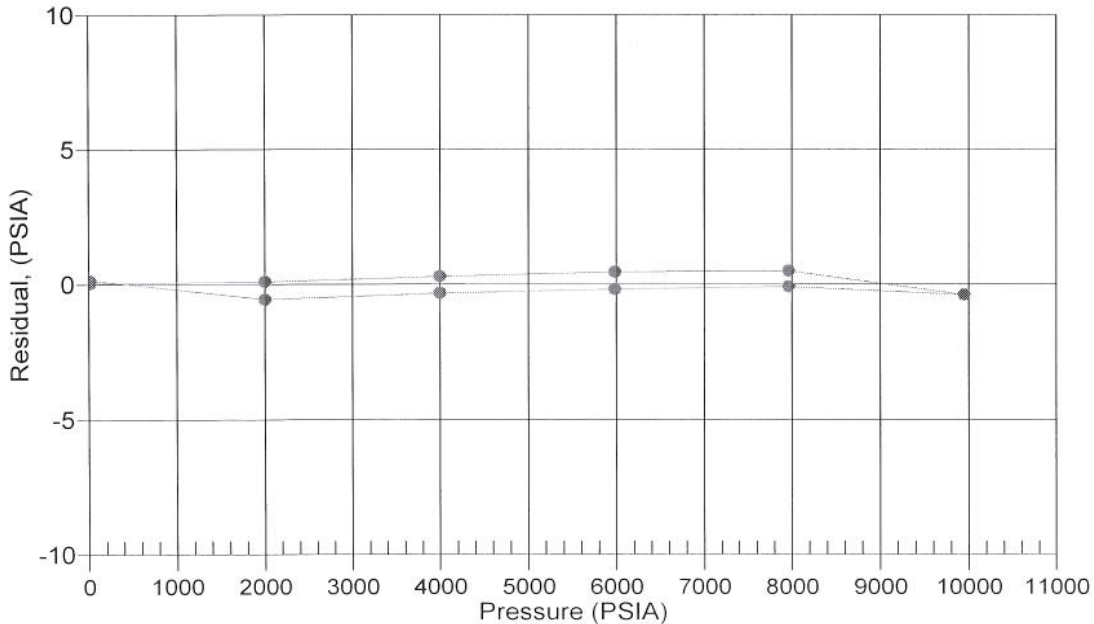
AD590M = 1.26296e-002
AD590B = -9.53017e+000
Slope = 0.99993
Offset = 0.0369 (dbars)

PRESSURE (PSIA)	INST OUTPUT(Hz)	INST TEMP(C)	INST OUTPUT (PSIA)	CORRECTED INST OUTPUT (PSIA)	RESIDUAL (PSIA)
14.700	33072.90	14.6	14.797	14.851	0.151
2001.648	33781.80	14.8	2001.182	2001.095	-0.553
3988.590	34474.30	14.8	3988.497	3988.268	-0.322
5975.525	35151.10	14.8	5975.708	5975.339	-0.186
7962.363	35813.10	14.9	7962.786	7962.275	-0.088
9949.345	36461.10	15.0	9949.617	9948.965	-0.380
7962.163	35813.30	15.1	7963.163	7962.652	0.489
5975.157	35151.40	15.3	5975.985	5975.615	0.458
3988.209	34474.70	15.5	3988.725	3988.496	0.287
2001.410	33782.30	15.6	2001.601	2001.514	0.104
14.697	33073.30	15.6	14.684	14.738	0.041

Residual = corrected instrument pressure - reference pressure

Date, Avg Offset (psia)

10-Dec-09 0.00





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Pressure Test Certificate

Customer Atlantic Marine Center

Job Number 56902

Date 12/8/2009

Technician AS

Serial Number 09P47490-0905

Low Pressure (PSI) 50 PSI

Time (Minutes) 15 Minutes

High Pressure (PSI) 10000 PSI

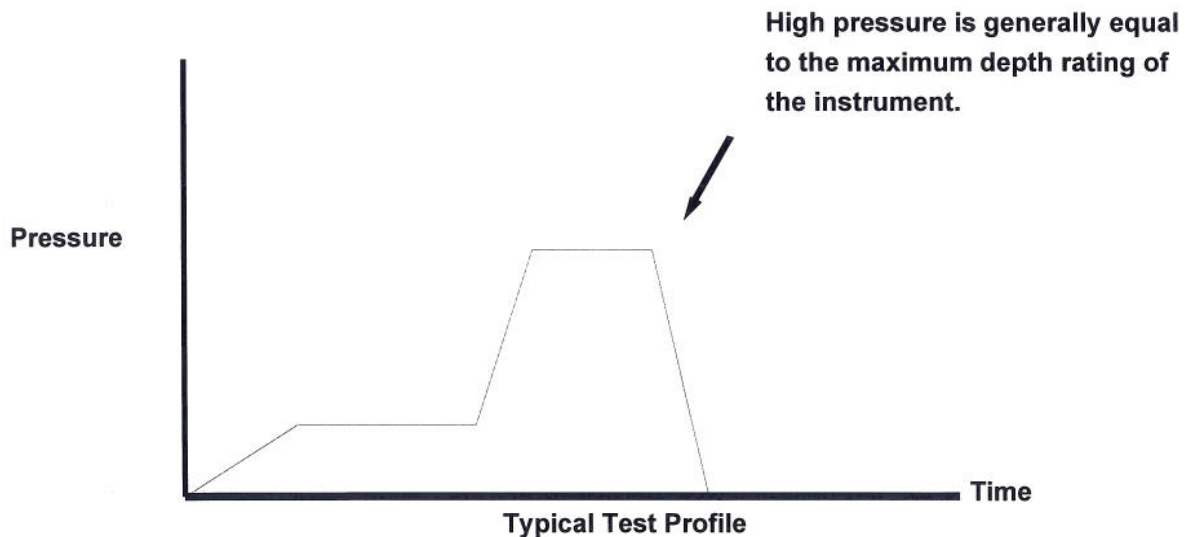
Time (Minutes) 30 Minutes

Pass

Fail

Comments

Replaced the main piston "O"-Rings.





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Service
Report

RMA Number	56902
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Customer Information:

Company	Atlantic Marine Center	Date	12/22/2009
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Contact	Eric Thompson
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PO Number	Credit card
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Serial Number	03P5017
Model Number	SBE 03Plus

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. Performed "Post Cruise" calibration of the temperature sensor.

Special Notes:

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

SENSOR SERIAL NUMBER: 5017
CALIBRATION DATE: 04-Dec-09

SBE3 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.33043613e-003
h = 6.36152693e-004
i = 2.13803019e-005
j = 1.92962185e-006
f0 = 1000.0

IPTS-68 COEFFICIENTS

a = 3.68121488e-003
b = 5.97648013e-004
c = 1.53037871e-005
d = 1.93106043e-006
f0 = 2870.130

BATH TEMP (ITS-90)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
-1.5002	2870.130	-1.5002	0.00001
0.9998	3036.241	0.9998	0.00000
4.4999	3280.334	4.4998	-0.00006
7.9998	3538.230	7.9998	0.00003
11.4998	3810.310	11.4998	0.00004
14.9999	4096.943	14.9999	-0.00003
18.4998	4398.475	18.4998	0.00001
21.9998	4715.263	21.9998	-0.00001
25.4998	5047.642	25.4998	0.00000
28.9998	5395.927	28.9998	-0.00001
32.4998	5760.434	32.4998	0.00001

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

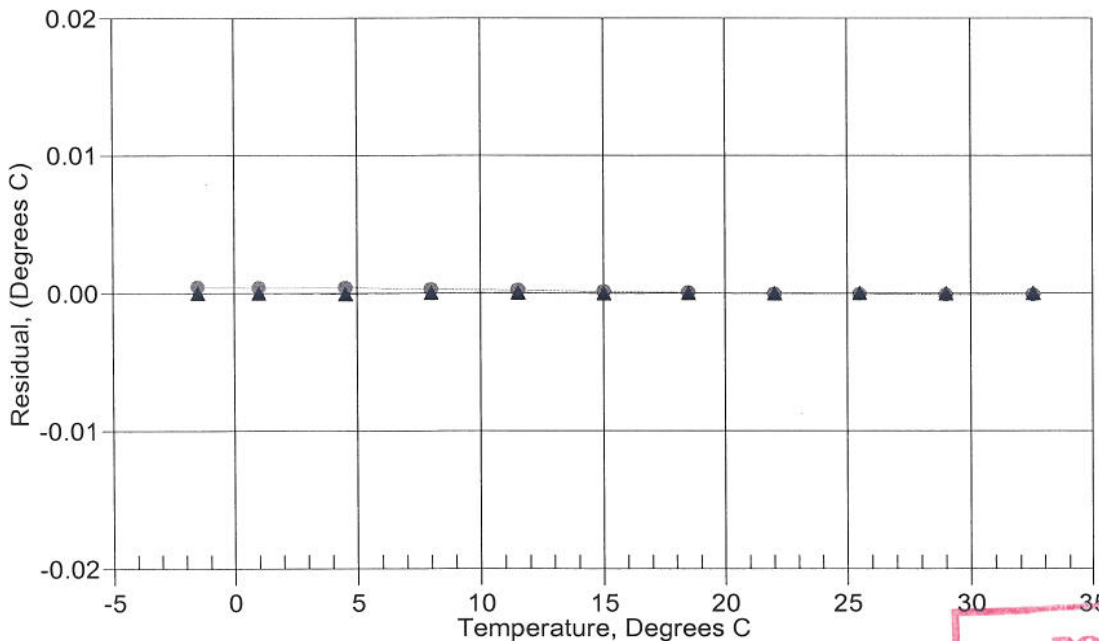
$$\text{Temperature IPTS-68} = 1/\{a + b[\ln(f_0/f)] + c[\ln^2(f_0/f)] + d[\ln^3(f_0/f)]\} - 273.15 \text{ (}^\circ\text{C)}$$

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

Residual = instrument temperature - bath temperature

Date, Offset(mdeg C)

● 29-May-08 0.15
▲ 04-Dec-09 0.00



**POST CRUISE
CALIBRATION**



SEA-BIRD ELECTRONICS, INC.

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Temperature Calibration Report

Customer:	Atlantic Marine Center		
Job Number:	56902	Date of Report:	12/4/2009
Model Number:	SBE 03Plus	Serial Number:	03P5017

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 using the program SEACON. 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: 12/4/2009

Drift since last cal: -0.00010 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR'

Performed Not Performed

Date:

Drift since Last cal: Degrees Celsius/year

Comments:



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Service
Report

RMA Number	56902
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Customer Information:

Company	Atlantic Marine Center	Date	12/22/2009
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Contact	Eric Thompson
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PO Number	Credit card
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Serial Number	03P5001
Model Number	SBE 03Plus

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. Performed "Post Cruise" calibration of the temperature sensor.

Special Notes:

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SENSOR SERIAL NUMBER: 5001
CALIBRATION DATE: 04-Dec-09

SBE3 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.41627122e-003
h = 6.50113941e-004
i = 2.30066756e-005
j = 1.93550068e-006
f0 = 1000.0

IPTS-68 COEFFICIENTS

a = 3.68121448e-003
b = 6.04222059e-004
c = 1.62137010e-005
d = 1.93702392e-006
f0 = 3237.079

BATH TEMP (ITS-90)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
-1.5002	3237.079	-1.5002	0.00004
0.9998	3422.338	0.9998	-0.00002
4.4999	3694.412	4.4998	-0.00009
7.9998	3981.683	7.9998	0.00002
11.4998	4284.563	11.4998	0.00004
14.9999	4603.453	14.9999	0.00001
18.4998	4938.730	18.4999	0.00011
21.9998	5290.753	21.9997	-0.00009
25.4998	5659.929	25.4997	-0.00005
28.9998	6046.584	28.9998	-0.00001
32.4998	6451.056	32.4998	0.00004

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

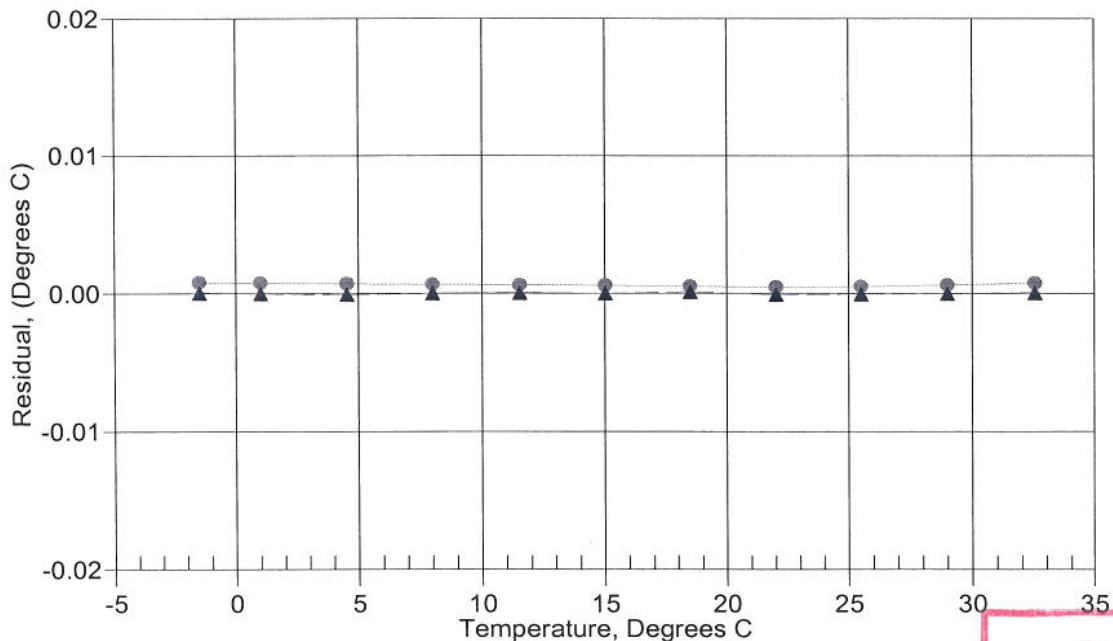
$$\text{Temperature IPTS-68} = 1/\{a + b[\ln(f_0/f)] + c[\ln^2(f_0/f)] + d[\ln^3(f_0/f)]\} - 273.15 \text{ (}^\circ\text{C)}$$

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

Residual = instrument temperature - bath temperature

Date, Offset(mdeg C)

● 30-May-08 0.63
▲ 04-Dec-09 0.00



**POST CRUISE
CALIBRATION**



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Temperature Calibration Report

Customer:	Atlantic Marine Center		
Job Number:	56902	Date of Report:	12/4/2009
Model Number:	SBE 03Plus	Serial Number:	03P5001

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 using the program SEACON. 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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Service
Report

RMA Number	56902
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Customer Information:

Company	Atlantic Marine Center	Date	12/22/2009
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Contact	Eric Thompson
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PO Number	Credit card
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Serial Number	043449
Model Number	SBE 04C

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. Performed "Post Cruise" calibration of the conductivity sensor.

Special Notes:

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

SENSOR SERIAL NUMBER: 3449
CALIBRATION DATE: 04-Dec-09

SBE4 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Seimens/meter

GHIJ COEFFICIENTS

g = -1.00559995e+001
h = 1.53357854e+000
i = -2.03979658e-003
j = 2.37337381e-004
CPcor = -9.5700e-008 (nominal)
CTcor = 3.2500e-006 (nominal)

ABCDM COEFFICIENTS

a = 7.92011650e-007
b = 1.52833749e+000
c = -1.00458526e+001
d = -8.46017784e-005
m = 6.1
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)
0.0000	0.0000	0.00000	2.56378	0.00000	0.00000
-0.9998	34.8697	2.80849	4.99398	2.80848	-0.00001
1.0002	34.8700	2.98013	5.10507	2.98014	0.00000
15.0001	34.8708	4.27760	5.87682	4.27763	0.00003
18.5002	34.8709	4.62485	6.06659	4.62483	-0.00002
29.0002	34.8692	5.71003	6.62439	5.71001	-0.00002
32.5002	34.8628	6.08320	6.80555	6.08322	0.00001

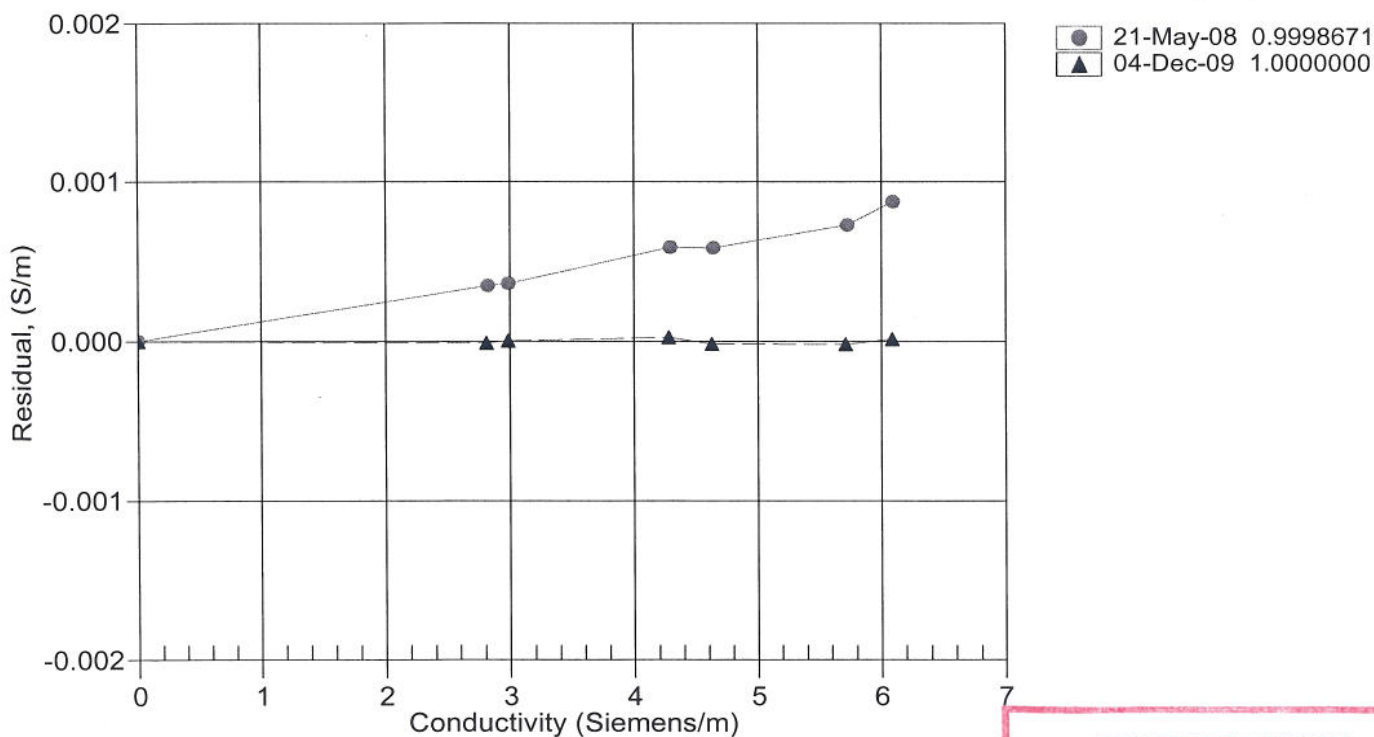
Conductivity = $(g + hf^2 + if^3 + jf^4) / 10(1 + \delta t + \epsilon p)$ Siemens/meter

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

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

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

Date, Slope Correction



**POST CRUISE
CALIBRATION**



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Conductivity Calibration Report

Customer:	Atlantic Marine Center		
Job Number:	56902	Date of Report:	12/4/2009
Model Number:	SBE 04C	Serial Number:	043449

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 using the program SEACON. 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: 12/4/2009

Drift since last cal: -0.00020 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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Service
Report

RMA Number	56902
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Customer Information:

Company	Atlantic Marine Center	Date	12/22/2009
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Contact	Eric Thompson
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PO Number	Credit card
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Serial Number	043451
Model Number	SBE 04C

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. Performed "Post Cruise" calibration of the conductivity sensor.

Special Notes:

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

SENSOR SERIAL NUMBER: 3451
CALIBRATION DATE: 04-Dec-09

SBE4 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Seimens/meter

GHIJ COEFFICIENTS

g = -1.02545085e+001
h = 1.59211083e+000
i = -2.16915884e-003
j = 2.57924672e-004
CPcor = -9.5700e-008 (nominal)
CTcor = 3.2500e-006 (nominal)

ABCDM COEFFICIENTS

a = 9.01886664e-007
b = 1.58665627e+000
c = -1.02443716e+001
d = -8.58272556e-005
m = 6.1
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)
0.0000	0.0000	0.00000	2.54095	0.00000	0.00000
-0.9998	34.8697	2.80849	4.91406	2.80848	-0.00001
1.0002	34.8700	2.98013	5.02281	2.98014	0.00001
15.0001	34.8708	4.27760	5.77858	4.27763	0.00003
18.5002	34.8709	4.62485	5.96448	4.62483	-0.00001
29.0002	34.8692	5.71003	6.51103	5.71000	-0.00002
32.5002	34.8628	6.08320	6.68856	6.08322	0.00002

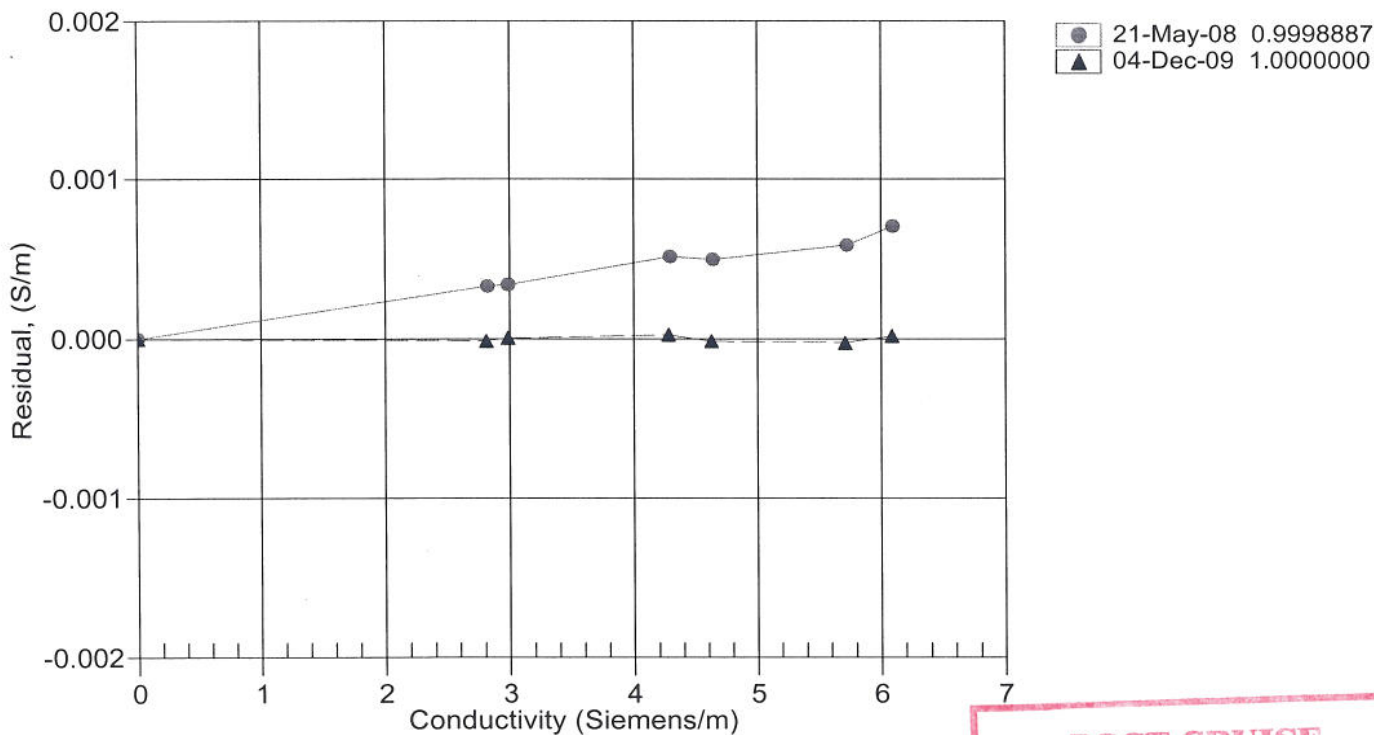
Conductivity = $(g + hf^2 + if^3 + jf^4) / 10(1 + \delta t + \epsilon p)$ Siemens/meter

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

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

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

Date, Slope Correction



**POST CRUISE
CALIBRATION**



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Conductivity Calibration Report

Customer:	Atlantic Marine Center		
Job Number:	56902	Date of Report:	12/4/2009
Model Number:	SBE 04C	Serial Number:	043451

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 using the program SEACON. 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: 12/4/2009

Drift since last cal: -0.00020 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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Service
Report

RMA Number	56902
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Customer Information:

Company	Atlantic Marine Center	Date	12/22/2009
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Contact	Eric Thompson
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PO Number	Credit card
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Serial Number	054928
Model Number	SBE 05T

Services Requested:

1. Evaluate/Repair Instrumentation.

Problems Found:

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Services Performed:

1. Performed initial diagnostic evaluation.

Special Notes:

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Service
Report

RMA Number	56902
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Customer Information:

Company	Atlantic Marine Center	Date	12/22/2009
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Contact	Eric Thompson
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PO Number	Credit card
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Serial Number	054978
Model Number	SBE 05T

Services Requested:

1. Evaluate/Repair Instrumentation.

Problems Found:

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Services Performed:

1. Performed initial diagnostic evaluation.

Special Notes:

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