SBE
SEA-BIRD ELECTRONICS, INC.
1808 - 136th Place Northeast, Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Conductivity Calibration Report

Customer:	ExplorOcean
Job Number:	29758R
Date of Report:	23-Jul-02
Model Number:	SBE 04C
Serial Number:	041912

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: 19-Jul-02 *Drift since last cal:* -.00010 *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 = 1912
CALIBRATION DATE: 19-Jul-02s

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

GHIJ COEFFICIENTS

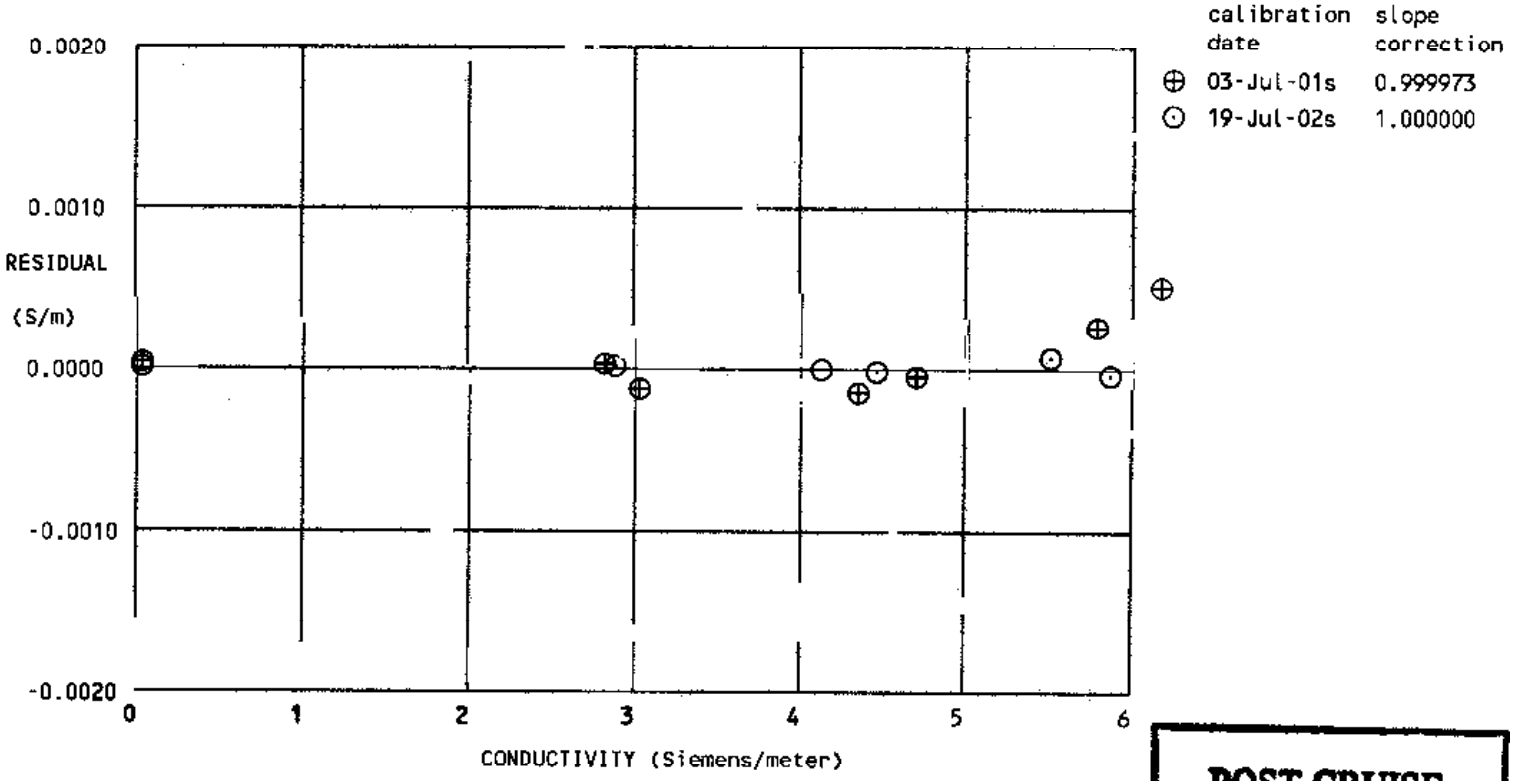
g = -4.16212062e+00
h = 5.36713913e-01
i = -7.86598365e-04
j = 6.80295512e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 4.05489283e-07
b = 5.33927267e-01
c = -4.15327127e+00
d = -1.01626355e-04
m = 5.6
CPcor = -9.57e-08 (nominal)

BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78908	-0.00000	-0.00000
0.9998	33.1901	2.84980	7.81531	2.84981	0.00001
14.9998	33.1920	4.09279	9.17870	4.09278	-0.00001
18.4998	33.1925	4.42550	9.50992	4.42548	-0.00002
28.9998	33.1923	5.46536	10.47636	5.46543	0.00007
32.4999	33.1915	5.82374	10.78870	5.82370	-0.00004

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 = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

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SENSOR SERIAL NUMBER = 1912
CALIBRATION DATE: 03-Jul-01s

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

GHIJ COEFFICIENTS

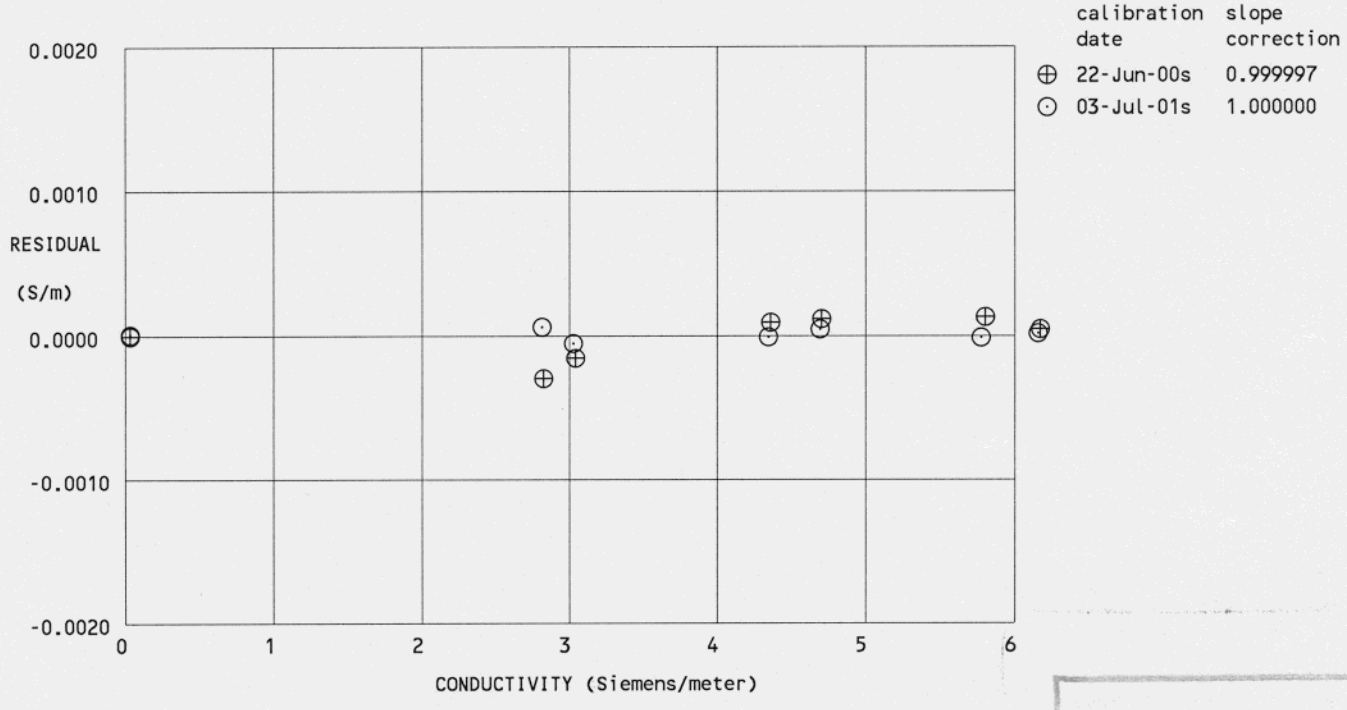
g = -4.15735241e+00
h = 5.35433598e-01
i = -5.20267488e-04
j = 5.37516311e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 1.84247967e-06
b = 5.33689095e-01
c = -4.15196342e+00
d = -8.34682636e-05
m = 5.0
CPcor = -9.57e-08 (nominal)

BATH TEMP (IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78917	-0.00000	-0.00000
-1.4213	35.0258	2.78410	7.73645	2.78415	0.00005
1.0394	35.0285	2.99578	7.98753	2.99572	-0.00006
15.2077	35.0298	4.31511	9.40118	4.31509	-0.00002
18.6889	35.0296	4.66219	9.73849	4.66223	0.00004
29.1152	35.0295	5.74482	10.72092	5.74480	-0.00002
32.6810	35.0247	6.12693	11.04632	6.12694	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 = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



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Conductivity Calibration Report

Customer:	British Antarctic Survey
Job Number:	26329R
Date of Report:	09-Jul-01
Model Number:	SBE 04C
Serial Number:	041912

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: 03-Jul-01 *Drift since last cal:* 0 *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 = 1912
CALIBRATION DATE: 22-Jun-00s

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

GHIJ COEFFICIENTS

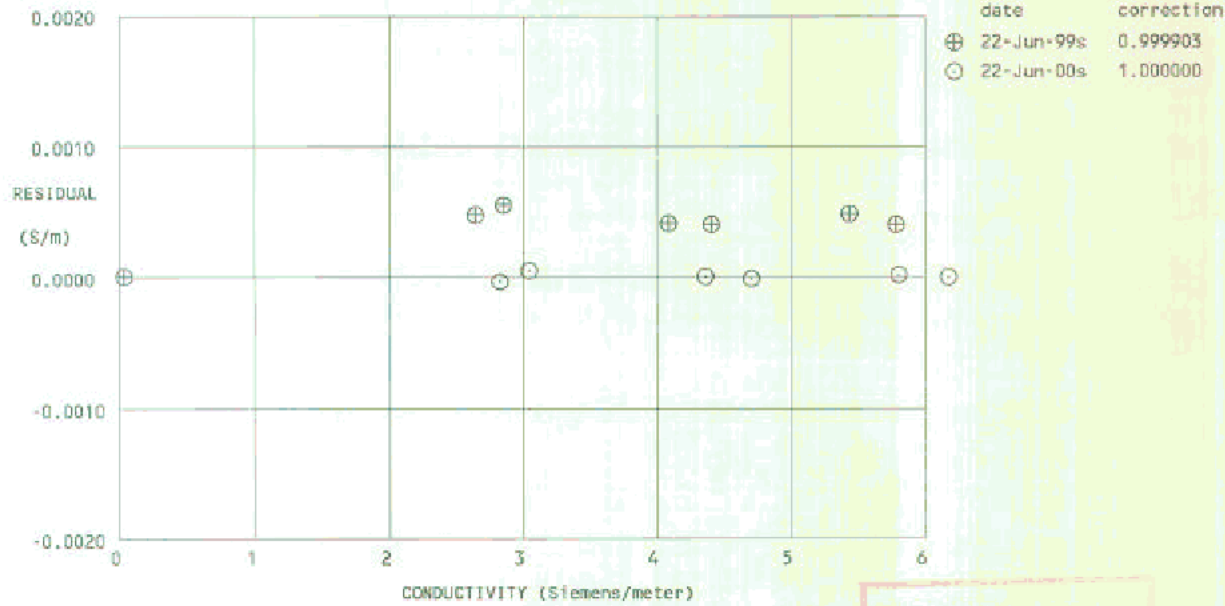
g = -4.16390422e+00
h = 5.36973955e-01
i = -8.02788477e-04
j = 6.71130207e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 3.79038239e-07
b = 5.34024350e-01
c = -4.15388528e+00
d = -7.71306709e-05
m = 5.6
CPcor = -9.57e-08 (nominal)

BATH TEMP (IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78913	0.00000	0.00000
-1.3777	35.1134	2.79412	7.74809	2.79408	-0.00004
1.1617	35.1132	3.01301	8.00750	3.01306	0.00005
15.2815	35.1132	4.33159	9.41757	4.33159	0.00000
18.7194	35.1128	4.67514	9.75090	4.67512	-0.00002
29.2630	35.1102	5.77235	10.74483	5.77236	0.00001
32.7023	35.1055	6.14175	11.05876	6.14174	-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 = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

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Conductivity Calibration Report

Customer:	British Antarctic Survey		
Job Number:	23157R	*Date of Report:*	26-Jun-00
Model Number:	SBE 04C	*Serial Number:*	041912

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: 22-Jun-00 *Drift since last cal:* +.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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Conductivity Calibration Report

Customer: ExplorOcean

SBE Job Number: 21241R Date of report: 23 June 1999

SBE Model Number: 4C Serial Number: 041912

Unless instructed otherwise and if received intact (not broken) and functional, conductivity sensors are calibrated 'as received', i.e, without cleaning or other processing that would prevent determination of the sensor's drift history. If calibration uncovers problems with the sensor or demonstrates the need to clean the conductivity cell and replatinize the cell electrodes, a second calibration will be performed after the necessary work is finished.

An 'as received' calibration certificate listing the coefficients used to convert sensor frequency to conductivity will be provided. Users may judge whether the 'as received' or previously determined coefficients are more likely to represent the condition of the sensor at the time of deployment (those using SEASOFT should enter the chosen coefficients using SEACON). Calibration coefficients obtained after a repair or after cleaning and replatinizing the cell should only be used with data collected subsequent to the calibration.

'AS RECEIVED CALIBRATION' (x) Performed ( ) Not Performed

Date: 22 Jun 99 Drift since last cal: .00050 [PSU]/month[1]

Comments:

'POST CLEANING/REPLATINIZING CALIBRATION' ( ) Performed (x) Not Performed

Date: _____ Drift since initial cal:[2] _____ [PSU]/month[1]

Comments:

[1]Measured at 3.0 S/m

[2]Cleaning and replatinizing tend to 'reset' the conductivity sensor to its original condition. Therefore, lack of drift in post cleaning/replatinizing calibration is an indicator of geometric stability of the cell and the electrical stability of the sensor interface circuits. 'Drift since initial cal' is the total drift from date of the sensor's initial calibration (at time of manufacture) except where the cell has been replaced in which case the drift is referenced to the 1st calibration using the replacement cell.

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SENSOR SERIAL NUMBER = 1912
CALIBRATION DATE: 22-Jun-99s

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

GHIJ COEFFICIENTS

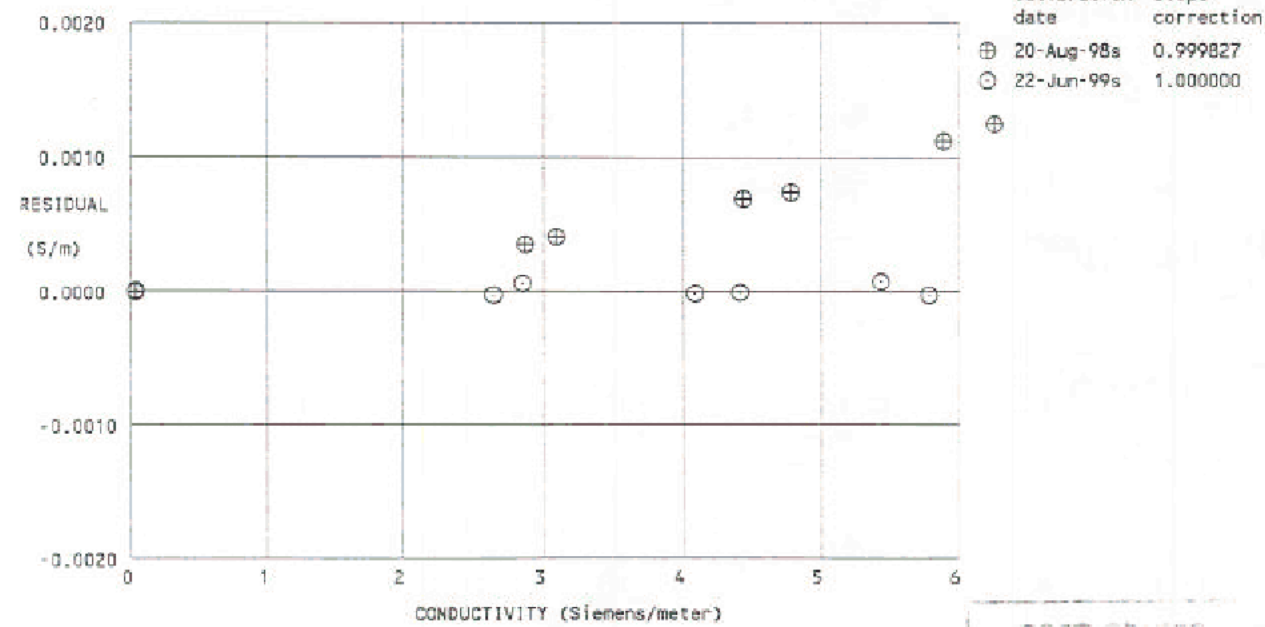
g = -4.15963737e+00
h = 5.36060167e-01
i = -6.52854797e-04
j = 6.04284482e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 6.57219895e-07
b = 5.33832392e-01
c = -4.15294552e+00
d = -8.76614983e-05
m = 5.4
CPcor = -9.57e-08 (nominal)

BATH TEMP (IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78913	-0.00000	-0.00000
-1.3982	32.6323	2.61258	7.52682	2.61254	-0.00004
1.1410	32.6328	2.81792	7.77744	2.81797	0.00005
15.2601	32.6325	4.05467	9.14027	4.05465	-0.00002
18.6976	32.6297	4.37665	9.46241	4.37663	-0.00002
29.2409	32.6290	5.40620	10.42446	5.40626	0.00006
32.6804	32.6247	5.75284	10.72837	5.75280	-0.00004

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 = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

SBE SEA-BIRD ELECTRONICS, INC TELEPHONE 206 643-9866 FAX 206 643-9954
1808-136th Place Northeast, Bellevue, Washington 98005 USA Telex 292915 SBEI UR

Conductivity Calibration Report

Customer: ExplorOcean

SBE Job Number: 18993R Date of report: 21 August 1998

SBE Model Number: 4C Serial Number: 041912

Unless instructed otherwise and if received intact (not broken) and functional, conductivity sensors are calibrated 'as received', i.e, without cleaning or other processing that would prevent determination of the sensor's drift history. If calibration uncovers problems with the sensor or demonstrates the need to clean the conductivity cell and replatinize the cell electrodes, a second calibration will be performed after the necessary work is finished.

An 'as received' calibration certificate listing the coefficients used to convert sensor frequency to conductivity will be provided. Users may judge whether the 'as received' or previously determined coefficients are more likely to represent the condition of the sensor at the time of deployment (those using SEASOFT should enter the chosen coefficients using SEACON). Calibration coefficients obtained after a repair or after cleaning and replatinizing the cell should only be used with data collected subsequent to the calibration.

'AS RECEIVED CALIBRATION' (x) Performed ( ) Not Performed

Date: 23 Jul 98 Drift since last cal: .00050 [PSU]/month[1]

Comments:
The conductivity cell was accidently damaged during the C&P process.

'POST REPAIR CALIBRATION' (x) Performed ( ) Not Performed

Date: 20 August 98 Drift since initial cal:[2] N/A [PSU]/month[2]

Comments:
Replaced conductivity cell.

[1]Measured at 3.0 S/m

[2]Cleaning and replatinizing tend to 'reset' the conductivity sensor to its original condition. Therefore, lack of drift in post cleaning/replatinizing calibration is an indicator of geometric stability of the cell and the electrical stability of the sensor interface circuits. 'Drift since initial cal' is the total drift from date of the sensor's initial calibration (at time of manufacture) except where the cell has been replaced in which case the drift is referenced to the 1st calibration using the replacement cell.

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SENSOR SERIAL NUMBER = 1912
CALIBRATION DATE: 23-Jul-98s

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

GHIJ COEFFICIENTS

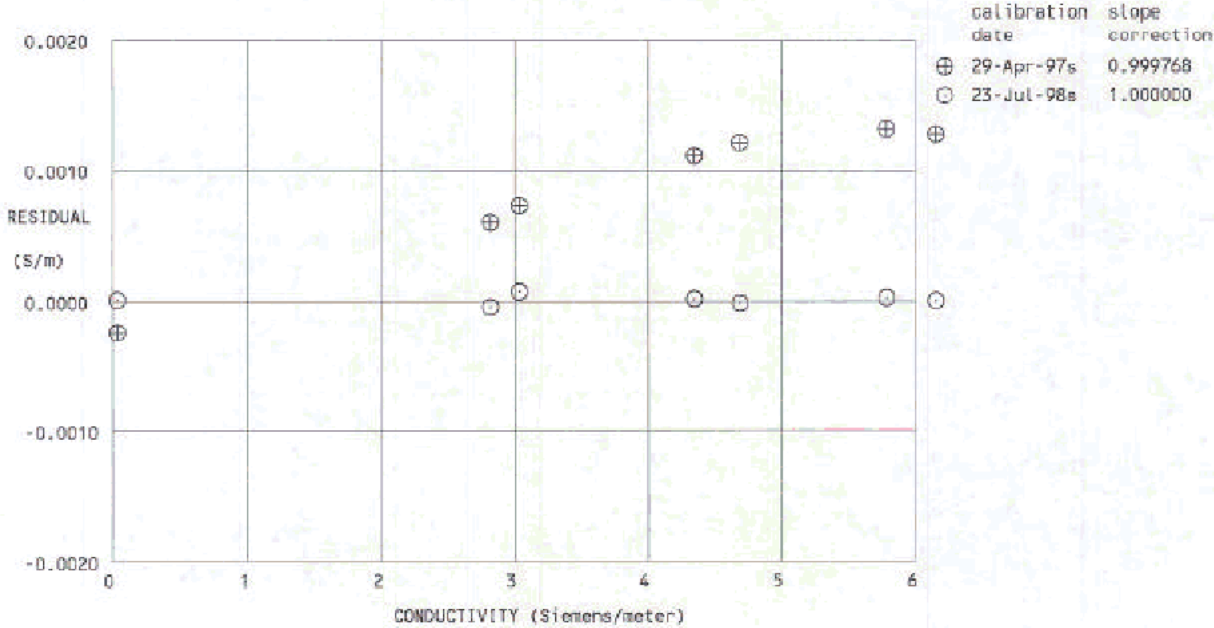
g = -4.10035725e+00
h = 5.27756359e-01
i = -5.01656489e-04
j = 5.05619988e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 1.68967579e-06
b = 5.26031426e-01
c = -4.09475384e+00
d = -8.02851481e-05
m = 5.0
CPcor = -9.57e-08 (nominal)

BATH TEMP (IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.79003	0.00000	0.00000
-1.4099	35.0069	2.78370	7.78528	2.78365	-0.00005
1.1279	35.0083	3.00192	8.04644	3.00198	0.00006
15.2469	35.0085	4.31663	9.46587	4.31664	0.00001
18.6850	35.0069	4.65909	9.80134	4.65906	-0.00003
29.2277	35.0041	5.75312	10.80207	5.75314	0.00002
32.6677	35.0018	6.12193	11.11860	6.12192	-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 = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

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SENSOR SERIAL NUMBER = 1912
CALIBRATION DATE: 20-Aug-98s

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

GHIJ COEFFICIENTS

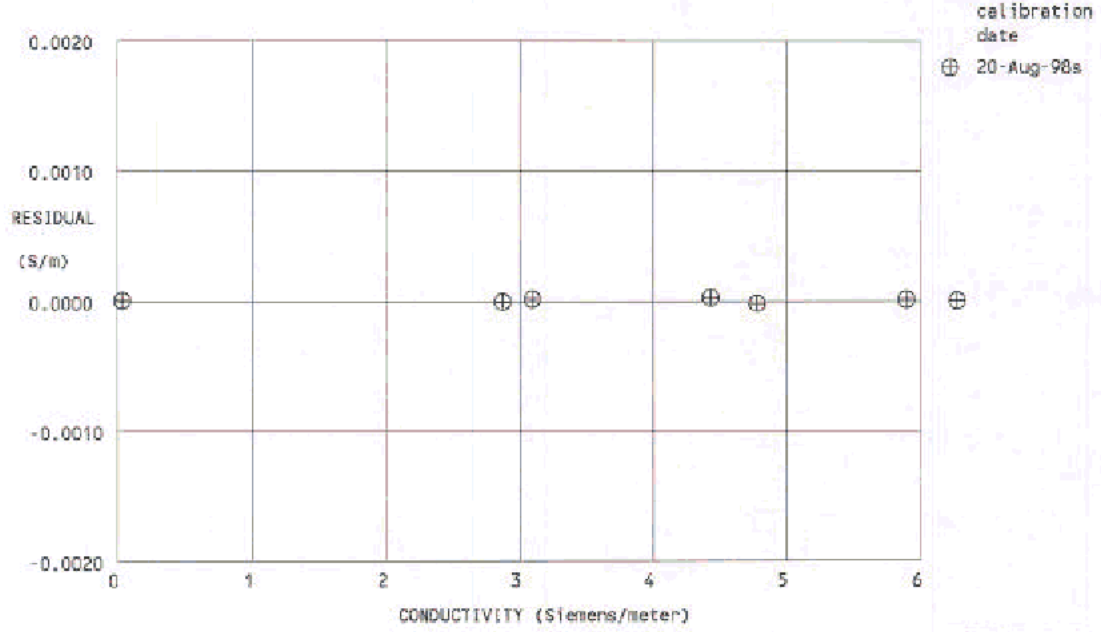
g = -4.15856853e+00
h = 5.35866120e-01
i = -6.20046081e-04
j = 5.81708310e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 1.07033713e-06
b = 5.33694920e-01
c = -4.15151133e+00
d = -8.08604607e-05
m = 5.2
CPcor = -9.57e-08 (nominal)

BATH TEMP (IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78909	0.00000	0.00000
-1.4115	35.7596	2.83778	7.80155	2.83777	-0.00001
1.1279	35.7612	3.06022	8.06328	3.06023	0.00001
15.2467	35.7608	4.39937	9.48535	4.39939	0.00002
18.6843	35.7598	4.74823	9.82141	4.74821	-0.00002
29.2275	35.7590	5.86296	10.82401	5.86297	0.00001
32.6669	35.7539	6.23816	11.14061	6.23816	-0.00000

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 = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



CALIBRATION AFTER MODIFICATIONS

SEA-BIRD ELECTRONICS, INC.
1808 136th Place N.E., Bellevue, Washington 98005 USA
Telephone: (206) 643-9866 Telex: 292915 SBEI UR Fax: (206)643-9954

PRESSURE TEST CERTIFICATE

Date: 28 Jul 98

Job # 18993R

Model # 4C

S/N 041912

Pressure test results:

Low pressure (psi)	50	psi
Time (minutes)	15	min
High pressure (psi)	10000	psi
Time (minutes)	30	min

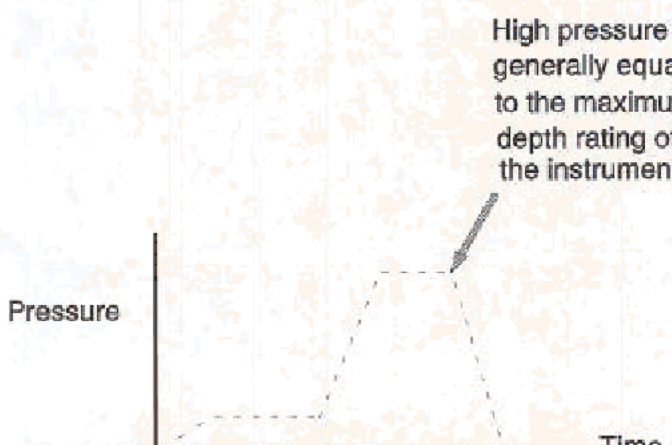
Pass ✓

Fail

Comments:

Replaced Cell

Tested by: CPE



typical Test Profile