



SEA-BIRD ELECTRONICS, INC.

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

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

Temperature Calibration Report

Customer: ExplorOcean

Job Number: 29758R

Date of Report: 22-Jul-02

Model Number: SBE 03Plus

Serial Number: 03P2191

Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. 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: 19-Jul-02

Drift since last cal: -.00006 **Degrees Celsius/ye**

Comments:

'CALIBRATION AFTER REPAIR'

performed **Not Performed**

Date:

Drift since last cal: **Degrees Celsius/ye**

Comments:

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
 Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2191
 CALIBRATION DATE: 19-Jul-02s

TEMPERATURE CALIBRATION DATA ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.31967419e-03
 h = 6.38837657e-04
 i = 2.27990979e-05
 j = 2.17976156e-06
 f₀ = 1000.000

IPTS-68 COEFFICIENTS

a = 3.68120888e-03
 b = 5.98832425e-04
 c = 1.60660919e-05
 d = 2.18129376e-06
 f₀ = 2811.720

BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.4997	2811.720	-1.4997	-0.00005
1.0003	2974.139	1.0004	0.00009
4.5004	3212.798	4.5004	-0.00000
8.0004	3464.957	8.0003	-0.00007
11.5003	3730.994	11.5003	0.00000
15.0004	4011.276	15.0004	0.00001
18.5004	4306.133	18.5004	0.00002
22.0003	4615.903	22.0003	0.00004
25.5004	4940.924	25.5003	-0.00007
29.0003	5281.505	29.0003	0.00002
32.5004	5637.954	32.5004	-0.00000

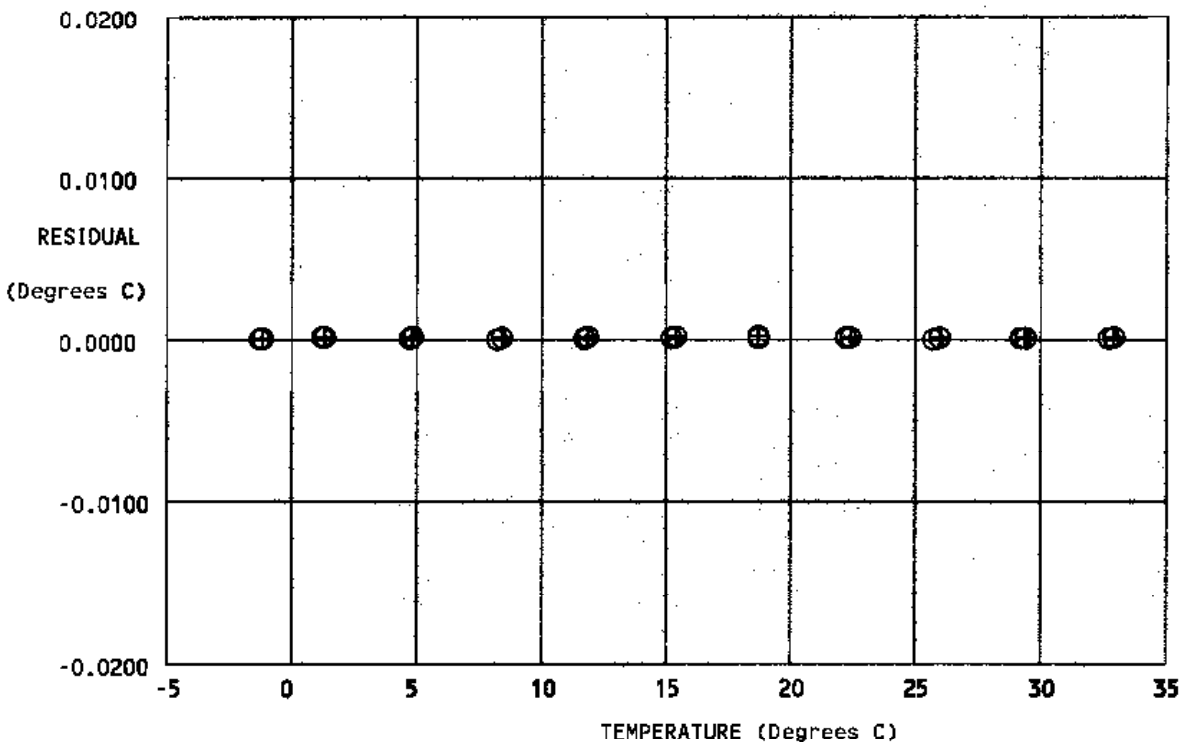
Temperature ITS-90 = $1/\{g + h[\ln(f_0/f)] + i[\ln^2(f_0/f)] + j[\ln^3(f_0/f)]\} - 273.15$ (°C)

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: T₆₈ is assumed to be 1.00024 * T₉₀ (-2 to 35 °C).

Residual = instrument temperature - bath temperature

calibration date	delta T [mdeg C]
⊕ 02-Jul-01s	0.06
⊙ 19-Jul-02s	-0.00



**POST CRUISE
 CALIBRATION**

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
 Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2191
 CALIBRATION DATE: 02-Jul-01s

TEMPERATURE CALIBRATION DATA
 ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.31962908e-03
 h = 6.38744187e-04
 i = 2.27372802e-05
 j = 2.16646251e-06
 $f_0 = 1000.000$

IPTS-68 COEFFICIENTS

a = 3.67980130e-03
 b = 5.98748719e-04
 c = 1.60302221e-05
 d = 2.16798920e-06
 $f_0 = 2818.338$

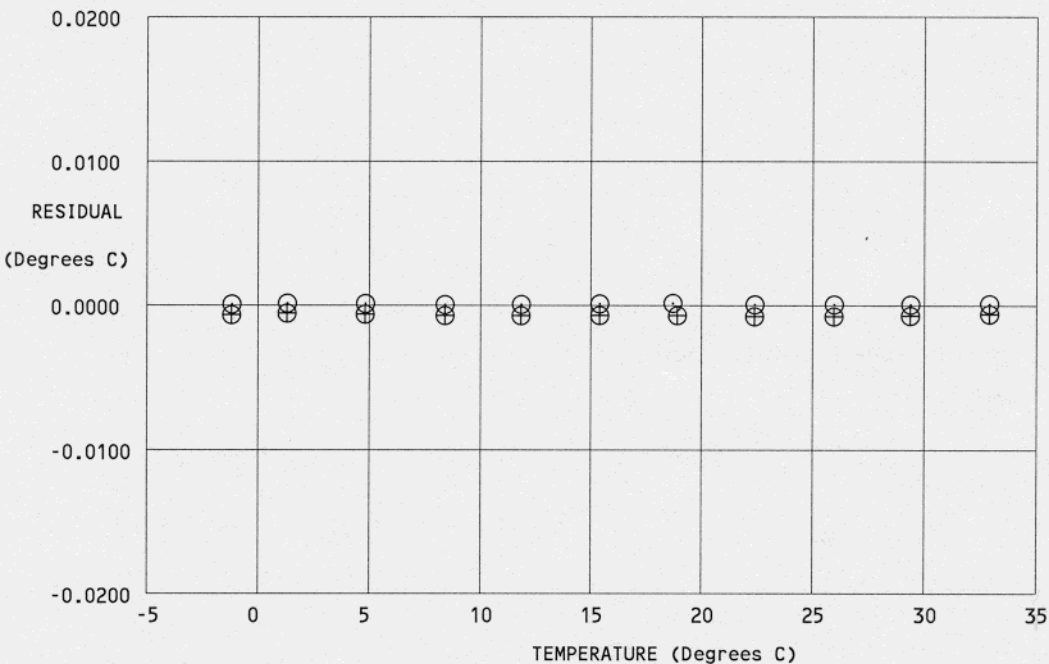
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.3958	2818.338	-1.3959	-0.00002
1.1114	2981.508	1.1114	0.00004
4.6067	3220.262	4.6067	0.00002
8.2049	3480.120	8.2048	-0.00006
11.6381	3741.764	11.6381	-0.00002
15.1961	4027.379	15.1961	0.00003
18.4965	4305.810	18.4966	0.00006
22.1984	4633.887	22.1983	-0.00001
25.7591	4965.570	25.7591	-0.00002
29.1745	5298.863	29.1744	-0.00002
32.7075	5659.557	32.7075	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



POST CRUISE
 CALIBRATION



SEA-BIRD ELECTRONICS, INC.

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

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

Temperature Calibration Report

Customer: British Antarctic Survey

Job Number: 26329R

Date of Report: 02-Jul-01

Model Number: SBE 03Plus

Serial Number: 03P2191

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: 02-Jul-01

Drift since last cal: +.00076 **Degrees Celsius/year**

Comments:

'CALIBRATION AFTER REPAIR' **performed** **Not Performed**

Date:

Drift since last cal: **Degrees Celsius/year**

Comments:

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2191
CALIBRATION DATE: 22-Jun-00s

TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

$g = 4.31953065e-03$
 $h = 6.38536354e-04$
 $i = 2.25769542e-05$
 $j = 2.12570795e-06$
 $f_0 = 1000.000$

IPTS-68 COEFFICIENTS

$a = 3.67992230e-03$
 $b = 5.98748857e-04$
 $c = 1.59979676e-05$
 $d = 2.12722669e-06$
 $f_0 = 2817.722$

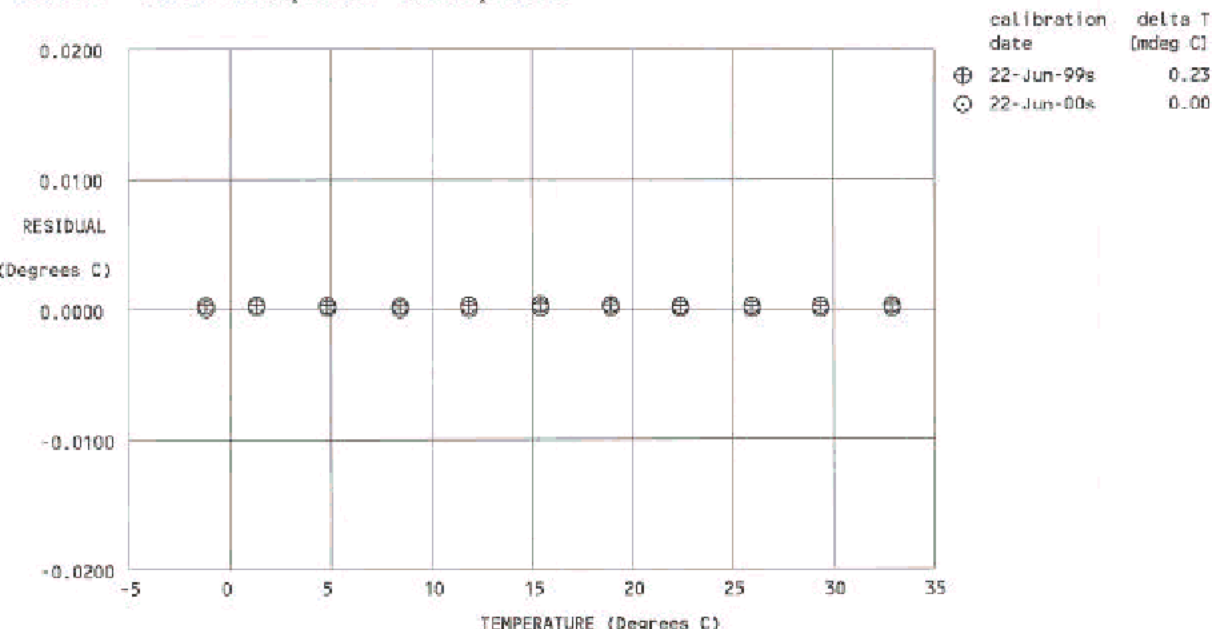
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.4048	2817.722	-1.4048	-0.00004
1.1034	2980.933	1.1035	0.00006
4.5978	3219.583	4.5978	0.00001
8.1960	3479.407	8.1959	-0.00006
11.6298	3741.051	11.6298	-0.00003
15.1877	4026.622	15.1877	0.00004
18.6919	4322.629	18.6919	0.00006
22.1906	4633.107	22.1906	-0.00001
25.7515	4964.762	25.7514	-0.00002
29.1667	5298.010	29.1667	-0.00003
32.7008	5658.785	32.7009	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



POST CRUISE
CALIBRATION



SEA-BIRD ELECTRONICS, INC.

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

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

Temperature Calibration Report

Customer: British Antarctic Survey

Job Number: 23157R

Date of Report: 22-Jun-00

Model Number: SBE 03Plus

Serial Number: 03P2191

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: 22-Jun-00

Drift since last cal: -.00023 *Degrees Celsius/year*

Comments:

'CALIBRATION AFTER REPAIR'

performed Not performed

Date:

Drift since last cal: *Degrees Celsius/year*

Comments:



PRESSURE TEST CERTIFICATE

Date: 05 Jul 00

Job # 23157R

Model # 3plus 6800m

S/N 03P2191

Pressure test results:

Low pressure (psi) 50 psi
Time (minutes) 15 min

High pressure (psi) 10000 psi
Time (minutes) 30 min

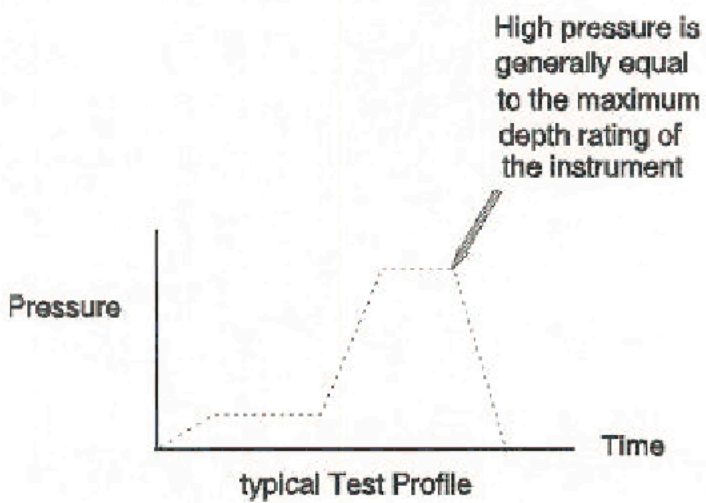
Pass ✓

Fail _____

Comments:

Replaced the 3-pin connector.

Tested by: CPE



Temperature Calibration Report

Customer: ExplorOceanSBE Job Number: 21241R Date of report: 22 June 1999SBE Model Number: 3Plus Serial Number: 032191

Unless instructed otherwise and if received intact (not broken) and functional, temperature sensors are calibrated 'as received', i.e. without repairs or adjustments that would prevent determination of the sensor's drift history. If calibration uncovers problems with the sensor, a second calibration will be required after the necessary work is finished.

An 'as received' calibration certificate listing the coefficients used to convert sensor frequency to temperature 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 should only be used with data collected subsequent to the calibration.

"AS RECEIVED CALIBRATION" Performed Not Performed

Date: 22 Jun 99 Drift since last cal: .00003 °Celsius/yearComments:

"POST REPAIR CALIBRATION" Performed Not Performed

Date: _____ Drift since last cal: _____ °Celsius/year

Comments:

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
 Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2191
 CALIBRATION DATE: 22-Jun-99s

TEMPERATURE CALIBRATION DATA
 ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

$g = 4.31952842e-03$
 $h = 6.38524293e-04$
 $i = 2.25683861e-05$
 $j = 2.12390152e-06$
 $f_0 = 1000.000$

IPTS-68 COEFFICIENTS

$a = 3.68000338e-03$
 $b = 5.98752900e-04$
 $c = 1.59958439e-05$
 $d = 2.12542030e-06$
 $f_0 = 2817.355$

BATH TEMP
 (ITS-90 °C)

INSTRUMENT FREQ
 (Hz)

INST TEMP
 (ITS-90 °C)

RESIDUAL
 (ITS-90 °C)

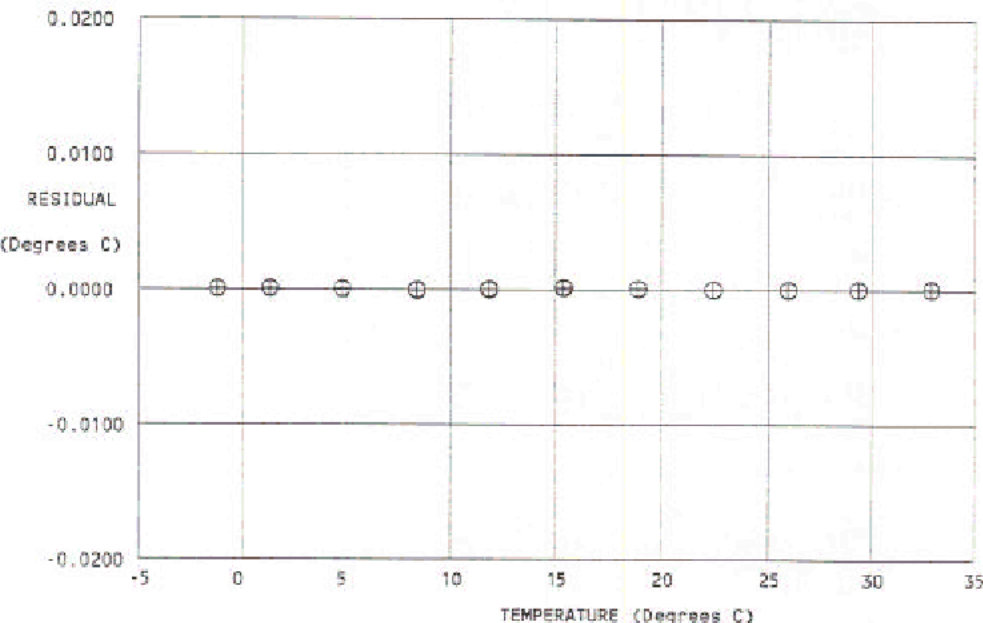
-1.4108	2817.355	-1.4108	-0.00001
1.0989	2980.649	1.0990	0.00003
4.5911	3219.127	4.5910	-0.00001
8.1887	3478.884	8.1887	-0.00007
11.6226	3740.506	11.6226	-0.00000
15.1790	4025.933	15.1791	0.00007
18.6829	4321.872	18.6830	0.00002
22.1820	4632.344	22.1820	-0.00002
25.7414	4963.822	25.7413	-0.00003
29.1563	5296.995	29.1563	-0.00001
32.6892	5657.595	32.6892	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 IPOTS: T_{68} is assumed to be $1.00024 * T_{90}$ (-2 to 35 °C).

Residual = instrument temperature - bath temperature



calibration date	delta T (mdeg C)
⊕ 24-Jul-98s	-0.03
○ 22-Jun-99s	0.00



Temperature Calibration Report

Customer: ExplorOceanSBE Job Number: 18993R Date of report: 24 July 1998SBE Model Number: 3Plus Serial Number: 032191

Unless instructed otherwise and if received intact (not broken) and functional, temperature sensors are calibrated 'as received', i.e. without repairs or adjustments that would prevent determination of the sensor's drift history. If calibration uncovers problems with the sensor, a second calibration will be required after the necessary work is finished.

An 'as received' calibration certificate listing the coefficients used to convert sensor frequency to temperature 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 should only be used with data collected subsequent to the calibration.

'AS RECEIVED CALIBRATION' Performed Not Performed

Date: 24 Jul 98 Drift since last cal: .00025 °Celsius/year

Comments:

'POST REPAIR CALIBRATION' Performed Not Performed

Date: _____ Drift since last cal: _____ °Celsius/year

Comments:

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
 Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2191
 CALIBRATION DATE: 24-Jul-98s

TEMPERATURE CALIBRATION DATA
 ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.31957254e-03
 h = 6.38624315e-04
 i = 2.26416532e-05
 j = 2.14140789e-06
 f₀ = 1000.000

IPTS-68 COEFFICIENTS

a = 3.68010974e-03
 b = 5.98763197e-04
 c = 1.60158614e-05
 d = 2.14293028e-06
 f₀ = 2816.853

BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)
-1.4186	2816.853
1.0907	2980.100
4.5833	3218.579
8.1823	3478.402
11.6153	3739.935
15.1728	4025.420
18.6765	4321.318
22.1756	4631.763
25.7357	4963.275
29.1506	5296.421
32.6844	5657.086

INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.4186	-0.00001
1.0907	0.00004
4.5833	0.00001
8.1822	-0.00008
11.6153	-0.00003
15.1729	0.00010
18.6766	0.00004
22.1756	-0.00003
25.7356	-0.00004
29.1505	-0.00003
32.6844	0.00003

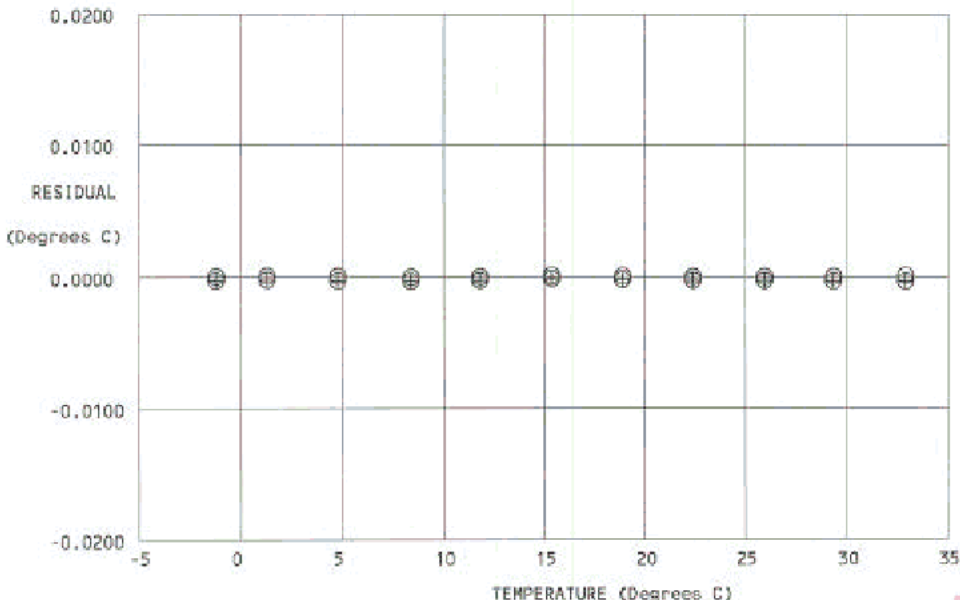
Temperature ITS-90 = 1/{g + h[ln(f₀/f)] + i[ln²(f₀/f)] + j[ln³(f₀/f)]} - 273.15 (°C)

Temperature IPTS-68 = 1/{a + b[ln(f₀/f)] + c[ln²(f₀/f)] + d[ln³(f₀/f)]} - 273.15 (°C)

Following the recommendation of JPOTS: T₆₈ is assumed to be 1.00024 * T₉₀ (-2 to 35 °C).

Residual = instrument temperature - bath temperature

calibration date	delta T (mdeg C)
⊕ 05-May-97s	-0.30
○ 24-Jul-98s	0.00



POST CRUISE
CALIBRATION