

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 = 2326
 CALIBRATION DATE: 01-Apr-03

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

GHI COEFFICIENTS

g = -4.07474930e+00
 h = 4.85938343e-01
 i = 1.29569193e-03
 j = -2.92370312e-05
 CPcor = -9.57e-08 (nominal)
 CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 5.90417458e-02
 b = 4.21408983e-01
 c = -4.05269573e+00
 d = -9.70485591e-05
 m = 2.1
 CPcor = -9.57e-08 (nominal)

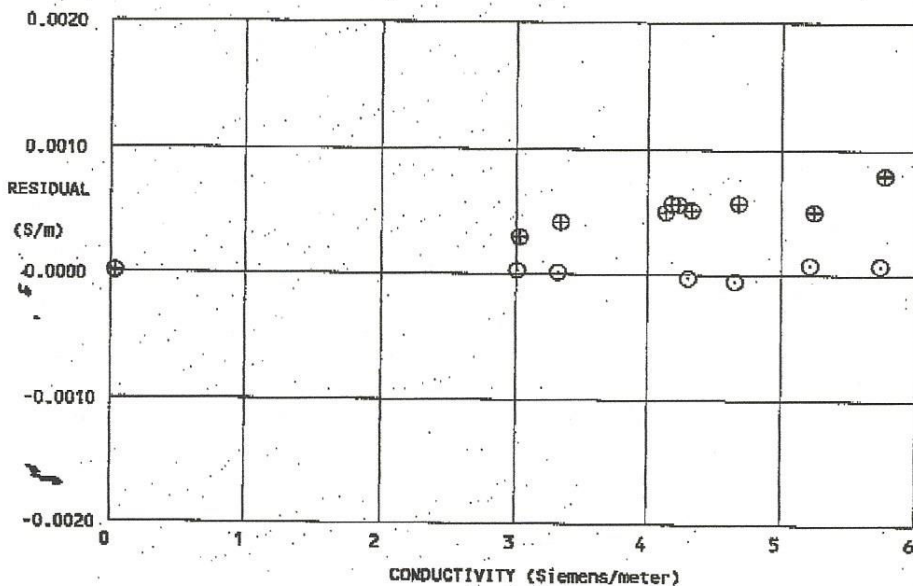
BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2.88538	-0.00000	-0.00000
1.0000	34.8721	2.98028	8.27570	2.98030	0.00002
4.4999	34.8717	3.28942	8.64251	3.28943	0.00001
15.0000	34.8679	4.27727	9.72099	4.27723	-0.00004
18.4999	34.8668	4.62433	10.07211	4.62427	-0.00006
24.0000	34.8655	5.18514	10.61478	5.18521	0.00007
29.0000	34.8653	5.70944	11.09771	5.70951	0.00007
32.5000	34.8652	6.08356	11.42956	6.08350	-0.00006

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 [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;

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



calibration date	slope correction
⊕ 23-Mar-00	0.999867
⊖ 01-Apr-03	1.000000

POST CRUISE CALIBRATION

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SENSOR SERIAL NUMBER = 2326
 CALIBRATION DATE: 01-Apr-03

TEMPERATURE CALIBRATION DATA
 ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.17686922e-03
 h = 6.06041464e-04
 i = 3.42348564e-06
 j = -1.75449673e-06
 f₀ = 1000.000

IPTS-68 COEFFICIENTS

a = 3.64763706e-03
 b = 5.96088581e-04
 c = 8.07849912e-06
 d = -1.75412183e-06
 f₀ = 2409.926

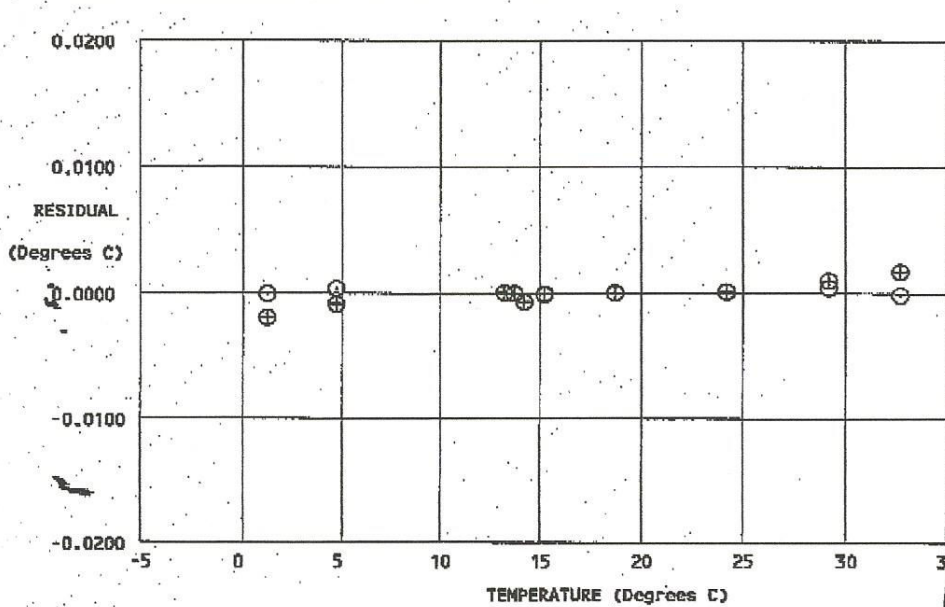
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
1.0000	2409.926	0.9998	-0.00016
4.4999	2603.463	4.5002	0.00028
15.0000	3248.719	14.9998	-0.00020
18.4999	3486.342	18.4998	-0.00006
24.0000	3883.568	24.0000	0.00001
29.0000	4270.737	29.0003	0.00034
32.5000	4556.884	32.4998	-0.00022

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)
⊕ 23-Mar-00	-0.15
⊙ 01-Apr-03	-0.00

POST CRUISE CALIBRATION

Pressure Calibration Check

04 April 2003

pressure sensor model: DigiQuartz 410K-105
 sensor serial number: 64857
 installed in: CTD 161148-2326

This pressure calibration is a check of the 'test' sensor against a stable reference pressure sensor. The reference pressure sensor is itself checked several times per year against a NIST-traceable pressure standard maintained at Paroscientific, Inc.. The circumstances of this pressure check introduce no more than 1.5 psia total error in 10,000 psi (0.015 %) in addition to the error resident in the Paroscientific site standard. The check offers a very high level certification of the health and proper operation of the 'test' sensor.

Input Pressure* [psia]	Sensor Output [hz]	Sensor Temperature [deg C]	Pressure Factory Coef [psia]	Pressure Corrected [psia]	Error [psia]
14.598	33027.68	20.4	14.949	14.736	0.138
2014.973	33694.43	20.5	2015.354	2014.736	-0.237
4014.999	34346.35	20.5	4016.270	4015.249	0.250
6015.061	34983.93	20.5	6016.541	6015.116	0.055
8015.174	35608.28	20.6	8017.159	8015.330	0.156
10015.367	36219.84	20.6	10017.273	10015.040	-0.327
8015.225	35608.32	20.7	8017.191	8015.362	0.137
6015.076	34983.94	20.7	6016.393	6014.968	-0.108
4014.973	34346.45	20.7	4016.318	4015.297	0.324
2014.991	33694.54	20.7	2015.318	2014.701	-0.290
14.601	33027.78	20.8	14.717	14.504	-0.097

Input pressure is generated with a Ruska model 5201 dead-weight tester, serial number 23330/380, and is determined by measurement with reference pressure sensor model DigiQuartz 410K-105, serial number 73292.

Sensor Temperature: ~~pressure sensor internal temperature.~~

Pressure Corrected: pressure computed with original factory coefficients and then corrected with a slope and offset to give the best linear agreement with the 'reference' input pressure.

Error: Corrected pressure - Input pressure

A linear fit of this calibration data, between sensor pressure computed with factory coefficients and the input pressure, yields correction coefficients:

$$\text{Corrected pressure} = \text{psi slope} * \text{Factory pressure} + \text{psi offset [psia]}$$

$$\text{psi slope} = 0.99980 \text{ and } \text{psi offset} = -0.21 \text{ [psia]}$$

These are converted to Slope and Offset for use in the SEASOFT programs by:
 Slope = psi slope = 0.99980
 Offset = 0.689476 * (psi offset - 14.7 * (1 - psi slope)) = -0.1473 [dbars]

Slope and Offset coefficients are entered into the pressure sensor calibration coefficient section of the <>.CON file using the program SEACON.

DigiQuartz Coefficients:

- C1 = -4.894762e+04
- C2 = -9.102170e-01
- C3 = 1.593180e-02
- D1 = 3.883600e-02
- D2 = 0.000000e+00
- T1 = 3.029141e+01
- T2 = -5.307730e-04
- T3 = 3.883590e-06
- T4 = 4.607360e-09

Calibration Correction:

- Slope = 0.99980
- Offset = -0.1473