Pressure Calibration Report
STS Calibration Facility

SENSOR SERIAL NUMBER: 0914
CALIBRATION DATE: 05-FEB-2021
Mfg: SEABIRD Model: 09P CTD Prs s/n: 110547

C1= -4.347419E+4
C2= 9.519583E-2
C3= 1.217347E-2
D1= 3.695368E-2
D2= 0.000000E+0
T1= 3.006841E+1
T2= -2.734151E-4
T3= 3.937442E-6
T4= 5.448912E-9
T5= 0.000000E+0
AD590M= 1.28789E-2
AD590B= -8.81353E+0
Slope = 1.00000000E+0
Offset = 0.00000000E+0

Calibration Standard: Mfg: FLUKE Model: P3125 s/n: 70856
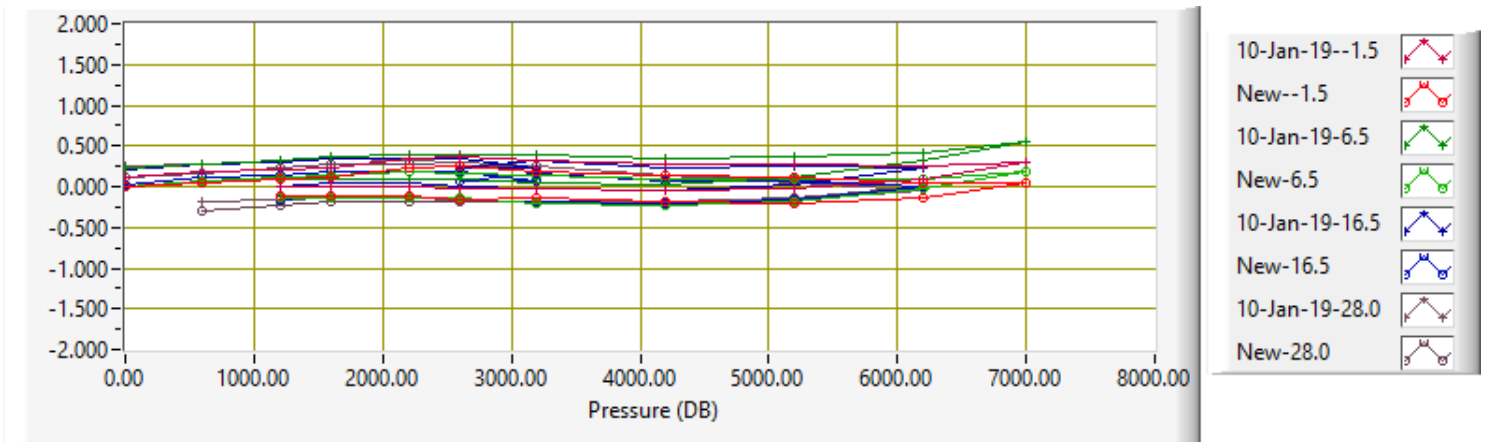t0=t1+t2*td+t3*td*td+t4*td*td*td
w = 1-t0*t0*f*f
Pressure = (0.6894759*((c1+c2*td+c3*td*td)*w*(1-(d1+d2*td)*w)-14.7)

Sensor Output	DWT	Sensor New_Coefs	DWT-Sensor Prev_Coefs	DWT-Sensor NEW_Coefs	PT-DegC	Bath_Temp
33262.977	0.27	0.27	0.12	-0.00	-0.94	-1.524
33593.871	600.32	600.26	0.17	0.06	-0.93	-1.523
33921.049	1200.33	1200.24	0.21	0.09	-0.93	-1.523
34137.163	1600.35	1600.23	0.24	0.12	-0.93	-1.523
34458.372	2200.39	2200.15	0.35	0.23	-0.93	-1.524
34670.629	2600.41	2600.16	0.37	0.25	-0.93	-1.523
34986.255	3200.43	3200.24	0.31	0.18	-0.93	-1.523
35505.006	4200.40	4200.27	0.28	0.13	-0.93	-1.523
36015.059	5200.40	5200.29	0.29	0.11	-0.93	-1.523
36516.815	6200.41	6200.36	0.26	0.05	-0.93	-1.523
36912.408	7000.37	7000.31	0.30	0.06	-0.93	-1.523
36516.889	6200.38	6200.51	0.08	-0.13	-0.93	-1.523
36015.219	5200.41	5200.61	-0.02	-0.20	-0.93	-1.523
35505.191	4200.44	4200.63	-0.04	-0.19	-0.93	-1.523
34986.433	3200.44	3200.58	-0.01	-0.14	-0.93	-1.523
34670.827	2600.39	2600.54	-0.03	-0.15	-0.94	-1.523
34458.548	2200.37	2200.48	0.00	-0.11	-0.93	-1.523
34137.296	1600.36	1600.48	-0.00	-0.12	-0.94	-1.523

Sensor Output	DWT	Sensor New_Coefs	DWT-Sensor Prev_Coefs	DWT-Sensor NEW_Coefs	PT-DegC	Bath_Temp
33921.159	1200.34	1200.45	0.01	-0.10	-0.94	-1.523
33593.964	600.31	600.43	-0.00	-0.12	-0.94	-1.523
33265.090	0.27	0.26	0.23	0.01	6.71	6.484
33596.020	600.32	600.25	0.28	0.07	6.73	6.484
33923.231	1200.34	1200.22	0.33	0.11	6.75	6.484
34139.364	1600.36	1600.21	0.36	0.15	6.76	6.484
34460.652	2200.40	2200.22	0.40	0.18	6.78	6.484
34672.944	2600.42	2600.25	0.39	0.16	6.78	6.484
34988.582	3200.43	3200.29	0.38	0.14	6.81	6.484
35507.396	4200.43	4200.35	0.34	0.08	6.81	6.484
36017.495	5200.44	5200.35	0.38	0.09	6.83	6.484
36519.254	6200.42	6200.34	0.41	0.08	6.83	6.484
36914.833	7000.36	7000.17	0.55	0.18	6.86	6.484
36519.312	6200.42	6200.43	0.32	-0.01	6.88	6.484
36017.652	5200.46	5200.64	0.11	-0.18	6.89	6.484
35507.591	4200.45	4200.69	0.02	-0.24	6.89	6.484
34988.776	3200.42	3200.62	0.04	-0.20	6.89	6.484
34673.126	2600.40	2600.54	0.08	-0.14	6.90	6.484
34460.851	2200.40	2200.53	0.09	-0.13	6.91	6.484
34139.559	1600.36	1600.50	0.08	-0.13	6.91	6.484
33923.409	1200.34	1200.47	0.08	-0.13	6.93	6.484
33596.164	600.31	600.42	0.11	-0.11	6.94	6.484
33267.148	0.27	0.25	0.20	0.02	17.27	16.489
33598.103	600.31	600.20	0.28	0.11	17.27	16.489
33925.365	1200.32	1200.19	0.31	0.14	17.27	16.489
34141.531	1600.35	1600.17	0.34	0.17	17.27	16.489
34462.869	2200.39	2200.20	0.35	0.19	17.27	16.489
34675.177	2600.40	2600.20	0.35	0.20	17.27	16.489
34990.902	3200.40	3200.33	0.23	0.07	17.27	16.490
34675.234	2600.38	2600.31	0.23	0.07	17.27	16.489
34990.870	3200.43	3200.27	0.32	0.16	17.27	16.489
35509.760	4200.39	4200.32	0.24	0.07	17.27	16.489
36019.924	5200.38	5200.32	0.25	0.07	17.28	16.489
36521.797	6200.40	6200.38	0.22	0.01	17.28	16.489
36020.065	5200.43	5200.59	0.02	-0.16	17.28	16.490
35509.913	4200.40	4200.62	-0.04	-0.21	17.27	16.489
34991.029	3200.39	3200.57	-0.02	-0.18	17.27	16.489
34675.353	2600.38	2600.54	0.00	-0.16	17.27	16.489
34463.035	2200.39	2200.51	0.04	-0.12	17.27	16.489
34141.696	1600.36	1600.48	0.04	-0.13	17.27	16.489
33925.527	1200.33	1200.49	0.01	-0.16	17.27	16.489
33598.228	600.31	600.43	0.05	-0.12	17.27	16.489
33268.160	0.27	0.15	0.26	0.11	28.87	28.000
33599.211	600.31	600.16	0.26	0.15	28.87	28.000
33926.523	1200.34	1200.11	0.31	0.23	28.87	28.000
34142.724	1600.36	1600.08	0.35	0.28	28.87	28.000

Sensor Output	DWT	Sensor New_Coefs	DWT-Sensor Prev_Coefs	DWT-Sensor NEW_Coefs	PT-DegC	Bath_Temp
34464.126	2200.37	2200.10	0.32	0.27	28.87	28.000
34676.481	2600.38	2600.11	0.29	0.26	28.87	28.000
34992.232	3200.42	3200.17	0.26	0.25	28.87	28.000
35511.255	4200.43	4200.28	0.13	0.14	28.87	28.000
36021.545	5200.40	5200.33	0.04	0.07	28.88	28.000
36523.496	6200.35	6200.36	-0.05	-0.01	28.88	28.000
36021.659	5200.43	5200.56	-0.17	-0.13	28.87	27.999
35511.424	4200.44	4200.61	-0.19	-0.17	28.87	28.000
34992.457	3200.41	3200.60	-0.18	-0.19	28.87	28.000
34676.719	2600.38	2600.57	-0.16	-0.18	28.87	28.000
34464.373	2200.37	2200.56	-0.15	-0.19	28.87	27.999
34142.980	1600.36	1600.55	-0.13	-0.19	28.87	27.999
33926.777	1200.34	1200.58	-0.16	-0.24	28.87	28.000
33599.463	600.31	600.62	-0.19	-0.30	28.87	28.000
33268.316	0.27	0.43	-0.03	-0.17	28.87	27.999

Legend:
- 10-Jan-19--1.5
- New--1.5
- 10-Jan-19-6.5
- New-6.5
- 10-Jan-19-16.5
- New-16.5
- 10-Jan-19-28.0
- New-28.0

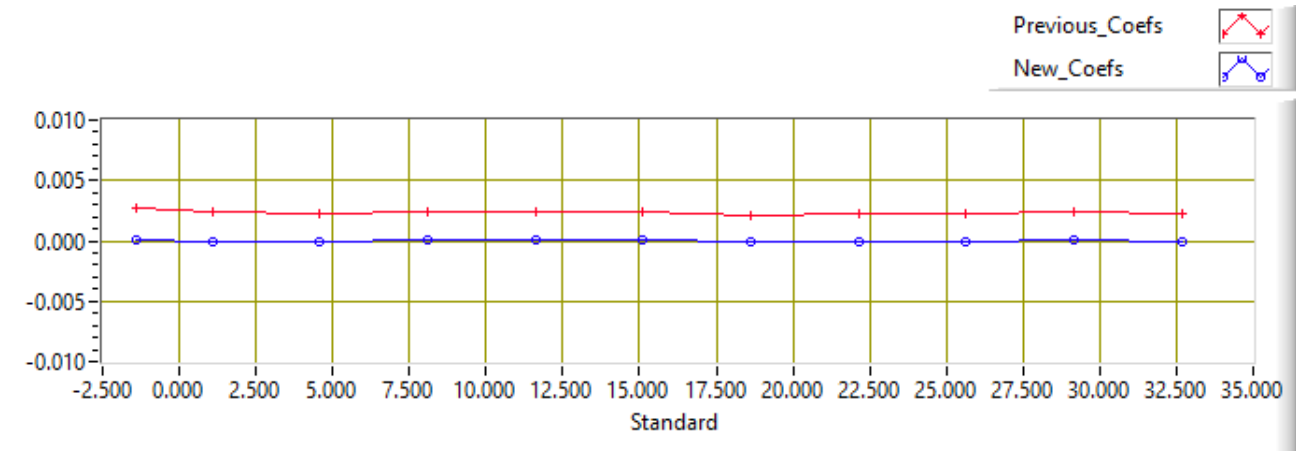# Temperature Calibration Report
STS Calibration Facility

SENSOR SERIAL NUMBER: 2309
CALIBRATION DATE: 02-Feb-2021
Mfg: SEABIRD   Model: 03
Previous cal: 22-Aug-18
Calibration Tech: JRB

ITS-90_COEFFICIENTS	IPTS-68_COEFFICIENTS ITS-T90	
g = 4.35766978E-3	a = 4.35786799E-3	
h = 6.44842157E-4	b = 6.45053483E-4	
i = 2.41461092E-5	c = 2.41788429E-5	
j = 2.32316822E-6	d = 2.32475796E-6	
f0 = 1000.0	Slope = 1.0	Offset = 0.0

Calibration Standard: Mfg: Isotech   Model: MicroK100   s/n: 291088-2

Temperature ITS-90 = $1/\{g+h[\ln(f0/f)]+i[\ln^2(f0/f)]+j[\ln^3(f0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 = $1/\{a+b[\ln(f0/f)]+c[\ln^2(f0/f)]+d[\ln^3(f0/f)]\} - 273.15$ (°C)

T68 = 1.00024 * T90 (-2 to -35 Deg C)

| SBE3 Freq	SPRT ITS-T90	SBE3 ITS-T90	SPRT-SBE3 OLD_Coefs	SPRT-SBE3 NEW_Coefs
2975.5870	-1.4260	-1.4261	0.00265	0.00009
3147.1972	1.0788	1.0789	0.00238	-0.00009
3399.3413	4.5854	4.5856	0.00226	-0.00011
3665.8671	8.0939	8.0939	0.00234	0.00004
3947.2597	11.6048	11.6047	0.00238	0.00012
4242.8745	15.1060	15.1060	0.00233	0.00008
4554.7523	18.6173	18.6174	0.00216	-0.00009
4882.4355	22.1289	22.1290	0.00220	-0.00007
5225.9295	25.6375	25.6375	0.00223	-0.00005
5586.0060	29.1476	29.1475	0.00243	0.00012
5963.0718	32.6596	32.6596	0.00228	-0.00004

Temperature Calibration Report
STS Calibration Facility

SENSOR SERIAL NUMBER: 2380
CALIBRATION DATE: 02-Feb-2021
Mfg: SEABIRD   Model: 03
Previous cal: 01-Oct-19
Calibration Tech: JRB

ITS-90_COEFFICIENTS	IPTS-68_COEFFICIENTS ITS-T90	
g = 4.34100532E-3	a = 4.34119811E-3	
h = 6.41789424E-4	b = 6.41998534E-4	
i = 2.37299874E-5	c = 2.37624492E-5	
j = 2.23207901E-6	d = 2.23365599E-6	
f0 = 1000.0	Slope = 1.0	Offset = 0.0

Calibration Standard: Mfg: Isotech   Model: MicroK100   s/n: 291088-2

Temperature ITS-90 = $1/\{g+h[\ln(f0/f)]+i[\ln^2(f0/f)]+j[\ln^3(f0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 = $1/\{a+b[\ln(f0/f)]+c[\ln^2(f0/f)]+d[\ln^3(f0/f)]\} - 273.15$ (°C)

T68 = 1.00024 * T90 (-2 to -35 Deg C)

SBE3 Freq	SPRT ITS-T90	SBE3 ITS-T90	SPRT-SBE3 OLD_Coefs	SPRT-SBE3 NEW_Coefs
2908.1745	-1.4260	-1.4261	0.00050	0.00008
3076.3906	1.0788	1.0789	0.00033	-0.00006
3323.6099	4.5854	4.5856	0.00024	-0.00013
3584.9964	8.0939	8.0939	0.00035	0.00001
3861.0310	11.6048	11.6047	0.00047	0.00015
4151.1088	15.1060	15.1060	0.00030	0.00001
4457.2075	18.6173	18.6173	0.00024	-0.00004
4778.9118	22.1289	22.1289	0.00031	0.00006
5116.2600	25.6375	25.6376	0.00009	-0.00015
5469.9675	29.1476	29.1476	0.00027	0.00005
5840.4566	32.6596	32.6596	0.00021	0.00002
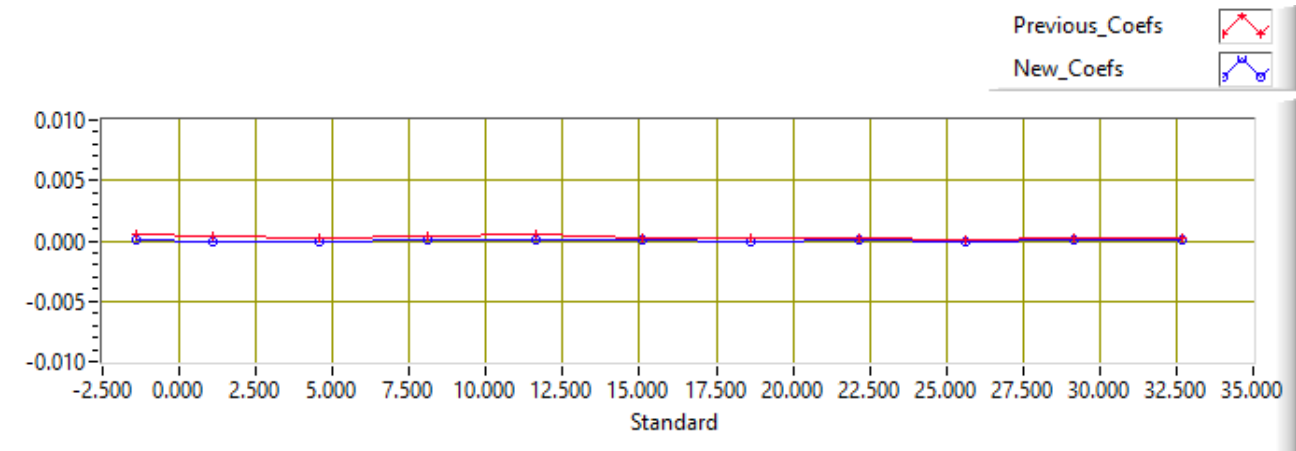
Sea-Bird Scientific
13431 NE 20th Street
Bellevue, WA 98005
USA

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seabird@seabird.com
www.seabird.com

SENSOR SERIAL NUMBER: 3399
CALIBRATION DATE: 25-Nov-20

SBE 4 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = –9.90599021e+000
h =   1.49772528e+000
i = –2.27347443e–003
j =   2.57836284e–004

CPcor = –9.5700e–008 (nominal)
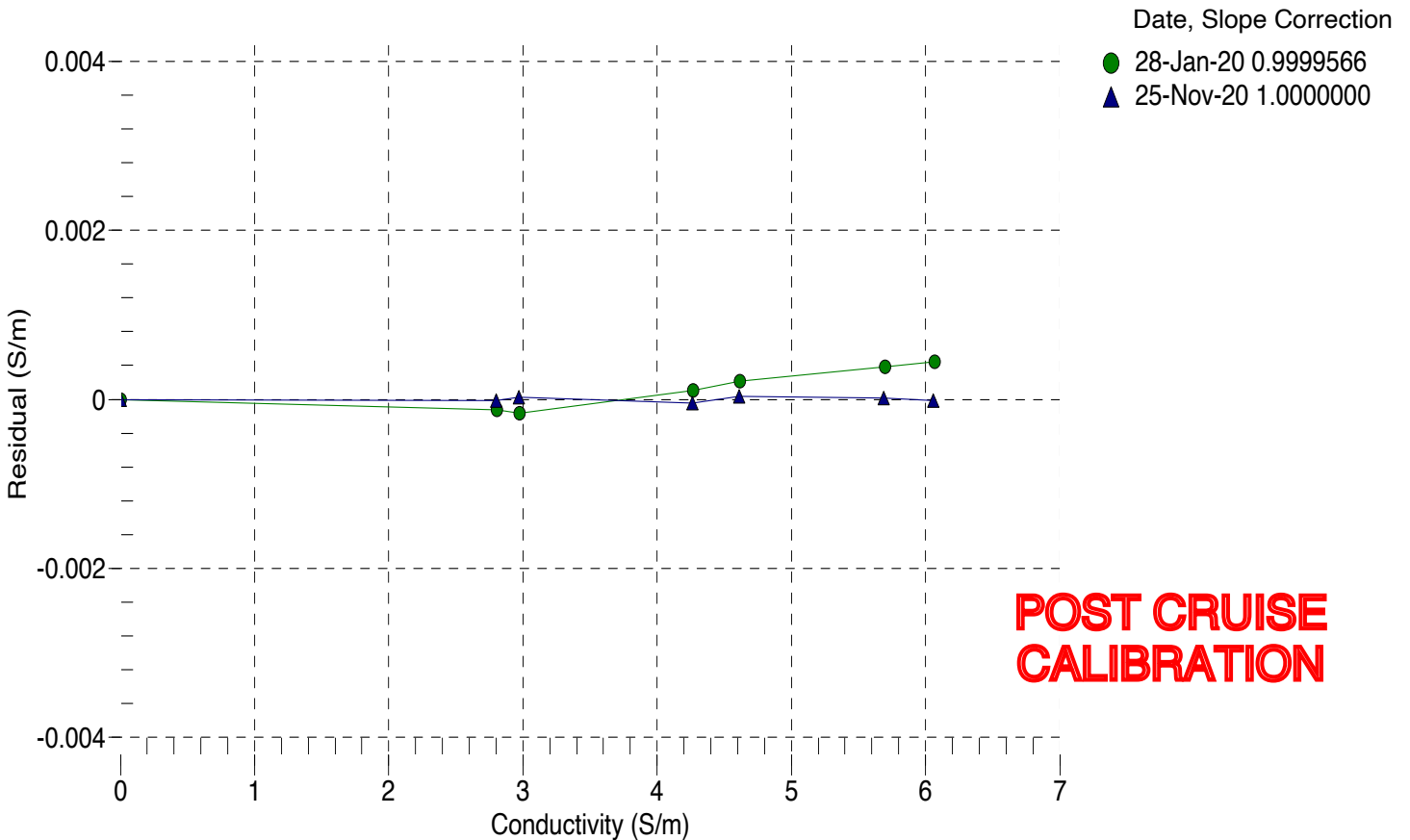CTcor = 3.2500e–006 (nominal)

BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (kHz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
0.0000	0.0000	0.00000	2.57534	0.00000	0.00000
–1.0000	34.7650	2.80083	5.03961	2.80082	–0.00001
1.0000	34.7630	2.97184	5.15198	2.97186	0.00002
15.0000	34.7550	4.26489	5.93250	4.26484	–0.00005
18.5000	34.7466	4.61012	6.12400	4.61015	0.00003
29.0000	34.7247	5.68900	6.68668	5.68902	0.00002
32.5000	34.6927	6.05687	6.86785	6.05685	–0.00002

f = Instrument Output (kHz)

t = temperature (°C);   p = pressure (decibars); δ = CTcor; ϵ = CPcor;

Conductivity (S/m) = $(g + h * f^2 + i * f^3 + j * f^4)\,/10\,(1 + \delta * t + \epsilon * p)$

Residual (Siemens/meter) = instrument conductivity - bath conductivity

Date, Slope Correction
● 28-Jan-20 0.9999566
▲ 25-Nov-20 1.0000000

POST CRUISE
CALIBRATION

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SENSOR SERIAL NUMBER: 1880
CALIBRATION DATE: 04-Dec-20

SBE 4 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:
g = -3.96399499e+000
h =   4.84055685e-001
i = -5.86292632e-004
j =   5.45468975e-005

CPcor = -9.5700e-008 (nominal)
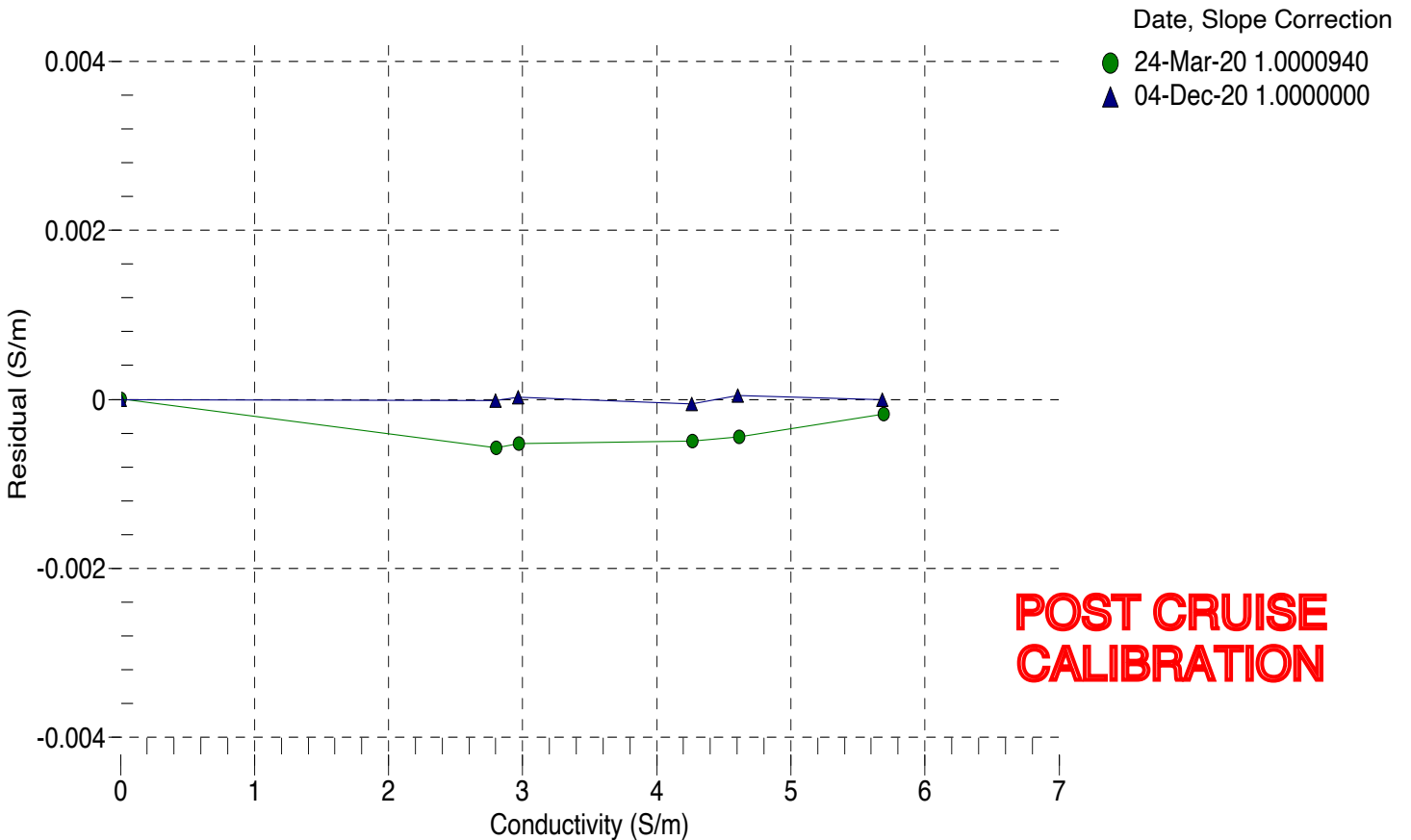CTcor = 3.2500e-006 (nominal)

BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (kHz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
0.0000	0.0000	0.00000	2.86531	0.00000	0.00000
-1.0000	34.7034	2.79633	8.13117	2.79632	-0.00001
1.0000	34.7028	2.96719	8.34539	2.96721	0.00002
15.0000	34.7013	4.25900	9.81212	4.25894	-0.00005
18.5000	34.6979	4.60435	10.16784	4.60440	0.00005
29.0000	34.6895	5.68388	11.20490	5.68388	-0.00001
32.5000	34.6740	6.05398	11.53820	6.05381	-0.00017

f = Instrument Output (kHz)

t = temperature (°C);   p = pressure (decibars); δ = CTcor; ε = CPcor;

Conductivity (S/m) = $(g + h * f^2 + i * f^3 + j * f^4) / 10 (1 + \delta * t + \varepsilon * p)$

Residual (Siemens/meter) = instrument conductivity - bath conductivity

Date, Slope Correction
● 24-Mar-20 1.0000940
▲ 04-Dec-20 1.0000000

POST CRUISE
CALIBRATION

1

SBE SEA-BIRD ELECTRONICS, INC.

13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866   Fax: (425) 643-9954   www.seabird.com

Service Report

RMA Number	87926

Customer Information:

Company	Scripps Institute of Oceanography	Date	3/16/2016
Contact	Carl Mattson		
PO Number	TBD		

Serial Number	051871
Model Number	SBE 05T

Services Requested:

1. Evaluate/Repair Instrumentation.

Problems Found:

1. Pump needs 10-18 VDC -Test pump cable.

Services Performed:

1. Performed initial diagnostic evaluation.

2. Performed internal inspection and O-ring and thrust washer replacements.

3. Performed hydrostatic pressure test.

Special Notes:

Pressure Test Certificate

Test Date: **04/14/16**

Description: **SBE-5T Submersible Pump**

Sensor Information:

Model Number: **5T**

Serial Number: **8690**

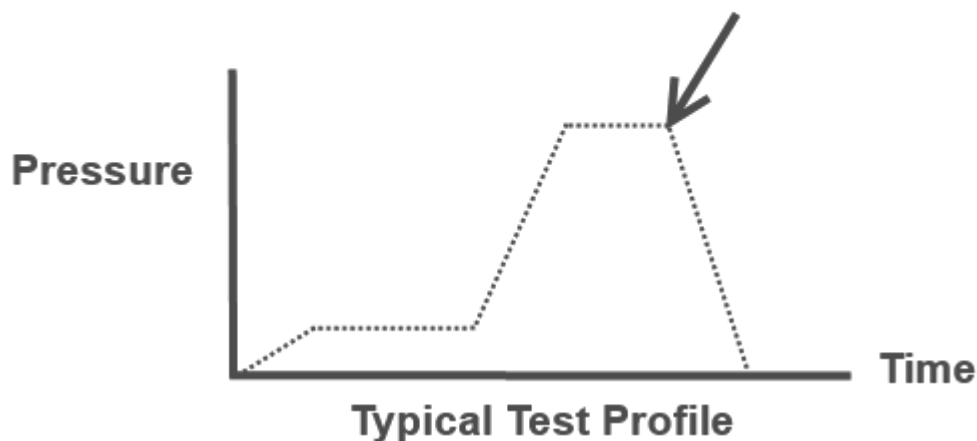## Pressure Test Protocol:

Low Pressure Test: **40** PSI   Held For: **15** Minutes

High Pressure Test: **10000** PSI   Held For: **15** Minutes

Passed Test: **Yes**

Tested By: **nd**

High pressure is generally equal to the maximum depth rating of the instrument

Pressure

Time

Typical Test Profile

Sea-Bird Scientific
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SENSOR SERIAL NUMBER: 0255
CALIBRATION DATE: 13-Nov-20

SBE 43 OXYGEN CALIBRATION DATA

COEFFICIENTS:
Soc = 0.4735
Voffset = -0.5091
Tau20 = 1.56

A = -4.1544e-003
B = 1.9043e-004
C = -2.8141e-006
E nominal = 0.036

NOMINAL DYNAMIC COEFFICIENTS
D1 = 1.92634e-4   H1 = -3.300000e-2
D2 = -4.64803e-2   H2 = 5.00000e+3
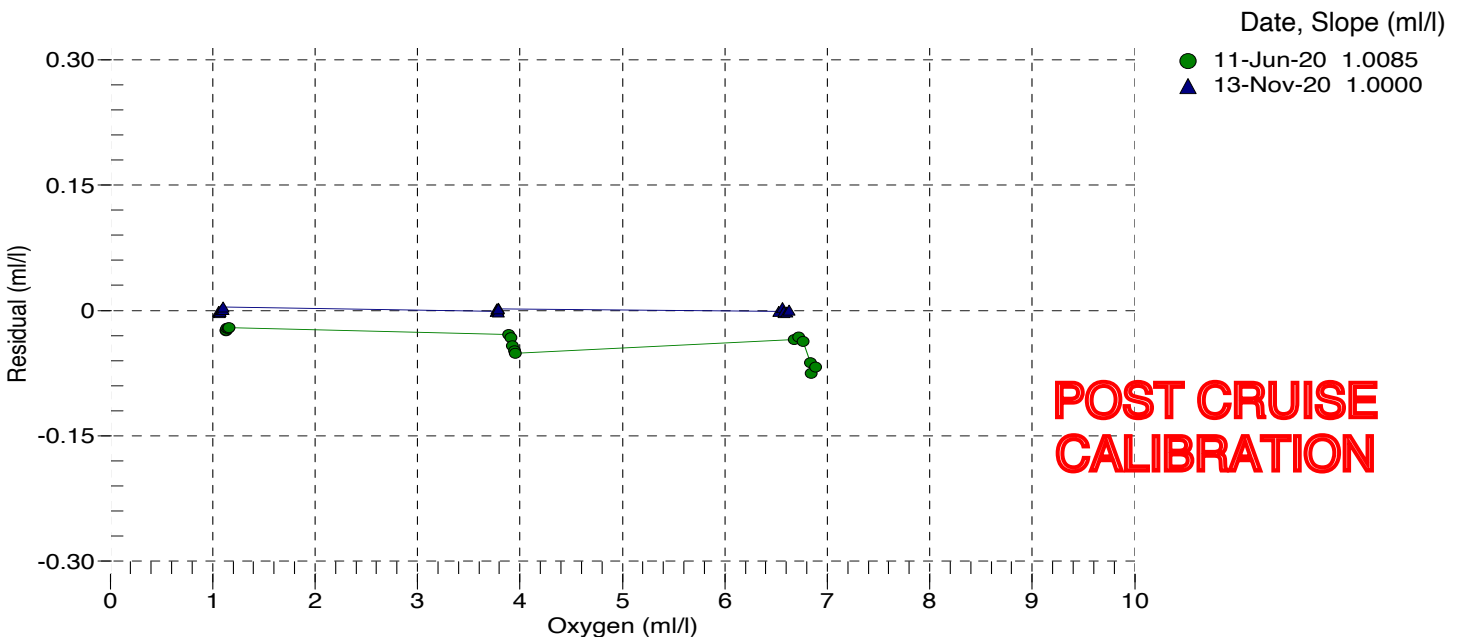   H3 = 1.45000e+3

BATH OXYGEN (ml/l)	BATH TEMPERATURE (° C)	BATH SALINITY (PSU)	INSTRUMENT OUTPUT (volts)	INSTRUMENT OXYGEN (ml/l)	RESIDUAL (ml/l)
1.06	2.00	0.00	0.742	1.06	−0.00
1.07	6.00	0.00	0.772	1.06	−0.00
1.08	12.00	0.00	0.819	1.08	−0.00
1.09	20.00	0.00	0.882	1.09	0.00
1.10	26.00	0.00	0.931	1.10	0.00
1.10	30.00	0.00	0.964	1.10	0.00
3.77	2.00	0.00	1.338	3.77	−0.00
3.77	30.00	0.00	2.062	3.78	0.00
3.78	6.00	0.00	1.443	3.78	0.00
3.79	12.00	0.00	1.599	3.79	−0.00
3.79	26.00	0.00	1.962	3.79	0.00
3.79	20.00	0.00	1.807	3.79	0.00
6.53	2.00	0.00	1.945	6.53	−0.00
6.56	6.00	0.00	2.132	6.57	0.00
6.58	30.00	0.00	3.214	6.58	−0.00
6.58	12.00	0.00	2.403	6.58	−0.00
6.60	20.00	0.00	2.767	6.60	−0.00
6.63	26.00	0.00	3.049	6.63	0.00

V = instrument output (volts);   T = temperature (°C);   S = salinity (PSU);   K = temperature (°K)

Oxsol(T,S) = oxygen saturation (ml/l);   P = pressure (dbar)

$$\text{Oxygen (ml/l)} = Soc * (V + Voffset) * (1.0 + A * T + B * T^2 + C * T^3) * Oxsol(T,S) * \exp(E * P / K)$$

Residual (ml/l) = instrument oxygen - bath oxygen

Date, Slope (ml/l)
● 11-Jun-20 1.0085
▲ 13-Nov-20 1.0000

POST CRUISE CALIBRATION

1

CALIBRATION CERTIFICATE

NAME : RINKO Ⅲ

MODEL : ARO-CAV

SERIAL No. : 0296

Parameter : Temperature
Dissolved Oxygen

JFE Advantech Co., Ltd.

Temperature Calibration Certificate

Model : ARO-CAV

Serial No. : 0296

Date : April 07, 2017

Location : Production Section

Method : Calibration equation is determined from third order regression of samples of the reference temperature against instrument voltages. Samples are taken at approximately 3, 10, 17, 24, and 31 °C.

1. Equation

Instrument temperature[°C] = $A + B \times V + C \times V^2 + D \times V^3$ V: Instrument voltage[V]

2. Coefficients

A = −5.305905e+00

B = +1.666857e+01

C = −2.142681e+00

D = +4.582805e−01

3. Calibration results

Reference temperature [°C]	Instrument voltage [V]	Instrument temperature [°C]	Residual error [°C]	Acceptance [°C]	OK/NG
2.437	0.49243	2.437	0.000	±0.020	OK
10.737	1.07715	10.735	−0.002	±0.020	OK
17.463	1.57825	17.466	0.003	±0.020	OK
24.123	2.07288	24.121	−0.002	±0.020	OK
31.105	2.56635	31.105	0.000	±0.020	OK

4. Verification

Criteria of judgement : Residual error of the instrument temperature at arbitrary point is within the acceptance value.

Reference temperature [°C]	Instrument temperature [°C]	Residual error [°C]	Acceptance [°C]	Judgement
20.068	20.086	0.018	±0.020	Passed

Examined   R Kashida

Approved   a. Fukuoka

Dissolved Oxygen Calibration Certificate

Model   :   ARO-CAV

Serial No.   :   0296

Date   :   April 10, 2017

Location   :   Production Section

Method   :   Calibration is performed with the nitrogen gas (zero) and the oxygen saturated water (span) kept by air bubbling.

Film No.   :   164312BA

1. Equation

$$DO[\%] = G + H \times P'$$

Here, $P'[\%]$ consists of the coefficients A–F determined by the initial calibration.

2. Coefficients

A =	−4.524084e+01	E =	+4.000000e−03
B =	+1.449377e+02	F =	+6.250000e−05
C =	−3.051590e−01	G =	+0.000000e+00
D =	+1.065300e−02	H =	+1.000000e+00

3. Verification

Criteria of judgement   :   Residual error of the instrument DO at arbitrary point is within the acceptance value. The test is performed 3 times.

Acceptance：±0.5% of full scale

Test for DO 0 %

	Test condition		Instrument DO [%]	Residual error [%]	Acceptance [%]	Judgement
	Atm. pressure [hPa]	Reference DO [%]				
1st	1015.7	0.00	0.02	0.02	±1.00	Passed
2nd	1015.7	0.00	0.02	0.02	±1.00	Passed
3rd	1015.7	0.00	0.02	0.02	±1.00	Passed

Test for DO 100 %

	Test condition			Instrument DO [%]	Residual error [%]	Acceptance [%]	Judgement
	Water T. [°C]	Atm. pressure [hPa]	Reference DO [%]				
1st	25.1	1015.0	100.18	99.89	−0.29	±1.00	Passed
2nd	25.1	1015.0	100.18	99.94	−0.24	±1.00	Passed
3rd	25.1	1014.9	100.17	99.95	−0.22	±1.00	Passed

Examined   *M. TAKEISHI*

Approved   *a. Fukuoka*

Temperature Calibration Report
STS Calibration Facility

SENSOR SERIAL NUMBER: 0105

CALIBRATION DATE: 09-Feb-2021

Mfg: SEABIRD   Model: 35

Previous cal: 04-Mar-19

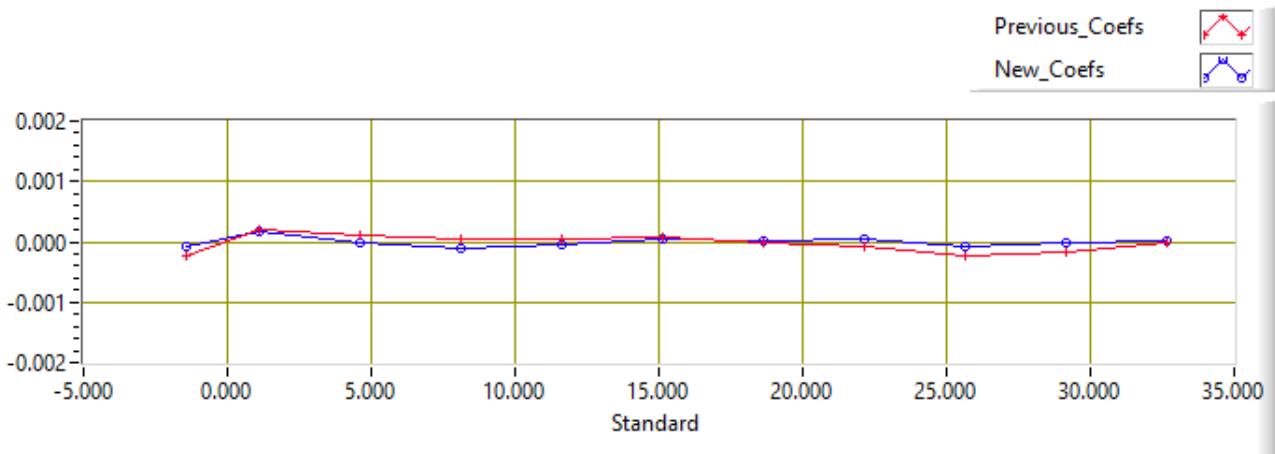**Calibration Tech: CAL**

ITS-90_COEFFICIENTS

$a0 = 5.975308880E-3$

$a1 = -1.681244320E-3$

$a2 = 2.377301998E-4$

$a3 = -1.302239067E-5$

$a4 = 2.723298781E-7$

Slope = 1.000000 Offset = 0.000000

Calibration Standard: Mfg: Isotech   Model: MicroK100   s/n: 291088-2

Calibration Standard: Mfg: Isotech   Model: MicroK100   s/n: 291088-2

Temperature ITS-90 = 1/{a0+a1[ln(f)]+a2[ln2(f)]+a3[ln3(f)]+a4[ln4(f)]} - 273.15 (°C)

SBE35 Count	SPRT ITS-T90	SBE35 ITS-T90	SPRT-SBE35 OLD_Coefs	SPRT-SBE35 NEW_Coefs
921017.6404	-1.4262	-1.4261	-0.00023	-0.00009
823597.3265	1.0788	1.0786	0.00020	0.00018
705820.0404	4.5853	4.5853	0.00012	-0.00001
606424.7522	8.0935	8.0936	0.00005	-0.00010
522375.2763	11.6031	11.6032	0.00006	-0.00005
451318.4282	15.1050	15.1049	0.00009	0.00006
390785.6089	18.6176	18.6176	-0.00003	0.00003
339309.7652	22.1272	22.1272	-0.00007	0.00006
295375.1636	25.6377	25.6377	-0.00023	-0.00007
257804.2798	29.1473	29.1473	-0.00016	-0.00003
225560.7487	32.6597	32.6596	0.00000	0.00003

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SEA·BIRD
SCIENTIFIC

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www.sea-birdscientific.com

C-Star Calibration

Date   August 9, 2019   S/N#   CST-1803DR   Pathlength 25 cm

	Analog output	Digital output
V_{dark}	0.014 V	0 counts
V_{air}	4.795 V	15714 counts
V_{ref}	4.699 V	15400 counts

Temperature of calibration water	24.7 °C
Ambient temperature during calibration	21.8 °C

Relationship of transmittance (Tr) to beam attenuation coefficient (c), and pathlength (x, in meters): $Tr = e^{-cx}$

To determine beam transmittance: $Tr = (V_{sig} - V_{dark}) / (V_{ref} - V_{dark})$

To determine beam attenuation coefficient: $c = -1/x * ln\ (Tr)$

V_{dark} Meter output with the beam blocked. This is the offset.
V_{air} Meter output in air with a clear beam path.
V_{ref} Meter output with clean water in the path.
Temperature of calibration water: temperature of clean water used to obtain V_{ref}.
Ambient temperature: meter temperature in air during the calibration.
V_{sig} Measured signal output of meter.