SEA-BIRD SCIENTIFIC
Sea-Bird Scientific
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SENSOR SERIAL NUMBER: 3361
CALIBRATION DATE: 07-Aug-18

SBE 21 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g =  -4.19427402e+000
h =   4.94275774e-001
i =  -2.09454188e-004
j =   3.31705537e-005

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

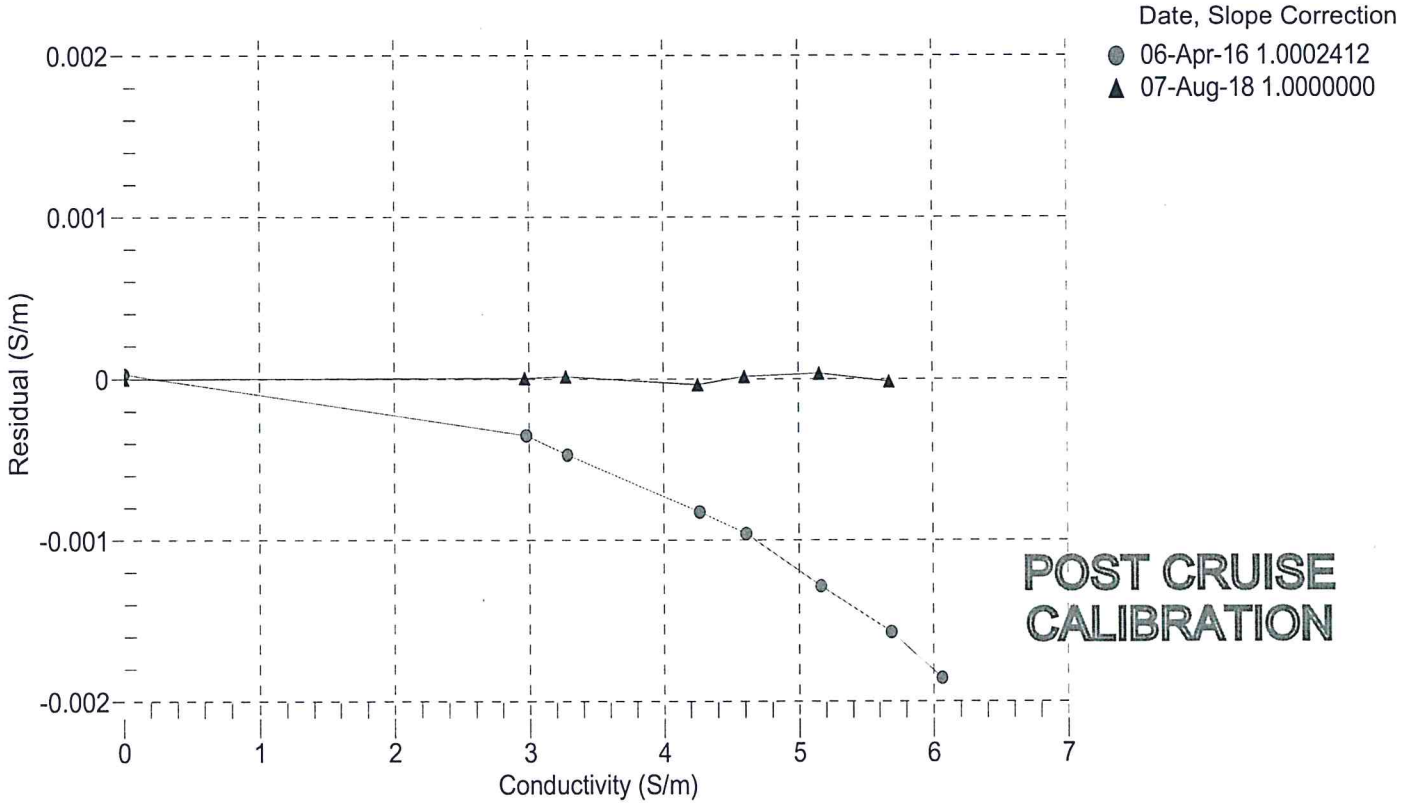
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (kHz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2.91399	0.00000	0.00000
1.0000	34.7143	2.96808	8.27408	2.96808	0.00000
4.5000	34.6947	3.27438	8.63900	3.27439	0.00001
14.9999	34.6525	4.25363	9.71277	4.25359	-0.00004
18.5000	34.6434	4.59790	10.06271	4.59791	0.00001
24.0000	34.6337	5.15446	10.60351	5.15449	0.00003
29.0000	34.6279	5.67492	11.08481	5.67491	-0.00002
32.5000	34.6233	6.04613	11.41529	6.04595	-0.00018

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



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SBE 21 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

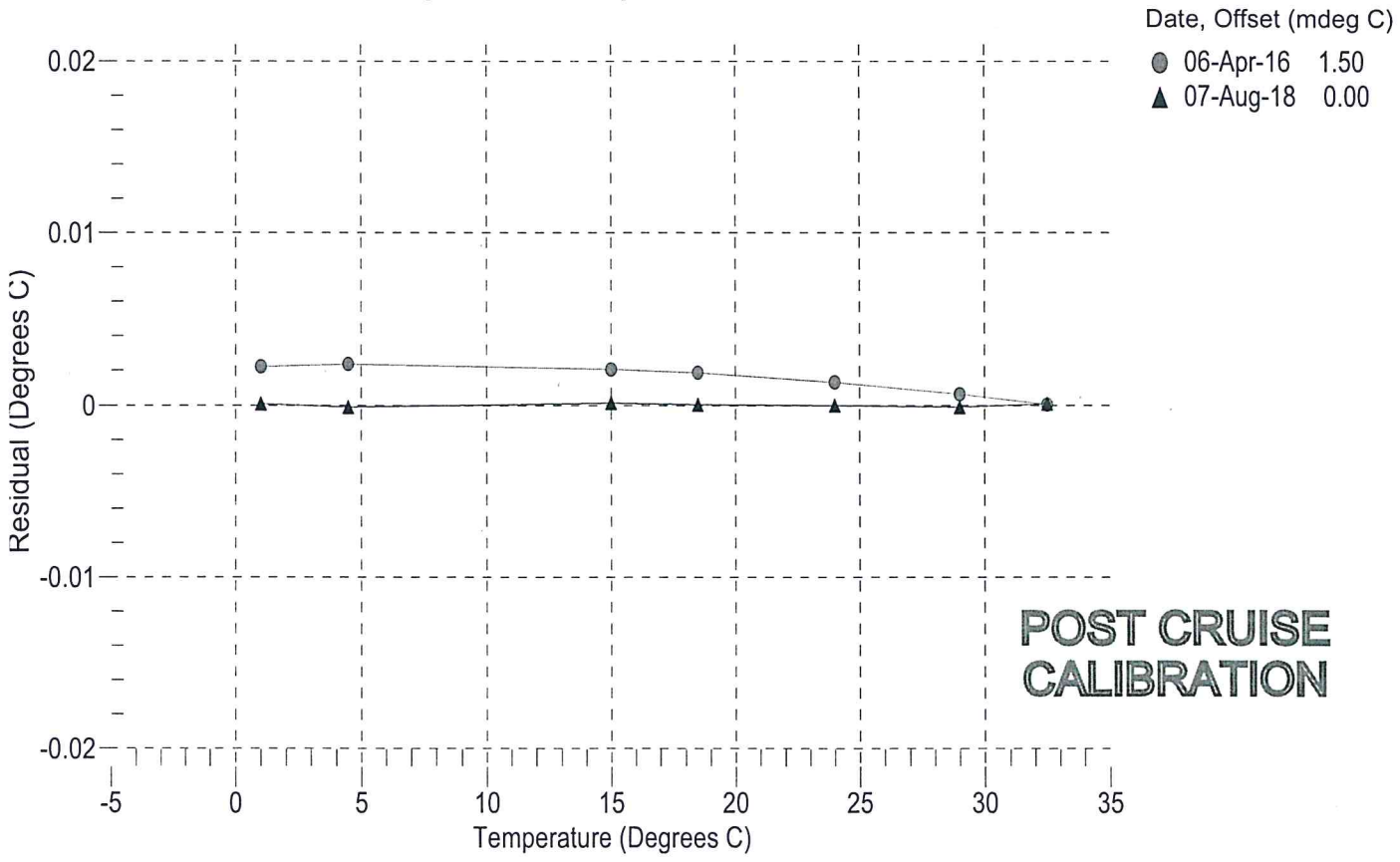
g = 4.21679908e-003
h = 6.10951946e-004
i = 1.74661569e-005
j = 1.00632356e-006
f0 = 1000.0

BATH TEMP (° C)	INSTRUMENT OUTPUT (Hz)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	2602.058	1.0001	0.00008
4.5000	2817.053	4.4999	-0.00015
14.9999	3539.643	15.0000	0.00013
18.5000	3807.643	18.5000	0.00001
24.0000	4257.621	24.0000	-0.00004
29.0000	4698.316	28.9999	-0.00012
32.5000	5025.326	32.5001	0.00009

f = Instrument Output (Hz)

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

Residual (°C) = instrument temperature - bath temperature



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Chlorophyll WETStar
Post-Deployment Characterization

Date: September 7, 2018 S/N: WSCHL-1402

Chlorophyll concentration expressed in µg/l can be derived using the equation:

CHL(µg/l) = Scale Factor x (Output - Clean Water Offset)

	Analog output
Clean Water Offset (CWO)	0.059 V
Scale Factor (SF)	10.1 µg/l/V
Maximum Output	5.55 V
Resolution	0.37 mV
Ambient Characterization Temperature	22 ± 1°C
Current Draw	30 mA @ 12V (typical)
12-hour Stability	0.36 mV/hr
Temperature Stability, 25–2 °C	0.23 mV/°C

Range	
15 µg/l	0
50 µg/l	X
150 µg/l	0

Definitions:

CWO: Clean Water Offset value obtained using pure filtered de-ionized water.

SF: Scale Factor is used to convert the fluorescence response of the instrument into chlorophyll-a concentration. Scale Factor is determined at WET Labs during a cross calibration using a liquid fluorescent standard and a reference fluorometer whose chlorophyll fluorescence response has been characterized in a laboratory using a mono-species lab culture of *Thalassiosira weissflogii* phytoplankton.

Maximum Output: Maximum signal output of the fluorometer.

Resolution: Standard deviation of 1 minute of clean water data, sampled once per second.

Ambient Characterization Temperature: Room temperature at time of characterization.

Current Draw: The amount of current the instrument uses for operation.

12-hour Stability: Deviation of output averaged over 12 hours.

Temperature Stability: Measured output variation per degree.

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C-Star Calibration

Date August 31, 2018 S/N# CST-1427PR Pathlength 25

	Analog output	Digital output
V_d	0.004 V	0 counts
V_{air}	4.933 V	16183 counts
V_{ref}	4.702 V	15424 counts

Temperature of calibration water	23.7 ℃
Ambient temperature during calibration	22.9 ℃

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

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

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

$\mathbf{V_d}$ Meter output with the beam blocked. This is the offset.
$\mathbf{V_{air}}$ Meter output in air with a clear beam path.
$\mathbf{V_{ref}}$ 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.
$\mathbf{V_{sig}}$ Measured signal output of meter.