



**Sea-Bird Electronics, Inc.**  
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 Bellevue, WA 98005 United States

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**1005508829**  
 26-DEC-2019  
 315756594

**SERVICE REPORT**

**Service Request**  
**Date**  
**Sales Order**

**PRODUCT INFORMATION**

**Item:** SLOCUM.LEGACY  
**Item Description:** (LEGACY) Slocum Glider  
**Serial:** 9030

**Special Notes**

Services Requested:  
 Evaluate/Repair Instrumentation.  
 Perform Routine Calibration Service.

**Problems Found:**

The conductivity cell was found to be cracked. Replacement required.  
 The temperature probe is bent. Replacement required.  
 The intake duct is damaged. Replacement required.

**Services Performed:**

Performed initial diagnostic evaluation.  
 Performed pressure calibration.  
 Performed "POST" cruise calibration.  
 Replaced the lithium back-up battery(s).  
 Replaced the conductivity cell.  
 Replaced the temperature probe.  
 Replaced the O-rings.  
 Performed a hydrostatic pressure test.  
 Performed a "Final" Calibration.  
 Installed NEW AF24173 Anti-foulant cylinder.

Item	Item Description	Qty
233974	WEBB PAYLOAD CTD, INTAKE DUCT	1
CAL_SLOCUM	Calibrate SLOCUM conductivity and temperature sensors	1
REPGLIDERCELL	Extra charge to replace broken SBE Glider conductivity cell	1
CNCRTSLOCUM	Confirm & Re-certify Webb SLOCUM Glider CTD	1
REPLACEAF	Extra charge to install one antifoulant device, includes one 801542.1.	1
REPGLIDERPROB	Replace SBE Glider thermistor probe	1
PCAL_SLOCUM	Calibrate SLOCUM pressure sensor	1

**Unbilled Items**

Item	Item Description	Qty
801801	GLIDER TEMPERATURE PROBE ASSY, FENWAL	1
22096	LITHIUM COIN BATTERY, WITH TABS, BR1632A/HA	1
802599	SBE37 V2.5 CONDUCTIVITY CELL ASSY, NO WRAP	1



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SENSOR SERIAL NUMBER: 9030  
 CALIBRATION DATE: 14-Dec-19

Slocum Payload CTD TEMPERATURE CALIBRATION DATA  
 ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

a0 = -6.811641e-005  
 a1 = 2.956888e-004  
 a2 = -3.454931e-006  
 a3 = 1.734383e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	569958.4	1.0001	0.0001
4.5000	487693.8	4.4999	-0.0001
15.0000	311597.8	15.0001	0.0001
18.5000	270059.2	18.5001	0.0001
24.0000	216980.0	23.9999	-0.0001
29.0000	178923.6	29.0000	-0.0000
32.5000	156851.6	32.5000	0.0000

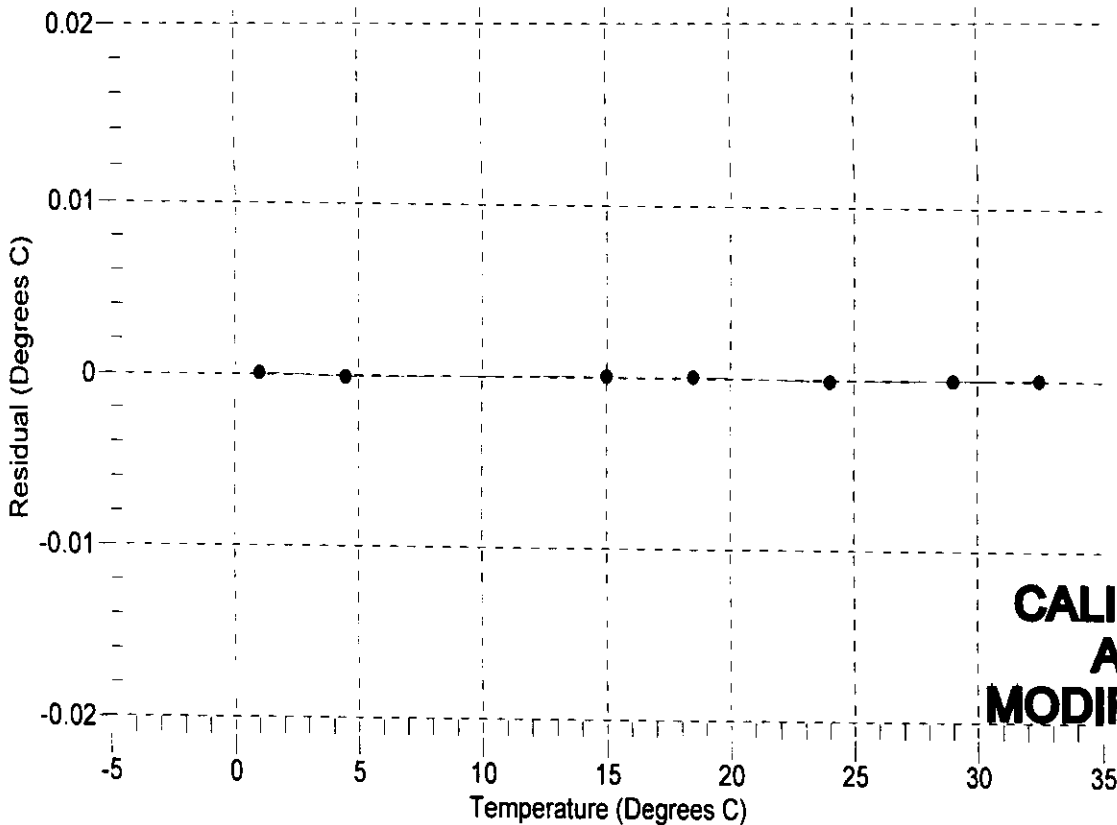
n = Instrument Output (counts)

$$\text{Temperature ITS-90 (°C)} = 1 / \{a_0 + a_1[\ln(n)] + a_2[\ln^2(n)] + a_3[\ln^3(n)]\} - 273.15$$

$$\text{Residual (°C)} = \text{instrument temperature} - \text{bath temperature}$$

Date, Offset (mdeg C)

● 14-Dec-19 0.00



**CALIBRATION  
 AFTER  
 MODIFICATIONS**



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SENSOR SERIAL NUMBER: 9030  
 CALIBRATION DATE: 27-Sep-19

Slocum Payload CTD TEMPERATURE CALIBRATION DATA  
 ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

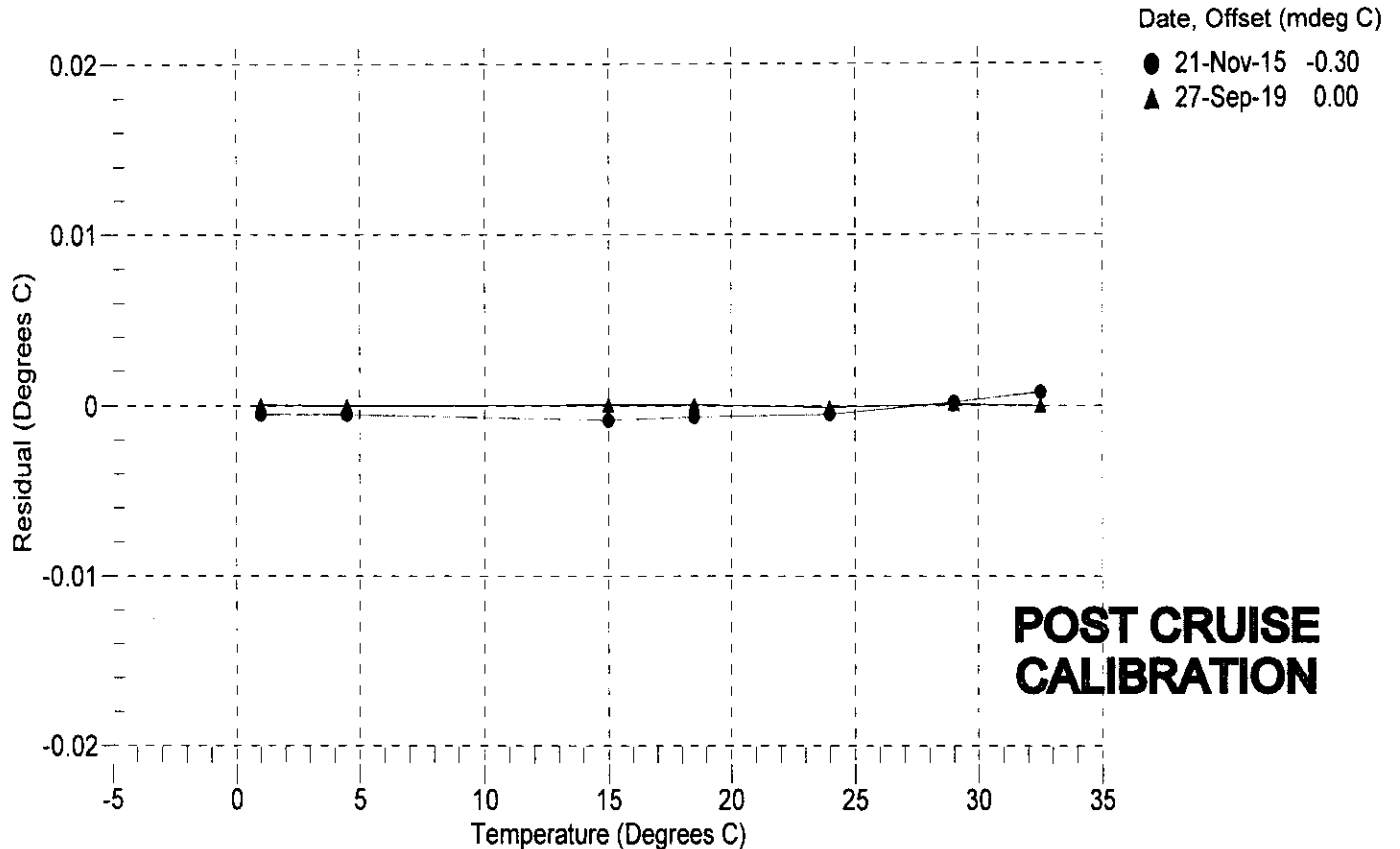
a0 = -1.022322e-004  
 a1 = 3.086158e-004  
 a2 = -4.763553e-006  
 a3 = 2.094797e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	587243.0	1.0000	0.0000
4.5000	501789.4	4.5000	-0.0000
15.0000	319288.2	15.0000	0.0000
18.4999	276350.0	18.4999	0.0000
24.0000	221565.0	23.9999	-0.0001
29.0001	182359.2	29.0002	0.0001
32.5000	159658.0	32.5000	-0.0000

n = Instrument Output (counts)

$$\text{Temperature ITS-90 (°C)} = 1 / \{ a_0 + a_1[\ln(n)] + a_2[\ln^2(n)] + a_3[\ln^3(n)] \} - 273.15$$

$$\text{Residual (°C)} = \text{instrument temperature} - \text{bath temperature}$$





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SENSOR SERIAL NUMBER: 9030  
 CALIBRATION DATE: 14-Dec-19

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

COEFFICIENTS:

g = -1.006347e+000  
 h = 1.389773e-001  
 i = -1.397240e-004  
 j = 2.832283e-005

CPcor = -9.5700e-008  
 CTcor = 3.2500e-006  
 WBOTC = -2.1664e-007

BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2692.59	0.00000	0.00000
1.0000	34.8564	2.97907	5353.85	2.97908	0.00001
4.5000	34.8363	3.28642	5555.79	3.28642	-0.00001
15.0000	34.7941	4.26918	6156.55	4.26919	0.00001
18.5000	34.7850	4.61466	6353.99	4.61463	-0.00004
24.0000	34.7735	5.17296	6660.49	5.17301	0.00005
29.0000	34.7656	5.69495	6934.46	5.69493	-0.00002
32.5000	34.7581	6.06699	7123.08	6.06684	-0.00015

$$f = \text{Instrument Output(Hz)} * \text{sqrt}(1.0 + \text{WBOTC} * t) / 1000.0$$

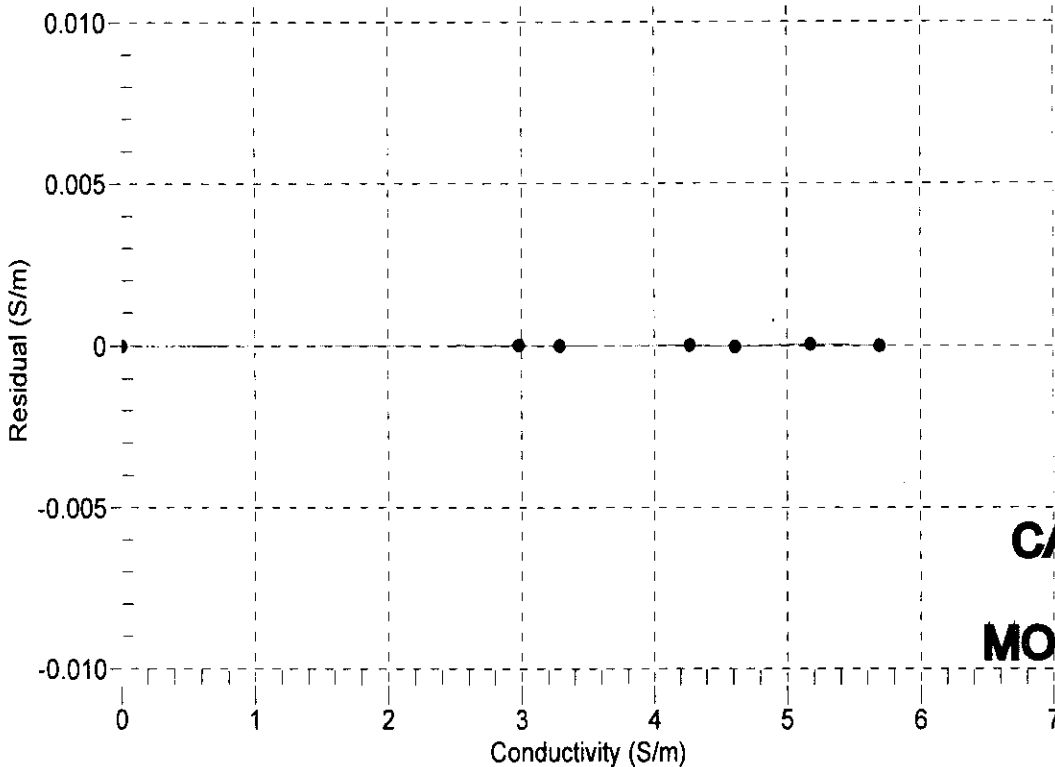
t = temperature (°C); p = pressure (decibars);  $\delta = \text{CTcor}$ ;  $\epsilon = \text{CPcor}$ ;

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

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

Date, Slope Correction

● 14-Dec-19 1.0000000



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SENSOR SERIAL NUMBER: 9030  
 CALIBRATION DATE: 27-Sep-19

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

COEFFICIENTS:

g = -9.888782e-001  
 h = 1.366435e-001  
 i = -1.848830e-004  
 j = 3.408608e-005

CPcor = -9.5700e-008  
 CTcor = 3.2500e-006  
 WBOTC = -2.1664e-007

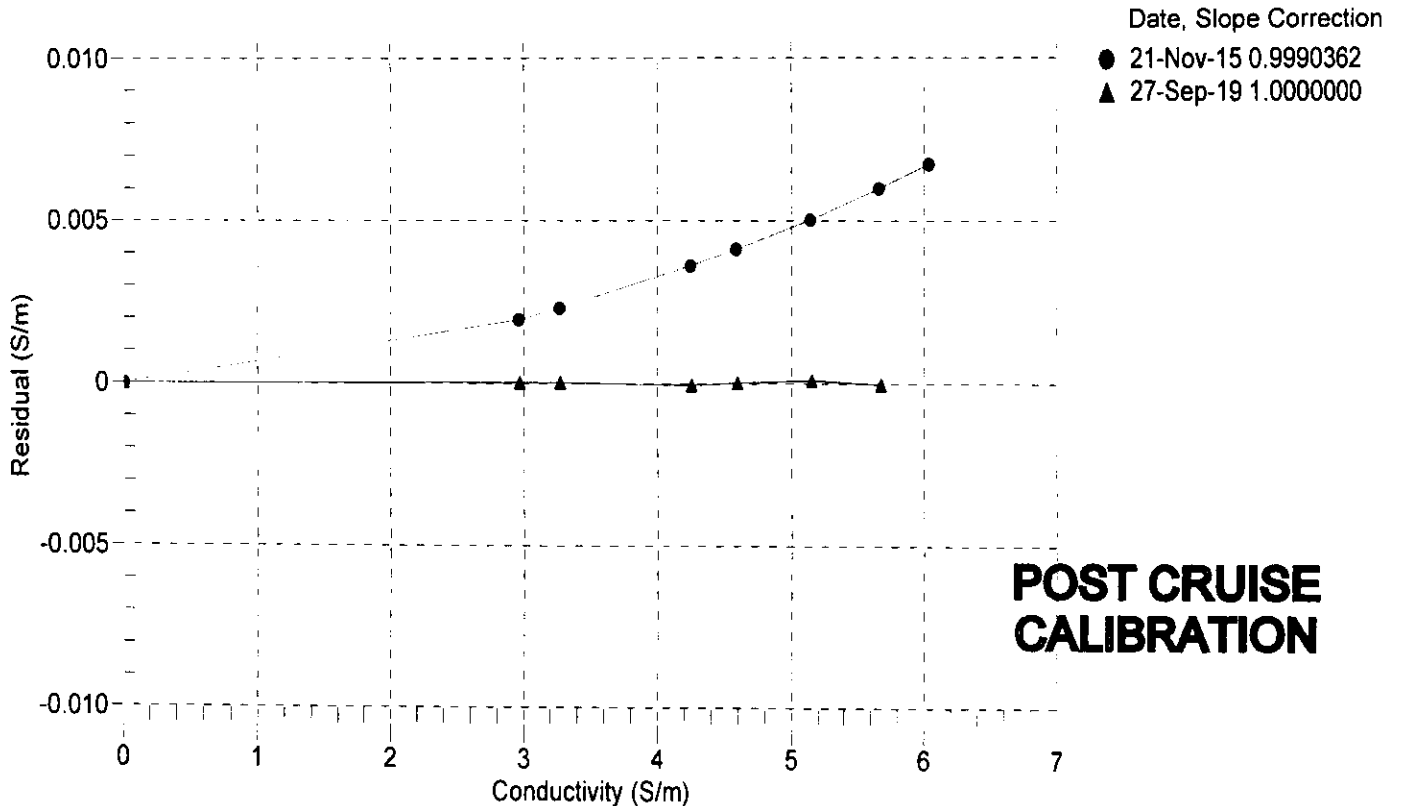
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2692.63	0.00000	0.00000
1.0000	34.7320	2.96945	5382.38	2.96946	0.00001
4.5000	34.7128	3.27592	5586.10	3.27593	0.00001
15.0000	34.6714	4.25571	6191.71	4.25564	-0.00007
18.4999	34.6627	4.60018	6390.76	4.60019	0.00001
24.0000	34.6526	5.15696	6699.65	5.15705	0.00009
29.0001	34.6460	5.67757	6975.65	5.67752	-0.00004
32.5000	34.6405	6.04879	7165.74	6.04863	-0.00016

$f = \text{Instrument Output(Hz)} * \text{sqrt}(1.0 + \text{WBOTC} * t) / 1000.0$

t = temperature (°C); p = pressure (decibars);  $\delta = \text{CTcor}$ ;  $\epsilon = \text{CPcor}$ ;

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

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





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SENSOR SERIAL NUMBER: 9030  
 CALIBRATION DATE: 24-Sep-19

Slocum Payload CTD PRESSURE CALIBRATION DATA  
 1450 psia S/N 3697024

COEFFICIENTS:

PA0 =	-2.153418e-002	PTCA0 =	5.245152e+005
PA1 =	4.663922e-003	PTCA1 =	-2.834241e+000
PA2 =	-1.568104e-011	PTCA2 =	1.010036e-001
PTEMPA0 =	-7.033819e+001	PTCB0 =	2.530262e+001
PTEMPA1 =	5.222623e-002	PTCB1 =	9.250000e-004
PTEMPA2 =	-6.426923e-007	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (volts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)	TEMP (°C)	THERMISTOR OUTPUT (volts)	INSTRUMENT OUTPUT (counts)
14.64	527662.0	1879.0	14.67	0.00	32.50	2019	527656.00
314.88	592089.0	1879.0	314.80	-0.01	29.00	1949	527648.80
614.86	656521.0	1878.0	614.83	-0.00	24.00	1848	527636.80
914.88	720977.0	1878.0	914.84	-0.00	18.50	1738	527623.20
1214.82	785453.0	1877.0	1214.81	-0.00	15.00	1668	527623.20
1464.79	839197.0	1878.0	1464.75	-0.00	4.50	1459	527633.80
1214.79	785465.0	1877.0	1214.86	0.01	1.00	1390	527641.00
914.83	720988.0	1877.0	914.89	0.00			
614.84	656530.0	1877.0	614.87	0.00			
314.88	592104.0	1875.0	314.88	-0.00			
14.64	527657.0	1875.0	14.65	0.00			

		TEMPERATURE (°C)	SPAN
		-5.00	25.30
		35.00	25.34

y = thermistor output (counts)

$$t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$$

$$x = \text{instrument output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$$

$$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$$

$$\text{pressure (PSIA)} = PA0 + PA1 * n + PA2 * n^2$$

$$\text{Residual (\%FSR)} = (\text{computed pressure} - \text{true pressure}) * 100 / \text{Full Scale Range}$$

Date, Offset (%FSR)

● 24-Sep-19 -0.00

